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The effect of distractions on the crash types of teenage drivers

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Abstract

Teenage drivers are overrepresented in crashes when compared to middle-aged drivers. Driver distraction is becoming a greater concern among this group as in-vehicle devices, opportunities for distractions, and teenage drivers' willingness to engage in these activities increase. The objective of this study was to determine how different distraction factors impact the crash types that are common among teenage drivers. A multinomial logit model was developed to predict the likelihood that a driver will be involved in one of three common crash types: an angular collision with a moving vehicle, a rear-end collision with a moving lead vehicle, and a collision with a fixed object. These crashes were evaluated in terms of four driver distraction categories: cognitive, cell phone related, in-vehicle, and passenger-related distractions. Different driver distractions have varying effects on teenage drivers' crash involvement. Teenage drivers that were distracted at an intersection by passengers or cognitively were more likely to be involved in rear-end and angular collisions when compared to fixed-object collisions. In-vehicle distractions resulted in a greater likelihood of a collision with a fixed object when compared to angular collisions. Cell phone distractions resulted in a higher likelihood of rear-end collision. The results from this study need to be evaluated with caution due to the limited number of distraction related cases available in the U.S. GES crash database. Implications for identifying and improving the reporting of driver distraction related factors are therefore discussed.

Keywords: Driver distraction; Crash types; Young drivers; Teenage drivers; Rear-end collisions; Angular collisions

1. Introduction

Numerous factors have been related to the high crash risk of teenage (16–19-year old) drivers including risk-taking behavior, nighttime driving, driving with teenage passengers, and under the influence of alcohol (Ferguson, 2003; Williams, 2003). Teenagers (as well as the elderly) are overrepresented in terms of hospitalization from crashes related to loss of vehicular control and collisions with other vehicles (Tavris et al., 2001). Much of the literature on young drivers – commonly defined as drivers younger than 25 – is particularly relevant for examining the crash risks of teenage drivers since they reveal similar risk taking behavior (Mao et al., 1997; McKnight and McKnight, 2003). Studies on young drivers also reveal their overrepresentation in crashes occurring on the weekend and on clear, dry days (McGwin and Brown, 1999).

An important aspect of the increased risks for teenage drivers is how such risks translate into the frequency of different crash types. The three most common types of crashes for teenage drivers are: angular crashes with other vehicles, rear-end collisions, and collisions with fixed objects (NHTSA, 2003a). Rear-end collisions usually occur when vehicles are traveling in the same direction and can be attributed to very short headways and failure to brake appropriately. Angular collisions usually involve colliding with vehicles not traveling in the same direction and can be attributed to improper decision making and lane keeping. The collisions with fixed objects are different than the other two crash types because they do not involve the same potential to inflict injuries on other drivers and passengers. These differences are important when considering what factors are likely to be involved in collisions and how crash risks associated with these crash types can be mitigated.

There is very little literature on the impact of driver distraction on the crashes of teenage drivers. Driver distraction can be defined as the diversion of driver attention away from the driv-

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ing task, and it can result from factors both within and outside of the vehicle (Sheridan, 2004). Both the attentional demands placed on the driver by a secondary task and the driver's willingness to engage in that task contribute to the potential for driver distraction and thus increase the likelihood of crashes (Donmez et al., in press). A distracted driver may also make riskier decisions. As observed by Cooper et al. (2003), distracted drivers made left hand turns with smaller gap acceptance than drivers who were not distracted. Understanding how driver demographics, driver behaviors, and environmental factors interact with distraction is very important, especially when developing policies and systems to reduce the effects of these distractions. This is particularly true for young drivers, who are typically at greater risk for crash involvement when compared to drivers in other age groups (Bedard et al., 2002; Matthews and Moran, 1986). Analyzing the crash and behavioral factors of younger drivers can provide important insights into the problematic behavior of young drivers and can have a substantial impact on society.

Driver distraction can include anything that distracts a driver from the primary task of driving. Distraction types have been categorized as follows: visual (e.g. reading a map), auditory (e.g., listening to a conversation), biomechanical (e.g., tuning a radio), and cognitive (e.g. 'being lost in thought,' and 'looking but not seeing') (Ranney et al., 2000). Most distractions are actually a combination of these, thus it may be more useful to categorize distractions according to the task that drivers are engaged in while driving (rather than the combination of the forms of distractions). For example, cell phones are associated with cognitive, auditory, biomechanical, and potentially, visual distractions. Given that, it may be easier to draw conclusions, make policy recommendations, and design systems around these task-centric identified distractions.

As teenage drivers gain moderate levels of experience, they also tend to have greater crash risks related to driver distraction when compared to drivers in other age groups (Lam, 2002). One proposed explanation for this is that younger drivers appear more willing to accept new technologies and devices than other drivers. As younger drivers become confident in their driving abilities, they tend to over-estimate their ability to multitask with these devices while driving (Sarkar and Andreas, 2004). Poysti et al. (2005) also found that young drivers, from 18- to 24-years old, were more likely to use their cell phones while driving than middle-aged drivers. Clearly, as in-vehicle systems and devices become more popular, further research is needed (Olsen et al., 2005; Sarkar and Andreas, 2004).

Given that teenage drivers are over-represented in terms of crash frequency, the goal of this research is to determine how driver distraction influences the types of crashes teenagers are more likely to be involved in. Understanding this will aid our understanding of driver distraction influences on teenage drivers, their passengers, and others. It is hypothesized that different distraction types will influence the odds of teenagers being involved in certain types of crashes. This hypothesis is addressed with a multinomial logit model to predict the odds that a teenage driver will be involved in a distraction-related crash.

2. Method

2.1. Data sources

Data from the General Estimates System (GES) from the year 2003 were used for the analysis in this study. The GES data, which is part of the National Automotive Sampling System (NASS) from the National Highway Traffic Safety Administration (NHTSA), is a stratified sample of crashes that is weighted to represent national crash trends. The data include numerous crash-related factors, including detailed descriptions of the vehicles involved, the demographics of the driver(s) and their passenger(s), the distracted state of the driver(s) involved in the crashes, and the crash characteristics. Because the focus of this study is on teenage drivers (16–19) and their crash types, any individuals not in this population group were omitted from the analysis. A vehicle was labeled as a striking vehicle if it is identified as such in the GES database (as part of the vehicle's role data). Vehicles driven by teenagers that were not the striking vehicle was removed. Further, data associated with non-passenger vehicles (e.g. motorcycles and semi-trucks) was also removed.

2.2. Crash types classification

The three major crash types used for this study are angular collisions with other moving vehicles, rear-end collisions, and collisions with fixed objects, which represent 28.4%, 34.9%, and 21.0%, as calculated from all crashes, respectively. These three crash categories account for over 84% of crashes in which a teenager was driving the striking vehicle. In fact, they are the most common types of crashes for all drivers regardless of age (NHTSA, 2003b). They are therefore used as the categories for the dependent variable for the regression model.

2.3. Independent variables

Variables included in the multinomial logit model account for factors that have previously been identified as influencing teenage drivers' crash types (Chen et al., 2000; Ferguson, 2003; Jonah, 1986; Laapotti et al., 2001; McEvoy et al., 2005). These include speeding and alcohol use, as well as environmental factors such as road surface conditions, and location (urban versus rural, interstate, or intersection occurrences). Drivers were classified as speeding if the reporting officer concluded that the vehicle's speed was related to the crash occurrence. This included traveling beyond the posted speed limit or when environmental or other factors may have caused the posted speed limit to be unsafe. Poor lighting conditions have been shown to influence the situational awareness of drivers (Massie et al., 1995). Lighting was therefore included as a variable (i.e., daylight or non-daylight condition). Finally, urban and rural environments were also considered with urban classified as an area with a population greater than 50,000 people. Each of the independent variables was categorized as a binary variable (e.g., the driver either was or was not speeding).