DRIVER DISTRACTION AND HANDS-FREE TEXTING WHILE DRIVING

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Introduction

Distracted driving has become a source of growing concern among governments, road safety researchers and the public in the past decade. This is due, in part, to concern that distracted driving contributes to increased crash risk, and, in part because of the link that has been established between at least some types of distractions and increased crash risk. These issues have been well documented in the literature (Governors Highway Safety Association 2011; Hedlund 2006; NHTSA 2010b; Smiley 2005; Ranney 2008; Trombley 2010).

In particular, research clearly demonstrates that texting while driving is an unsafe behavior because texting is a significant source of distraction. This behavior is especially problematic for teen drivers who are more often attracted to and more readily adopt new communication technologies (Lee et al. 2011). This is because, not only are teens more inexperienced at driving, but, additionally, their brains are not fully developed which makes them more susceptible to distractions and poor judgment (Smiley et al. 2008; Trombley 2010).

The increased relative risk of teen and young drivers being involved in a distraction-related collision can be attributed to behavior and attitudes among this age group. Recently, a nationally representative survey of distracted driving attitudes and behavior found that drivers under 25 are far more likely than older drivers to send text messages or emails while driving. Among 16-25 year old respondents, approximately 70% admitted to sending text messages or emails while driving compared to 14% of all respondents (Schroeder et al. 2013). And, while almost all drivers believe that sending text messages while driving is very unsafe, young passengers are more reluctant than older passengers to speak up if the driver is texting behind the wheel (NHTSA 2012).

The crash risk associated with hands-free texting while driving is not as well understood because in-car voice-to-text technology is relatively new, and few studies investigating this specific issue have been completed to date. What is known, however, supports the contention that hands-free texting while driving poses significant distraction, and consequently, unacceptable crash risk (Tijerina 2008). To put this traffic safety issue and public health concern into perspective, this paper draws upon existing research in order to share insight into key facets of distracted driving and the implications for texting while driving behavior among young drivers.

What is distracted driving?

While several definitions of distracted driving have been developed (Tasca 2005),

one of the most widely accepted is acknowledged in the proceedings from an international conference on distracted driving co-hosted by the Traffic Injury Research Foundation and the Canadian Automobile Association in 2005. It states:

"Distraction involves a diversion of attention from driving, because the driver is temporarily focused on an object, person, task, or event not related to driving, which reduces the driver's awareness, decision-making, and/or performance, leading to an increased risk of corrective actions, near-crashes or crashes"(Hedlund 2006, p.2).

This definition incorporates three important aspects of the problem – the source of the distraction, its effects on driving behavior, and the potential consequences. A more recent working definition of distracted driving comes from a Governors Highway Safety Association's (GHSA) report on the distracted driving research:

"Distraction occurs when a driver voluntarily diverts attention away from driving to something not related to driving that uses the driver's eyes, ears, or hands" (GHSA 2011, p. 3).

Initially, considerable attention on distracted driving focused mainly on cell phone use by drivers. Even today, for much of the public, distracted driving is synonymous with cell phone use. However, in spite of its significance as a distraction, cell phone use is, in fact, just one small part of a much larger problem. The reality is that distracted driving encompasses a much wider range of activities, many of which have become commonplace and routine in our daily driving environment (Robertson et al. 2010).

In the past decade, the potential for distracted driving has increased exponentially as passenger vehicles are increasingly equipped with new and potentially distracting "convenience technologies" (entertainment systems, navigation systems, multifunction controllers, talking cars). Drivers must cope with information from these technologies in addition to other ubiquitous distractions such as minding children in the vehicle (Koppel et al. 2011), talking to passengers, eating, grooming, reading billboards, and rubbernecking at stopped vehicles. The emergence of a new in-car technology that facilitates hands-free voice texting is the most recent addition that only adds to the potential sources of in-vehicle distractions.

What causes distraction?

Humans are serial processers of information, meaning that they are only capable of consciously attending to one task at a time (Smiley 2005). Given that people rapidly switch their attention back and forth across tasks, they falsely believe that they can "multi-task". In reality, they cannot, and, by trying to do so, neither task receives optimal attention or focus.

How information is processed is important, since driving is a "divided attention" task involving continuous interaction of manual, visual, and cognitive components. Furthermore, the amount of attention that a driver must allocate to driving is a function of the driver's experience, the complexity of the driving task and the nature of the driving environment. To illustrate, inexperienced drivers must consciously focus more on remaining within their lane whereas for experienced drivers this is very reflexive (Smiley 2005). An inexperienced driver, particularly one who is driving a technologically complex car, has to focus far more on controls and systems than someone who is familiar with the vehicle.

Biology is the fundamental limitation. Drivers can suffer from cognitive overload. At this stage the brain must decide which information will receive attention. Some of these decisions are conscious and can be controlled whereas other decisions are subconscious (Trombley 2010). To illustrate, a simulator study conducted at Carnegie Mellon University examined Magnetic Resonance Imaging (MRI) pictures of the brain while subjects drove on a simulator and listened to spoken statements. Participants had to determine if these statements were true or false. The results showed that activity in the brain's parietal lobe (an area associated with navigation and spatial sense) decreased 37% and activity in the occipital lobe (associated with processing visual information) also decreased (Just et al. 2008).

In a more recent study, Schweizer et al. (2013) placed a driving simulator with a fully functional steering wheel and pedals in a MRI system. In this experiment, participants were requested to perform concurrent tasks of responding to verbal questions while driving. Participants responded to general knowledge true or false questions by pressing corresponding buttons embedded on the steering wheel – which according to the authors is similar to modern vehicle designs for answering hands-free devices or volume controls.

The authors found that during distracted driving, brain activation shifted dramatically from the posterior of the brain, which governs visual and spatial areas to the prefrontal cortex which regulates cognitive function and decision-making. They concluded that "findings suggest that the distracted brain sacrificed areas of the posterior brain important for visual attention and alertness to recruit enough brain resources to perform a secondary, cognitive task." Although based on a small sample size (16 participants) and young adults (between the ages of 20 and 30), this study provides further confirmation based on neuroimaging that multi-tasking while driving may potentially compromise visual attention and alertness, both cognitive functions critical to safe driving.

The bottom line is that, as drivers focus more of their attention on secondary tasks unrelated to driving they begin to suffer from "inattention blindness", particularly as secondary tasks become more complex. They may look but not "see" what is happening in the driving environment. It is estimated that drivers using a cell phone may fail to see up to 50% of the available information in their driving environment (Strayer 2007).

Studies of distraction involving real-world driving have also been conducted with similar results. An on-road study was undertaken by Transport Canada to investigate possible changes in drivers' visual inspection patterns while they were distracted. A group of 21 drivers drove on an 8 km (5 miles) city route in vehicles equipped with a hands-free communications device. Drivers were required to perform no additional cognitive task, an easy cognitive task, and a difficult cognitive task. Results revealed that drivers spent less time looking in peripheral areas and more time looking centrally ahead. Among some drivers, there was reduced visual monitoring of instruments; other drivers stopped doing this entirely. Drivers also glanced less frequently at traffic lights compared to the No Condition task and reduced scanning to their right upon approaching intersections. Drivers' control of the vehicle was also compromised as there were more occurrences of hard braking during the most difficult cognitive tasks (Harbluk et al. 2007).

What is the importance of the source of distraction?

A number of simulator and observational studies have also measured the effects of distracted driving. While the focus has tended to be on cell phone distractions, the results are illustrative for distraction generally and hands-free texting specifically.

A Canadian simulator study in Calgary involving both novice and experienced drivers using cell phones revealed that both types of drivers restricted their visual scanning while using a phone. In sharp contrast to experienced drivers who slowed down while using the phone, novice drivers drove at similar speeds whether they were on or off the phone. Novice drivers also wandered more in their lane when on the phone. However, experienced drivers were not unaffected by distraction as findings showed that their perceptions and response times to pedestrian hazards deteriorated to novice levels when they were talking on the phone (Smiley et al. 2008).

In 2006, the 100-Car Naturalistic Driving study conducted by the Virginia Tech Transportation Institute examined data from 69 crashes and 761 near-crashes in conjunction with baseline data from 20,000 randomly selected, uneventful driving segments. The study revealed that distraction resulting from a secondary task was reported in 33% of crashes and 27% of near-crashes. Using these data to calculate the relative risk of crashing, researchers concluded that performing a complex secondary task (e.g., reaching for a moving object, applying makeup or dialing) exposed drivers to approximately three times the risk of involvement in a crash or near-crash. Moderate secondary tasks (talking/listening, eating, inserting a CD) were approximately twice the risk, and for simple secondary tasks (e.g., drinking, smoking) there was no appreciable increase in crash or near-crash risk (Klauer et al. 2006). It should be noted that there are limitations to this study. Most importantly, only a small number of crashes were studied, and many of the distraction-related crashes involved minor damage that may not necessarily be investigated by the police or included in a transportation department's collision data (Ranney 2008).

Few studies have considered the distracting effects of operating vehicle entertainment systems because these secondary tasks are generally considered harmless. However, studies that have examined in-vehicle technologies have demonstrated that tuning or simply listening to a radio can compromise driving performance (Young et al. 2003). With regard to navigational systems, destination entry (cognitive and physical distraction) is considered the most distracting component of their use (Tijerina et al. 1998; Young et al. 2003).

A meta-analysis by Caird et al. (2008) found that either talking on a cell phone or with a passenger had approximately equal effects on driving performance. Conversations increased reaction time to events and stimuli around and within the vehicle. A similar meta-analysis of 23 experimental studies of distraction effects of phone use was conducted by Horrey and Wickens (2006). It found similar levels of distraction among users of handheld and hands free cell phones, concluding that the main effect was the cognitive distraction, not the physical use of the phone.

McCartt and colleagues (2006) published a comprehensive review that synthesized the results of 125 studies on driver distraction and cell phone use. Slowed reaction time was the most consistent finding and degraded performance was more pronounced among older drivers (age 50 to 80).

What is the risk of and prevelance associated with distracted driving?

In a recent meta-analysis of crash data and naturalistic studies on cell phone effects on crash risk, Elvik (2011) concluded that crash risk is about three times greater when using a cell phone. And, a recent GHSA (2011) review of the distracted driving research concludes that cell phone use increases crash risk to some extent but there is no consensus on the size of the increase.

The potential increase in crash risk that can result from cell phone use poses a significant concern in light of the prevalence of this behavior and the estimated contribution of driver distraction to road crashes. According to the National Highway Traffic Safety Administration (NHTSA), in 2008 there were an estimated 11% of vehicles whose drivers were using some type of phone (handheld or hands free) while driving at any given time (NHTSA 2009b). In an international comparison of self-reported driving behavior, it was reported among drivers aged 18-64, 21% of British drivers and 69% of American drivers talked on a cell phone while driving at least once in the past 30 days. The prevalence of drivers who had read or sent an email or text message while driving in the past 30 days ranged from 15% in Spain to 31% in Portugal and the United States (Centers for Disease Control 2013).

Several phone surveys have been conducted in the United States to gauge public attitudes and behaviors regarding distracted driving. In 2009, the Insurance Institute for Highway Safety (IIHS) reported that 13% of respondents of all ages admitted to texting while driving. Among 18-24 year olds, 43% replied that they text and drive (Braitman and McCartt 2010). In 2010, a study by NHTSA reported that, overall, 18% of respondents sent texts or emails while driving, whereas 49% of 21-24 year olds affirmed this type of behavior (Tison et al. 2011). In a 2012 NHTSA survey 21% of respondents claimed that they sent texts or emails while driving. Later, in the survey, respondents were asked again if they engaged in this type of behavior. As expected, fewer (14%) respondents continued to admit they sent texts or emails while driving. However, 71% of 16-20 year olds and 69% of 21-24 year olds persisted positive involvement in texting or emailing while driving (Schroeder et al. 2013).

Moreover, it is generally believed that driver distraction is involved in 20-30% of road crashes (Hedlund 2006). This estimate is derived from a number of different sources including self-report data, crash data, and observational data from Canada and the U.S.

In light of these data, the high level of concern reported by the general public regarding this issue is certainly warranted. According to poll results reported in TIRF's Road Safety Monitor on distracted driving trends from 2006 (68.7%) to 2011 (73.5%), there remains a high degree of concern about the dangers posed by distracted drivers in Canada (Marcoux et al. 2012). The AAA Foundation for Traffic Safety reported that in a 2012 online survey, 88.5% of respondents felt that their personal safety was threatened by drivers talking on cell phones. When asked about dangers posed by drivers texting or emailing behind the wheel, 95.7% and 95.1% regarded these behaviors as harmful to their personal safety (Hamilton et al. 2013).

Why ban hands-free texting while driving?

Research has established that cell phone use and texting while driving are serious crash risks. However, there is conflicting evidence as to whether cell phone discussions are more or less disruptive than conversations with passengers or manipulating the music system (McCartt et al. 2006; Horry and Wickens 2006). Most recently, a review of the distracted driving research concluded that "there is no conclusive evidence on whether hands-free cell phone use is less risky than hand-held use" (GHSA 2011). Nonetheless, the crash risks associated with cell phone use have been deemed serious enough

that in December 2011, the National Transportation Safety Board (NTSB), in its report "Multivehicle Collision Interstate 44 Eastbound Gray Summit, Missouri August 5, 2010," recommended that states ban the nonemergency use of portable electronic devices while driving (NTSB 2011). The GHSA report also observed that "texting probably increases crash risk more than cell phone use" because texting requires both visual and manual distraction for a longer period of time than dialing a cell phone (GHSA 2011, p.4).

Although the relative crash risks of different sources of distraction are difficult to estimate, it is logical to believe that hands-free voice texting while driving should pose less crash risk than handheld texting while driving primarily because there should be less "eyes off the road" and manual distraction. However, the results of a recent study by Yager (2013) suggest that this logic may be seriously flawed. In this study, 43 participants drove an instrumented vehicle on a closed course without the use of a cell phone (i.e., no texting condition) and while sending and receiving text messages using: manual entry and two different voice-to-text applications. The order that participants completed each of these no texting and three texting conditions was counterbalanced to reduce potential learning biases. Performance measures that were recorded during the closed course drive included driver response times, eye gazes to the forward roadway, accuracy of and length of time to complete each text messaging task, and self-performance ratings. Results showed that driver response time was significantly delayed (about two times slower) and time with "eyes off the road" was significantly increased for all texting conditions compared to driving when not texting. This later finding suggests that the voice-to-texting did not help keep the driver's eyes on the roadway more frequently than texting manually. For similar texting tasks, and contrary to logic, voice-to-texting actually required more time than manual texting. However, driving performance was disrupted about the same for manual texting and voice-to-texting. Based on these study results, the author concludes that "using voice-to-text applications to send and receive text messages while driving do not increase driver safety compared to manual texting".

Although suggestive, the Yager study had a small sample size and further research will need to be conducted to replicate these findings as well as establish the crash risk of hands-free texting. In the absence of further research, however, it is logical that such a distraction will not reduce the risk to an acceptable level, either for safety advocates, or, more importantly, for the public who far too often suffer the consequences of distraction-related crashes, serious injuries, and premature deaths. As evidence of this, NHTSA (2012) reported from a national distracted driving telephone survey that nine out of ten drivers supported laws that ban texting, although research also indicates that there is a minority of drivers who believe that they can drive safely while texting. In a 2011 Canadian public opinion poll on distracted driving, Robertson et al. (2011) revealed that 13% of those surveyed believed this was true. Of importance, the recent Yager (2013) study found that participants felt less safe when they were texting but felt safer when hands-free texting than when texting manually, even though both texting methods equally decreased their driving performance.

More disturbing is the fact that, despite high levels of concern associated with distracted driving, there is some evidence to suggest that legislation prohibiting certain distractions can have the unintended negative consequence of implicitly suggesting that other distractions are in fact "safe". To illustrate, a national poll in Canada in 2010 revealed that 30% of respondents believed that talking on a cell phone was only dangerous if it was using a handheld phone (Robertson et al. 2010).

There are several reasons to be concerned about hands-free texting while driving. First, hands-free texting while driving is still "multi-tasking" as it increases drivers' cognitive workload, requiring them to shift their attention away from the complex task of driving. Second, in-car hands-free texting while driving still requires drivers to take their eyes off the road and glance down at the device since it does not always transcribe the spoken word accurately into text. Third, and most importantly, there is substantial evidence to illustrate that the inexperience of young and novice drivers places them at much higher risk of crashing even without the distractions of cell phones and other devices – e.g., the presence of teen passengers poses an especially significant risk factor for teen drivers (Williams et al. 2012).

More specifically, as evidence of the significance of the role of distraction in collisions involving younger drivers, NHTSA released a fact sheet highlighting findings from analysis of data on teen distracted driver crashes. Of the

3,331 persons killed in distraction-affected crashes in 2011, 305 (9%) were teens aged 15-19 (NHTSA 2013).

Research has established that distractions of all types can adversely affect driving performance. This appears to be especially problematic for teenage drivers who have a higher level of crash involvement than drivers in other age groups even without distractions. A growing body of research also suggests that distraction affects crash risk among drivers generally and young drivers specifically, and that texting may be riskier than cell phone use. Hands-free texting while driving also serves as a distraction which will affect crash risk.

At this stage, it is important that the absolute and relative magnitude of that risk is established in future research. To this end, NHTSA has implemented a multi-year Distraction Plan and Research Agenda that will further examine driver communications and entertainment devices and will also continue to monitor the research on this subject (NHTSA 2010c). NHTSA has also recently issued proposed guidelines for automobile manufacturers to encourage them to limit distraction risk for in-vehicle electronic devices. The proposed voluntary guidelines would apply to communications, entertainment, information gathering and navigation devices or functions that are not required to safely operate the vehicle. They would also establish specific recommended criteria for electronic devices installed in vehicles at the time they are manufactured that require visual or manual operation by drivers. And, further NHTSA guidelines may address voice-activated controls "to further minimize distraction in factory-installed aftermarket and portable devices" (NHTSA 2012, p.14).

To date, restrictions on handheld phone use while driving to combat distracted driving has received the most policy attention. In some respects, this can be equated to picking the low-hanging fruit from a tree. The risks and distractions associated with handheld phone use are perhaps more easily understood, and is an easier distraction to address using traditional road safety strategies such as education, enforcement and sanctions. However, for legislators and the public to assume that the problem has been solved by dealing only with handheld phone use may create a false sense of security (Robertson 2011).

Similar to other road safety issues such as drinking and driving, speeding and fatigue, a not insignificant percentage of drivers may be inclined to think that their driving skill is above average (Allstate Corporation 2011; Beck et al. 2006; Sanbonmatsu et al. 2013; Vanlaar et al. 2008), meaning that they falsely believe they are better able to consume alcohol, control a fast vehicle, and manage driving with less sleep more so than other drivers. This is certainly the case among young drivers who overestimate their driving skills, especially in relation to their peers and their own driving behavior (Mayhew and Simpson 1995; De Craen et al. 2011). Indeed, given that texting and driving requires "expertise" in two activities, texting and driving, there is also a risk that those with an above average self-confidence are even more likely to pose a risk. To illustrate, in a simulator study among drivers aged 18-19, test subjects were divided into groups of 'frequent' and 'infrequent' texters. Researchers noted whether or not the subjects looked away from the screen display of the roadway for at least two seconds while they sent a text message. It was discovered that the frequent texters who texted while driving were just as likely to look away from the screen and inside the vehicle as were infrequent texters (Samuel et al. 2011). Ironically, the authors mention that there were increases in texting-related collisions in three out of four states that had introduced laws banning texting while driving. One possible explanation is that as drivers become more accomplished at texting, they perhaps felt that they could ignore the law. Unless there is a fear of being caught, a law banning texting and driving may not be enough.

In summary, according to the GHSA (2011) there are four types of distractions:

- Visual – looking at something other than the road
- Auditory – hearing something not related to driving
- Manual – manipulating something other than the wheel
- Cognitive – thinking about something other than driving

Hands-free voice texting while driving involves all four of these types of distractions, albeit to different extents. Although further research is certainly needed to establish the absolute and relative crash risk of hands-free texting while driving, there is currently sufficient research evidence on distraction to support countermeasures directly focused at reducing or banning this specific unsafe behavior. To ban handheld texting but allow hands-free texting does not make for good public policy because both divert attention away from

driving. In particular, hands-free texting is not a solution for reducing young driver crashes since teen drivers already have the highest crash risk and they are the most vulnerable to distraction. Why exacerbate the crash risk by allowing for hands-free texting while driving? Only introducing legislation to combat hands-free texting while driving, however, will not likely be sufficient. Legislative measures should be accompanied by other strategies such as an education campaign to warn the public of the dangers of this type of distracted driving, increased enforcement to add efficacy to the law, and pre- and post-legislation program evaluation to measure its effectiveness.

About the Traffic Injury Research Foundation (TIRF)

The mission of the Traffic Injury Research Foundation (TIRF) is to reduce traffic-related deaths and injuries. TIRF is a national, independent, charitable road safety research institute. Since its inception in 1964, TIRF has become internationally recognized for its accomplishments in a wide range of subject areas related to identifying the causes of road crashes and developing programs and policies to address them effectively.

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