Published in final edited form as:

Traffic Inj Prev. 2015 ; 16(2): 140–146. doi:10.1080/15389588.2014.916797.

The prevalence of distraction among passenger vehicle drivers: a roadside observational approach

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Abstract

Objective—Distracted driving contributes to a large proportion of motor vehicle crashes, yet little is known about the prevalence of distracted driving and the specific types of distracting behaviors. The objective of this study was to estimate the prevalence of driver distraction using a roadside observational study design.

Methods—A cross-sectional survey involving direct roadside observation was conducted at 11 selected intersections. Trained investigators observed a sample of passenger vehicles and recorded distraction-related behaviors, driver characteristics, and contextual factors such as vehicle speed and traffic flow.

Results—Of the 3,265 drivers observed, the prevalence of distracted driving was 32.7%. Among those involved in a distracting activity, the most frequently observed distractions included interacting with another passenger (53.2%, where passengers were present), talking on the phone (31.4%), external-vehicle distractions (20.4%), and texting/dialing a phone (16.6%). The prevalence of talking on the phone was higher among females than males (38.6% vs. 24.3%), whereas external vehicle distractions were higher among males than females (25.8% vs. 24.3%). Drivers <30 years were observed being engaged in any distracting activity, interacting with other passengers and texting/dialing more frequently than drivers aged 30–50 and >50 years. Drivers were engaged in distracting behaviors more frequently when the car was stopped.

Conclusions—When using similar methodology, roadside observational studies generate comparable prevalence estimates of driver distraction as naturalistic driving studies. Driver distraction is a common problem among passenger vehicle drivers. Despite the increased awareness on the dangers of texting and cell phone use while driving, these specific activities were

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two of the most frequently observed distractions. There is a continued need for road safety education about the dangers of distracted driving, especially for younger drivers.

Keywords

Distraction; driver; epidemiology; observational; prevalence; safety

INTRODUCTION

According to the National Highway Traffic Safety Administration (NHTSA), driver distraction is a “specific type of inattention that occurs when drivers divert their attention away from the driving task to focus on another activity instead” (pg. 3). (National Highway Traffic Safety Administration, 2010) In 2010, 18% of motor vehicle collisions (MVCs) involved some type of distraction; these collisions resulted in over 3,000 deaths and 400,000 injuries. (Ascone & Lindsey, 2009; National Highway Traffic Safety Administration, 2012) These numbers are likely to increase as wireless communication, entertainment, and driver assistance systems (e.g. navigation systems) continue to become more widely used. (Ascone & Lindsey, 2009)

The incidence of driver distraction among crash-involved drivers has been extensively examined using MVC-based research studies. (National Highway Traffic Safety Administration, 2008; JC Stutts, Reinfurt, Staplin, & Rodgman, 2001) In addition, the relative crash risk associated with specific distracting behaviors has been established using naturalistic observational study designs. (Hanowski, Perez, & Dingus, 2005; Klauer, Dingus, Neale, Sudweeks, & Ramsey, 2006; Sayer, Devonshire, & Flannagan, 2005; J Stutts et al., 2005) One measure that has received less attention is the prevalence of any distraction among drivers while driving. A handful of studies have measured the prevalence of specific types of driver distraction; however, most focused only on cell phone use. (Crawford, 2002; Pickrell & Ye, 2013; Reinfurt, Huang, Reaganes, & Hunter, 2001; Salzberg, 2002) Recent research reveals that many things besides cell phones can distract a driver and pose a safety hazard including interacting with passengers, (Koppel, Charlton, Kopinathan, & Taranto, 2011) singing, (Brodsky & Slor, 2013) eating and drinking, (M. Young, Mahfoud, Walker, Jenkins, & Stanton, 2008) interacting with vehicle electronics, (JC Stutts et al., 2001) as well as environmental distractions and/or hazards outside the vehicle. (J Stutts et al., 2005) The prevalence of any activity that distracts the driver is important to assess because the proportion of drivers who engage in the activity will influence how often a distracting activity will result in a crash.

Naturalistic in-vehicle observation and roadside observation are two types of data collection that can be used to assess the prevalence of distracting-related behaviors and to examine groups of drivers who are likely to engage in these activities under real-world conditions. Naturalistic observational studies use a rigorous design which relies on volunteers to drive vehicles instrumented with sensors and video cameras and records detailed driving behavior for a prolonged period of time. It has been criticized for the potential for bias attributable to drivers altering their behavior due to the camera's presence, but surveys suggest the cameras do not unduly influence behavior. (J Stutts et al., 2005) The vast majority of everyday

driving behavior is uneventful so the cost of continuously recording and examining all driving activity relative to the number of crashes is high, and due to the expense of instrumenting every vehicle, relatively small samples of drivers can be included. (Ranney, 2008) Most of the prevalence estimates of driver distraction from naturalistic designs are generally consistent. For example, Stutts et al. (2005) observed 70 participants in the North Carolina and the Philadelphia metro areas, and found that approximately 31% of the total time the vehicle was moving participants were engaged in some form of distracting activity. (J Stutts et al., 2005) Data from 36 drivers in Ann Arbor, Michigan show that drivers were engaged in secondary behaviors approximately 34% of the time. (Sayer et al., 2005) Results from the 100-Car Naturalistic Driving Study (Northern Virginia/Washington DC metropolitan area) indicate that the prevalence of driving-related inattention was 44%. (Klauer et al., 2006) While the sample sizes were small, data were collected over an extended period and represent normal, daily driving that occurs in a metropolitan environment. Together, the results from these studies suggest that drivers frequently engage in distracting activities.

However, the extent of the problem is substantially lower when roadside observations are used. With roadside observation, a stationary observer simply records the activities and demographic characteristics of drivers as they pass a selected location. (Ranney, 2008) Driving-related distraction is observed discreetly and issues related to self-reporting errors and the effect of altering behaviors while being monitored are avoided. In addition, the cost and resources needed to analyze data is minimal. Johnson et al. (2004) observed drivers unobtrusively by reviewing 40,000 high quality digital photographs of drivers passing through a section of the New Jersey Turnpike, finding that approximately 5% of the drivers showed evidence of distraction. (Johnson, Robert, Lacey, McKnight, & James, 2004) The study was limited to high-speed drivers and may have failed to capture distracting behaviors or movements that may take a few seconds resulting in an underestimate of the true prevalence. More recently, Sullman (2012) observed drivers from the sidewalk using a clipboard, data collection form, and pen. Coders were positioned so that they were able to see movement and determine what the drivers were actually doing without being a distraction. (Sullman, 2012) This study found that only 14.4% of drivers were engaged in a distracting activity while driving; however, observation sites were limited to those with relatively free flowing traffic on 30 mph roads. (Sullman, 2012) Similar sources of distraction were recorded in the naturalistic and roadside observational studies; however, roadside observational studies did not include a range of traffic and roadway conditions that occur during the driving experience. Therefore, it is possible that the different prevalence estimates reported in naturalistic versus roadside observational studies are due to differences in methodology, rather than study design. It seems reasonable that if a roadside observational study included observational sites that captured a range of driving experiences in a metropolitan environment, then the prevalence estimates would be similar to those captured in the naturalistic in-vehicle approach.

Building on the extant literature, the current study will use a roadside observational approach to estimate the prevalence of distraction among drivers at various roadway sites in Jefferson County, Alabama. Further, the characteristics of those engaged in a distracting activity will be described. This study combines the following features: 1) utilization of a

cost-effective approach, 2) the large sample of drivers in real-world conditions, 3) the unobtrusive observation of drivers, and 4) inclusion of a range of vehicle speeds, traffic flow, and roadway conditions. By improving our understanding the extent of the problem, this information will help gauge the potential impact of interventions on driving safety and ultimately help reduce the morbidity and mortality associated with distracted driving.

METHODS

A cross-sectional observational study of passenger vehicles including automobiles, pickup trucks, light vans, commercial trucks, and sport utility vehicles, was conducted. The University of Alabama at Birmingham Institutional Review Board reviewed and approved this study.

Observation Sites

The Birmingham metro area in Jefferson County, Alabama were selected for observation. Jefferson County is the most populous county in the state and Birmingham is the most populous city. According to the 2010 Census, there are 658,466 people residing in Jefferson County, comprising 13.8% of the state's total population. (U.S. Census Bureau) The median age is 37.1 years, with approximately 63.4% aged 18–64 years, and 13.1% aged 65 years and over. (U.S. Census Bureau) Of those commuting to work, 83.9% drive alone compared to 16.1% who use other means such as carpooling or public transportation; the mean travel time to work is 23.4 minutes. (U.S. Census Bureau & 2010 American Community Survey) Four interstate highways plus one partial beltway service the Birmingham metro area. There is a public bus system however there is no rail rapid transit or commuter train service. Observations were conducted at eleven intersections controlled by stop signs or stoplights on geographically dispersed roads. Intersections were used in order to capture driving behaviors while traveling at continuous speeds or while stopped in traffic. Of the eleven locations, seven were controlled by stoplights and four by stop signs. Roadways included local streets, minor arterial roads, major collectors, and other principal arterial roads. (Regional Planning Commission of Greater Birmingham) Interstates and freeways were excluded. Approximately 6 hours of observation took place at each site.

Data Collection Procedures

Data collection occurred between January – March 2012 on Tuesdays from 9:00 a.m. to 11:00 a.m. and Wednesdays and Friday from 11:00 a.m. to 1:00 p.m. The time slots were selected based on the availability of the observers. Eight intersections were observed three times and one intersection was observed four times; due to inclement weather, two intersections were observed twice. Pilot test observations were conducted for approximately 30 minutes to review procedures and clarify definitions with the observers.

Observers worked in three teams of two and positioned themselves so they would not be a distraction to the drivers. The observers included six graduate students trained in what constitutes driver distraction. Inter-rater agreement was not assessed. Observations were conducted of approaching vehicles traveling in the lane closest to the observers with the observers facing the approaching vehicles. Using separate tablet computer devices, one

observer recorded specific information on vehicle characteristics. The other observer looked through the front and side windows and recorded driver and occupant characteristics and whether the driver was engaged in a distracting behavior. Emergency vehicles, tractor-trailer trucks, and buses were excluded. After the information was recorded, the next observed vehicle that was the next one to pass in front of the observers. In locations where traffic was heavy, the next vehicle observed was the tenth vehicle that passed in front of the observers. While this methodology may not produce a statistically representative sample, this approach permitted each data collector enough time to observe a wide variety of distracting behaviors and record the information accurately in a real-world setting.

Measures

Recent research has defined distraction as any activity that distracts the driver or competes for their attention while driving and has the potential to degrade driving performance and have serious consequences for road safety. (K. Young & Regan, 2007) Therefore, any sources of distraction were recorded including use of a cell phone (hands-free or hand-held devices), texting/dialing cell phone (manually dialing or manipulating buttons on a cell phone or smart phone), any external-vehicle distraction (driver's attention was directed at something outside of the vehicle), another occupant in the vehicle (conversing or interacting with another individual in the car), smoking (lighting, holding, smoking or extinguishing a cigarette while driving), other, or none (distracted behavior was not observed) (Table A1). Drivers were classified as using a cell phone if the data collectors observed them holding a cell phone to their ears, speaking or wearing headsets with microphones, or using a wireless earpiece. Other potentially distracting behaviors included adjusting buttons on the dashboard (GPS, radio, climate control), eating, drinking, grooming, reaching to another seat, reading, or singing. Data collectors used a free text field to describe any other type of distractions observed.

Information was collected regarding the estimated age (<30 years, 30–50 years, >50 years, unsure), gender (male, female, undetermined) and race (White, Black, Hispanic, Asian, Unsure, Other) of the driver. Vehicle and traffic information were also collected including the total number of children and adult occupants in the vehicle (0, 1, 2, 3, 4, 5+), vehicle type (car, SUV, van, pickup truck), and estimated vehicle speed (stopped, <25, 25–50, >50 miles per hour), and traffic flow (stopped, slow moving, moderate congestion, free flowing) was collected. Broad categories were used to avoid misclassification errors. Road type was defined according to classification network used by the Regional Planning Commission of Birmingham including arterial/collector (including other principal arterials, minor arterials, and major collectors), and local streets. (Regional Planning Commission of Greater Birmingham)

Statistical Analysis

Chi-square tests were used to compare the frequency and types of driver distraction according to age, gender, vehicle speed, and road type. A p-value of <0.05 was considered statistically significant.

RESULTS

There were 3,296 drivers observed during the study after 64 hours of observation. The type of distraction was missing in less than 1% (n=31) of the records, leaving 3,265 in the study population. Half of the drivers were female (49.8%), and aged 30–50 years (54.7%); the majority of vehicles observed were traveling at estimated speeds of <25 mph or 25–50 mph (Table A2). Overall, 32.7% (n=1,069) of the observed vehicles involved a distracted driver. Among those involved in a distracting activity, 5.1% engaged in more than one distracting activity at the same time (Table 3). The most frequently observed distractions were interacting with another passenger (53.2%), talking on the phone (31.4%), an external-vehicle distraction (20.4%), and texting/dialing a phone (16.6%). Other types of distraction that occurred less frequently included grooming (5.8%), smoking (5.5%), drinking a beverage (3.8%), reaching to another seat (3.2%), eating (3.0%), and manipulating radio controls (2.4%). Wearing headphones, singing, interacting with pets, balloons, manipulating papers, manipulating mirrors, and writing while driving were each observed in less than 1% of the drivers.

Driver Distraction by Gender

There was no difference in the prevalence of driver distraction between males and females (31.6% and 33.6%, respectively) (Table 4). Among those involved in a distracting activity, there was a significantly higher proportion of females (38.6%) observed talking on the phone compared to males (24.3%), whereas the proportion of males (25.8%) distracted by something external to the vehicle was significantly higher compared to females (14.9%). Occurrence of other distraction types was significantly higher among males than females (28.7% vs. 21.0%, respectively). There were no differences in the proportion of males and females observed texting/dialing a phone and interacting with another passenger.

Driver Distraction by Age Group

The proportion of distracted drivers was significantly higher among those aged <30 years compared to those aged 30–50 years and >50 years (Table 4). Among those distracted, talking on the phone was more common among those aged <30 years (30.8%) and 30–50 years (33.5%) compared to those >50 years (24.4%), but this difference was not statistically significant. Older drivers were significantly more likely to be distracted by something external to the vehicle. The proportion of drivers observed texting/dialing a phone was significantly higher in the youngest age group compared to the older age groups. The prevalence of drivers interacting with other passengers or engaging in other types of distractions was not statistically different across age groups.

Driver Distraction by Speed

There was a significantly higher proportion of drivers engaged in some type of distracting activity while the car was stopped (53.0%) compared to approximately one-third of drivers traveling < 25 mph, 25–50 mph, and > 50 mph (Table 4). The proportion of drivers talking on the phone was not statistically different across vehicle speeds. As vehicle speed increased, the proportion of drivers with passengers that were observed interacting with another passenger decreased significantly. However, vehicles that were traveling >50 mph

(25.8%) tended to have more drivers texting/dialing compared to vehicles stopped (19.3%), traveling < 25 mph (14.2%) or 25–50 mph (17.9%) ($p=0.070$).

Driver Distraction by Road Type

There was a significantly higher prevalence of driver distraction on local streets (36.3%) compared to arterial/collector roads (31.3%) (Table 4). External vehicle distractions were more common among drivers on local streets (28.7% vs. 16.6%), whereas, texting/dialing (18.1% vs. 13.1%) and other distraction types (26.6% vs. 20.3%) occurred more frequently on arterial/collector roads. The proportion of those interacting with another passenger and talking on the phone was similar across road types.

DISCUSSION

With increased use of wireless communication, entertainment and driver assistance systems, there has been widespread concern that the number of distraction-related crashes will increase because of the effect of driver distraction on driving performance. A growing body of evidence shows that distracted driving impairs driving performance on a number of critical safety measures including not having their hands on the steering wheel, directing their eyes inward, missing traffic signals, and having inattention blindness. (Strayer, Drews, & Johnston, 2003; Strayer & Johnston, 2001; J Stutts et al., 2005) Furthermore, impaired driving performance translates to increased crash risk. Analysis of eye glance behavior indicates that glances away from the forward roadway (for any reason) for more than 2 seconds double the near-crash/crash risk compared to that of normal, baseline driving. (Klauer et al., 2006) Naturalistic in-vehicle approaches provide extensive detail on driver behaviors, but may have limited implementation partly because of the inherent difficulties in obtaining naturalistic data. Roadside observational approaches may be less costly and more efficient ways to measure the prevalence of driver distraction than naturalistic in-vehicle approaches. Therefore, the current study investigated the prevalence of distracted driving and the frequency of distraction types among passenger vehicle drivers in an urban metro area of the southeastern US using a roadside observational approach.

Overall, one-third of drivers were engaged in one or more distracting activities while driving. The overall prevalence of distracted driving was consistent with the findings reported by naturalistic in-vehicle studies, but was considerably higher than those reported by Johnson et al. and Sullman. (Johnson et al., 2004; Klauer et al., 2006; J Stutts et al., 2005; Sullman, 2012) It is likely that the range of prevalence estimates are related to differences in the data collection methods, quality of the evidence obtained, and the type of locations included in the studies. The current study included a wider range of vehicle speeds compared to the studies by Johnson et al. (2004) and Sullman (2012), and therefore is more similar to the driving environments that would have been captured in the naturalistic studies. Another possibility is that the observers in this study were more likely to select vehicles for observation that had a distracted driver; however, we employed a data collection strategy that would minimize this problem. There is little to no evidence that suggests there was any selection bias from our observations, so the vehicles selected are likely representative of the population sampled.

The majority of the observed distractions included interacting with other passengers, talking on the phone, external vehicle distractions, and texting/dialing on the phone. We did observe patterns of these behaviors varied other distracting activities by driver characteristics which have been previously noted. Of the vehicles where passengers were present, over half of the drivers were observed interacting with these occupants. The prevalence of this distraction did not differ by age group, which is in contrast to findings reported by Stutts et al. who reported that younger drivers were more likely to be observed interacting with other passengers (JC Stutts et al., 2001). In terms of driving performance, it is not clear whether passengers are a source of distraction, or whether they can be a positive influence (e.g. detect an unexpected hazard on the road) particularly for novice drivers and older drivers. (Engström, Gregersen, Granström, & Nyberg, 2008; Hing, Stamatiadis, & Aultman-Hall, 2003) In terms of age, younger drivers were more likely than those aged 30–50 and >50 years to be distracted in general and texting/dialing while driving; similar findings have been consistently reported in the literature. (Johnson et al., 2004; Pickrell & Ye, 2013; Sullman, 2012). In terms of gender differences, females were more likely to be observed talking on the phone and males were more likely to be distracted by external factors. Results regarding gender differences with cell phone use while driving are mixed; some studies report that females are more likely to be distracted by talking on a phone, (Glassbrenner, 2005) whereas others reported men were more likely to use cell phones when driving. (Pöysti, Rajalin, & Summala, 2005; Sayer et al., 2005) Interestingly, several studies have found that gender has no effect on risk of a crash associated with phone use. (McCartt, Hellenga, & Bratiman, 2006; Pöysti et al., 2005) It remains unclear as to the exact relationship between cell phone use and distraction and how that relates to safety by gender.

Our results also suggest that the prevalence of certain distracting activities varies by contextual factors such as vehicle speed and road type. The proportion of those engaged in any distraction activity and those interacting with a passenger had an inverse relationship with vehicle speed, whereas the proportion of those texting/dialing was highest among drivers traveling > 50 mph (25%) and those in stopped vehicles (19%). Still, other behaviors such as talking on the phone and distractions external to the vehicle occurred regardless of the speed of the vehicle. In terms of road type, any distracting activity and external vehicle distractions occurred more frequently on local streets, whereas texting/dialing occurred more frequently on arterial/collector streets. Several studies have found that drivers either selectively engage in certain behaviors according to vehicle speed and traffic/roadway conditions or they reduce speed when engaging in a secondary task, underscoring the importance of contextual factors when collecting and analyzing driver distraction data. (Pöysti et al., 2005; Strayer et al., 2003; J Stutts et al., 2005) Therefore, the observed reductions in prevalence of driver distraction during certain vehicle speeds or certain roadway types could be the result of the drivers' attempt to self-regulate his or her driving or because of differences in the complexity of the traffic environment. (Pöysti et al., 2005; Strayer et al., 2003; J Stutts et al., 2005) Paradoxically, it is possible that more complex driving environments may reduce the prevalence of driver distraction and result in safer roadways.

Of the drivers observed, the proportion engaged in any phone use (15.6% combined talking/texting/dialing, n=511/3265) is of particular concern. This is substantially higher than a

previous report estimating that 9% of all drivers use either a hand-held or hands-free cell phone while driving. (Pickrell & Jianqiang Ye, 2010) It is not clear why the current study estimate is higher than previous reports, though one explanation may be that it is possible the National Occupant Protection Use Survey (NOPUS) rate is lower because driver cell phone use is restricted in a number of states, where the legislation banning texting and driving in Alabama had not yet passed at the time of the data collection for the current study. (McClendon, 2012)

As with any fixed-site observational study, a strength of this approach was the ability to observe all types of possible distractions and record what is actually happening on the road. In addition, the prevalence of driver distraction was comparable to estimates from naturalistic in-vehicle studies, providing some degree of validation for this estimate. Our study shows, when similar methodologies are used, roadside observational approaches are able to produce similar estimates of driver distraction as naturalistic studies, but with substantially fewer resources. Therefore, the roadside observational approach continues to be a preferred and viable option for researchers.

There are several limitations worth noting. Each observation was made by a single individual, so the reliability of the observations is not known. These estimates reflect daytime driver distraction only, specifically during morning and lunch hour traffic, and the type and frequency of distraction might be different in the evening and at night. (Klauer et al., 2006) The information obtained is limited by the time available and the fidelity of the discrimination that can be made by observers as vehicles move past a fixed location. (Ranney, 2008) This introduces the potential for misclassification bias since certain types of distractions are difficult to reliably identify and may obscure the prevalence of specific types of distraction-related behaviors. For example, the level of distraction for short-duration behaviors (e.g. manipulating radio controls) is likely an underestimate, as the roadside observers would not record behaviors in the sampled vehicles that cannot be observed from the roadside. However, we do not expect that the misclassification was differential by factors examined in the analysis. Alternatively, it is possible that observers identified a driver looking away from the forward roadway as distracted by something external to the vehicle when in fact, the driver was checking whether a pedestrian was going to cross the road. While we acknowledge that searching the roadside is essential for safe navigation, it still may lead to distracted and unsafe driving. Therefore, this proportion still represents a group of drivers at-risk for a crash (Boer, Cleij, Dawson, & Rizzo, 2011; Klauer et al., 2006) Lastly, this study has limited generalizability as the study population was restricted to a single county in Alabama and no randomization was used in scheduling the days and times for data collection. In addition, the use of a statistical weight would have been preferred to account for the different sampling rates used during heavier traffic; however, it was not feasible for observers to calculate the total number of vehicles in the area at each time a vehicle was chosen for observation.

Despite these limitations, this study provides detailed data from a reasonably large sample of drivers regarding the prevalence of distracted driving and the frequency of different types of activities that drivers engaged in while driving. These findings suggest that approximately one-third of drivers engage in some type of distracting behavior while driving, and the speed

of the vehicle influences a driver's decision to engage in certain behaviors. A better understanding of the distracted driving problems will likely emerge from a combination of research approaches, including roadside observation like the current study. Despite the increased attention on the dangers of texting and cell phone use while driving, these specific activities were two of the most frequently observed distractions. These findings indicate there is a continued need to target road safety education especially towards younger drivers. Future studies should be undertaken to identify other segments of the road users who may have an increased incidence of distraction, such as public bus drivers or pedestrians.

Acknowledgments

The project was funded by the US Department of Transportation, Federal Transit Administration (project number: AL-26-7261-04).

References

- Ascone, D.; Lindsey, T. An examination of driver distraction as recorded in NHTSA databases (HS-811 216). Washington DC: National Highway Traffic Safety Administration; 2009. Retrieved from <http://www-nrd.nhtsa.dot.gov/Pubs/811216.pdf>
- Boer E, Cleij D, Dawson J, Rizzo M. Serialization of vehicle control at intersections in older drivers. Paper presented at the Proceedings of the International Driving Symposium on Human Factors in Driver Assessment, Training, and Vehicle Design. 2011
- Brodsky W, Slor Z. Background music as a risk factor for distraction among young-novice drivers. *Accid Anal Prev*. 2013; 59:382–393. [PubMed: 23896043]
- Crawford, J. Paper presented at the Transportation Research Board 8th Annual Meeting. Washington DC: 2002. Assessment of handheld cellular telephone use on Dallas County, Texas freeways.
- Engström I, Gregersen NP, Granström K, Nyberg A. Young drivers—reduced crash risk with passengers in the vehicle. *Acci Anal & Prev*. 2008; 40(1):341–348.
- Glassbrenner, D. Driver cell phone use in 2005 – overall results. Washington DC: National Highway Traffic Safety Administration; 2005. Retrieved from <http://www-nrd.nhtsa.dot.gov/Pubs/809967.pdf>
- Hanowski R, Perez M, Dingus T. Driver distraction in long-haul truck drivers. *Transportation Res Part F: Traffic Psychology and Behav*. 2005; 8(6):441–458.
- Hing JYC, Stamatiadis N, Aultman-Hall L. Evaluating the impact of passengers on the safety of older drivers. *J Safety Research*. 2003; 34(4):343–351. [PubMed: 14636656]
- Johnson M, Robert B, Lacey J, McKnight A, James E. Living dangerously: driver distraction at high speed. *Traffic Injury Prevention*. 2004; 5(1):1–7. [PubMed: 14754669]
- Klauer, S.; Dingus, T.; Neale, V.; Sudweeks, J.; Ramsey, D. The impact of driver inattention on near-crash/crash risk: an analysis using the 100-car naturalistic driving study data (HS-810 594). Washington DC: National Highway Traffic Safety Administration; 2006. Retrieved from <http://www.nhtsa.gov/Research/Human+Factors/Naturalistic+driving+studies>:
- Koppel S, Charlton J, Kopinathan C, Taranto D. Are child occupants a significant source of driving distraction? *Accid Anal Prev*. 2011; 43(3):1236–1244. [PubMed: 21376923]
- McCartt A, Hellinga L, Bratiman K. Cell phones and driving: review of research. *Traffic Injury Prevention*. 2006; 7(2):89–106. [PubMed: 16854702]
- McClendon J. Motor vehicles, text messaging or operating a handheld wireless telecommunication device while operating a motor vehicle on public street, road, or highway prohibited, penalties, law enforcement agencies to report statistical information to Public Safety Department, House Bill 2 C.F.R. § 111.05. 2012
- National Highway Traffic Safety Administration National Motor Vehicle Crash Causation Survey – Report to Congress (DOT HS 811 059). Washington DC: U.S. Department of Transportation; 2008. Retrieved from <http://www-nrd.nhtsa.dot.gov/Pubs/811059.PDF>

- National Highway Traffic Safety Administration Overview of the National Highway Traffic Safety Administration's Driver Distraction Program (HS-811 299). Washington DC: U.S. Department of Transportation; 2010. Retrieved from http://www.nhtsa.gov/staticfiles/nti/distracted_driving/pdf/811299.pdf
- National Highway Traffic Safety Administration Distracted Driving 2010 (HS-811 650). Washington DC: U.S. Department of Transportation; 2012. Retrieved from <http://www.distraction.gov/download/research-pdf/2010FactSheet.pdf>
- Pickrell, T.; Jianqiang Ye, T. Driver electronic device use in 2009. (HS-811 372). Washington DC: National Highway Traffic Safety Administration; 2010. Retrieved from <http://www.distraction.gov/download/research-pdf/Driver-Electronic-Device-Use-2009.pdf>
- Pickrell, T.; Ye, T. Driver electronic device use in 2011. (HS-811 719). National Highway Traffic Safety Administration; 2013. Retrieved from <http://www-nrd.nhtsa.dot.gov/Pubs/811719.pdf>
- Pöysti L, Rajalin S, Summala H. Factors influencing the use of cellular (mobile) phone during driving and hazards while using it. *Accid Anal Prev.* 2005; 37(1):47–51. [PubMed: 15607274]
- Ranney, T. Driver distraction: a review of the current state-of-knowledge (HS-810 704). Washington DC: National Highway Traffic Safety Administration; 2008. Retrieved from <http://www.nhtsa.gov/Research/Human+Factors/ci.Distractioin.print>
- Regional Planning Commission of Greater Birmingham. Functional Classification Network. Retrieved from <https://rpcgb.maps.arcgis.com/home/gallery.html>
- Reinfurt, D.; Huang, H.; Reaganes, J.; Hunter, W. Cell phone use while driving in North Carolina. Chapel Hill, NC: University of North Carolina, Highway Safety Research Center; 2001.
- Salzberg, P. Cell phone use by motor vehicle drivers in Washington State. Olympia, WA: Washington Traffic Safety Commission; 2002.
- Sayer, J.; Devonshire, J.; Flannagan, C. The effects of secondary tasks on naturalistic driving performance. (UMTRI-2005-29). Ann Arbor, Michigan: The University of Michigan Transportation Research Institute; 2005. Retrieved from <http://deepblue.lib.umich.edu/bitstream/2027.42/57450/1/99225.pdf>
- Strayer D, Drews F, Johnston W. Cell-phone induced failures of visual attention during simulated driving. *J Experimental Psychology: Applied.* 2003; 2:23–32.
- Strayer D, Johnston W. Driven to distraction: Dual-task studies of simulated driving and conversing on a cellular telephone. *Psychological science.* 2001; 12(6):462–466. [PubMed: 11760132]
- Stutts J, Feaganes J, Reinfurt D, Rodgman E, Hamlett C, Gish K, Staplin L. Driver's exposure to distractions in their natural driving environment. *Accid Anal Prev.* 2005; 37:1093–1101. [PubMed: 16011827]
- Stutts, J.; Reinfurt, D.; Staplin, L.; Rodgman, E. The role of driver distraction in traffic crashes. Washington DC: AAA Foundation for Traffic Safety; 2001.
- Sullman M. An observational study of driver distraction in England. *Transportation Res Part F: Traffic Psychology and Behav.* 2012; 15(3):272–278.
- U.S. Census Bureau. Profile of general population and housing characteristics:2010, DP01. Retrieved May 2, 2012, from U.S. Census Bureau, 2010 Census <http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml>
- U.S. Census Bureau, & 2010 American Community Survey. Selected economic characteristics, DP03. Retrieved May 2, 2012, from U.S. Census Bureau, 2010 American Community Survey <http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml>
- Young, K.; Regan, M. Driver distraction: a review of the literature. Sydney, NSW: Australian College of Road Safety; 2007.
- Young M, Mahfoud J, Walker G, Jenkins D, Stanton N. Crash dieting: the effects of eating and drinking on driving performance. *Accid Anal & Prev.* 2008; 40:142–148.

Table 1

Categories of Driver Distraction-related Behaviors

Type of Distraction	What is Actually Being Observed by Data Collectors?
Use of a cell phone	Cell phone in drivers' hands or handsets with microphones or Bluetooth headsets; cell phones may not be in sight
Texting/dialing phone	Visibly manipulating cell phones, PDAs, video games, MP3 players and other hand-held devices.
Any external-vehicle distraction	Looking at shops or advertising signs
Another passenger	Conversing or talking with another visible passenger in the vehicle
Smoking	Cigarette in drivers' hands or driver is visibly in the act of smoking
Manipulating a GPS or radio	Inserting a CD, tuning a radio, or visibly manipulating GPS or other device on the dashboard
Drinking a beverage	Visibly holding a cup or sipping from a straw
Eating	Visibly holding food or eating food
Grooming	Combing hair, applying make-up
Reaching to another seat	Visibly stretching arm or body past the driver's seat to another part of the car
Reading	Reading a book, map or other document
Singing	Hearing driver sing

Table 2

Characteristics of drivers and vehicles observed (N=3265)

	N	% of total
Gender of driver		
Female	1613	49.8
Male	1629	50.3
Missing	23	
Race of driver		
Black	647	20.0
White	2511	77.5
Other	81	2.5
Missing	26	
Age of driver		
<30 years	853	26.3
30–50 years	1773	54.7
>50 years	617	19.0
Missing	22	
Vehicle Type		
Car	1667	51.3
Pickup truck	451	13.9
SUV	955	29.4
Van	180	5.5
Missing	12	
# of child passengers		
0	3156	97.0
1	99	3.0
Missing	10	
# of adult passengers		
0	2709	82.8
1	562	17.2
Missing	11	
Traffic flow		
Stopped	74	2.3
Slow moving	657	20.2
Free-flowing	1346	41.3
Moderate pace	1181	36.3
Missing	24	
Speed of vehicle		
Stopped	166	5.1
<25 mph	1560	47.9
25–50 mph	1330	40.9
>50 mph	200	6.1

	N	% of total
Missing	26	
Road type		
Arterial/collector	2343	71.8
Local street	922	28.2
Weekday		
Tuesday	967	29.5
Wednesday	1073	32.7
Thursday	165	5.0
Friday	1077	32.8
Any distraction	1069	32.7

Table 3

Frequency of specific driver distractions among distracted drivers observed (N=1069)

Source of distraction	N	% of drivers identified as distracted ^a
Interacting with another passenger ^b	124	53.2
Talking on phone	336	31.4
External-vehicle distraction	218	20.4
Texting/dialing phone	177	16.6
Grooming	62	5.8
Smoking	59	5.5
Drinking a beverage	41	3.8
Reaching to another seat	34	3.2
Eating	32	3.0
Manipulating radio controls	26	2.4
Wearing headphones	6	0.6
Singing	4	0.4
Pets	3	0.3
Balloons	2	0.2
Manipulating papers	1	0.1
Manipulating mirror	1	0.1
Writing	1	0.1
Multiple (2) distractions	55	5.1

^aPercentages may not add up to 100% because some of these activities could occur simultaneously^b Among those where passengers were present, based on total N=233

Table 4

Type of driving distraction by gender, age group, vehicle speed, and road type

	Any distraction	Another passenger ^a	Talking on phone ^b	External-vehicle distraction ^b	Texting/dialing ^b	Other ^{b,c}
<i>Gender, n (%)</i>						
Female	542 (33.6)	63 (54.8)	209 (38.6)	81 (14.9)	98 (18.1)	114 (21.0)
Male	515 (31.6)	56 (51.4)	125 (24.3)	133 (25.8)	78 (15.1)	148 (28.7)
p-value	0.23	0.61	<0.0001	<0.0001	0.20	0.0037
<i>Age Group, n (%)</i>						
<30 years	325 (38.1)	40 (60.6)	100 (30.8)	45 (13.8)	72 (22.2)	84 (25.8)
30–50 years	597 (33.7)	68 (50.7)	200 (33.5)	129 (21.6)	84 (14.1)	142 (23.8)
>50 years	135 (21.9)	13 (46.4)	33 (24.4)	39 (28.9)	19 (14.1)	35 (25.9)
p-value	<0.0001	0.32	0.12	0.0005	0.0049	0.74
<i>Vehicle Speed, n (%)</i>						
Stopped	88 (53.0)	17 (65.4)	23 (26.1)	11 (12.5)	17 (19.3)	28 (31.8)
<25 mph	514 (33.1)	80 (60.2)	165 (32.1)	107 (20.8)	73 (14.2)	121 (23.5)
25–50 mph	390 (29.5)	24 (38.1)	121 (31.0)	82 (21.0)	70 (17.9)	101 (25.9)
50+ mph	66 (33.2)	2 (25.0)	20 (30.3)	18 (27.3)	17 (25.8)	10 (15.2)
p-value	<0.0001	0.0055	0.74	0.15	0.070	0.097
<i>Road Type, n (%)</i>						
Arterial/collector	734 (31.3)	72 (50.4)	237 (32.3)	122 (16.6)	133 (18.1)	195 (26.6)
Local street	335 (36.3)	52 (57.8)	99 (29.6)	96 (28.7)	44 (13.1)	68 (20.3)
p-value	0.0061	0.27	0.37	<0.0001	0.042	0.027

^a Among those where passengers were present.^b Among those where any distraction was present.^c Includes grooming, smoking, drinking a beverage, reaching to another seat, eating, manipulating controls, wearing headphones, singing, pets, balloons, manipulating papers, manipulating mirror, and writing