Journal of Safety Research xxx (2017) xxx–xxx

Contents lists available at ScienceDirect

Journal of Safety Research

journal homepage: www.elsevier.com/locate/jsr

Teens' distracted driving behavior: Prevalence and predictors

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ARTICLE INFO

Article history:
Received 4 February 2017
Received in revised form 17 May 2017
Accepted 9 October 2017
Available online xxxx

Keywords:
Distracted driving
Naturalistic study
Teen drivers
Secondary task engagement
Risk

ABSTRACT

Introduction: Teen drivers' over-involvement in crashes has been attributed to a variety of factors, including distracted driving. With the rapid development of in-vehicle systems and portable electronic devices, the burden associated with distracted driving is expected to increase. The current study identifies predictors of secondary task engagement among teenage drivers and provides basis for interventions to reduce distracted driving behavior. We described the prevalence of secondary tasks by type and driving conditions and evaluated the associations between the prevalence of secondary task engagement, driving conditions, and selected psychosocial factors. *Methods:* The private vehicles of 83 newly-licensed teenage drivers were equipped with Data Acquisition Systems (DAS), which documented driving performance measures, including secondary task engagement and driving environment characteristics. Surveys administered at licensure provided psychosocial measures. *Results:* Overall, teens engaged in a potentially distracting secondary task in 58% of sampled road clips. The most prevalent types of secondary tasks were interaction with a passenger, external distraction, and texting/dialing the cell phone. Secondary task engagement was more prevalent among those with primary vehicle access and when driving alone. Social norms, friends' risky driving behaviors, and parental limitations were significantly associated with secondary task prevalence. In contrast, environmental attributes, including lighting and road surface conditions, were not associated with teens' engagement in secondary tasks. *Conclusions:* Our findings indicated that teens engaged in secondary tasks frequently and poorly regulate their driving behavior relative to environmental conditions. Peer and parent influences on secondary task engagement provide valuable objectives for countermeasures to reduce distracted driving among teenage drivers.

1. Introduction

Teens' over-involvement in crashes has been attributed to a variety of factors such as driving inexperience, risk-taking behavior, and distracted driving (Shope, 2006; Shope & Bingham, 2008; Simons-Morton et al., 2011). Driver distraction, a specific case of inattention, is associated with the engagement in a subsidiary, secondary task that diverts a driver's attention from the primary driving task (Goodwin, Foss, Harrell, & O'Brien, 2012). Compared to older drivers, teens' limited driving experience and youthful characteristics may also contribute to their higher risk for distraction when engaging in secondary tasks while driving (Bingham, Zakrajsek, Almani, Shope, & Sayer, 2015; Klauer et al., 2014). In 2013, among drivers age 15–19 years old, 10% of fatal crashes were attributed to driver distraction, the highest of all age groups (NHTSA, 2015). Nevertheless, the extent to which teens' distracted driving contributes to the occurrences of crashes may be underreported, possibly due to drivers' reluctance to admit driving distracted, recall bias, and the uncertainty of linking specific secondary tasks to crashes. With the rapid development of in-vehicle interactive technologies and the increased accessibility to portable electronic devices, the potential for distracting secondary task engagement, especially among teen drivers, has increased dramatically. Being early adopters, teen drivers are more likely than older drivers to embrace such new technologies and use them while driving.

Based on data from naturalistic driving studies, Klauer et al. (2014) reported frequent and varied secondary task engagement among both novices and adults, some of whom (particularly those that took the driver's eyes off the forward roadway) were associated with increased crash and near crash likelihood. A more recent naturalistic study that used an in-vehicle event recorder system to capture teenage driver behavior and crashes reported that secondary tasks of many types occurred proximal to 76% of the evaluated rear-end crashes (Carney, Harland, & McGehee, 2016).

Teens' risky driving behavior, including secondary task engagement, has been linked to multiple psychosocial, demographic, and environmental factors (Bingham et al., 2015; Gershon, O'Brien, Zhu, & Simons-Morton, 2016; Goodwin et al., 2012). Studies that focused on social factors found that greater parental involvement in and monitoring of teens' driving (both pre- and post-licensure) were associated with less risky driving behavior (Gershon et al., 2016; Mirman, Albert, Jacobsohn, & Winston, 2012; Prato, Toledo, Lotan, & Taubman-Ben-Ari, 2010; Simons-Morton &

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https://doi.org/10.1016/j.jsr.2017.10.002
0022-4375/

Ouimet, 2006). A cross-sectional survey study reported higher secondary task engagement of teens compared to their parents and a significant correlation between teens' and parents' secondary task engagement (Bingham et al., 2015). Peer influence is another significant social aspect associated with teens' driving behavior (Shope et al., 2006; Simons et al., 2011; Simons-Morton et al., 2012; Taubman–Ben-Ari, Kaplan, Lotan, & Prato, 2015). Carter, Bingham, Zakrajsek, Shope, and Sayer (2014) showed that teens' perception of their peers' distracted driving was associated with the teens' own distracted driving.

Driving with a teenage passenger is considered to be a risk factor uniquely associated with teen drivers (Klauer et al., 2011; Ouimet et al., 2015; Williams, Ferguson, & McCartt, 2007). Teenage passengers can increase crash risk through social influence, either by exerting pressure to increase risk, or by engaging in social norms that favor more risky driving (Ouimet et al., 2015). Ouimet et al. (2010) found that driving with a passenger significantly increased the likelihood of teens' involvement in fatal crashes, and the risk increased with the number of passengers. However, with respect to distracted driving, Foss and Goodwin (2014) showed a moderating effect of passenger presence on teen drivers' tendency to engage in secondary tasks. Another factor associated with teens' risky driving behavior and crash risk is vehicle ownership (or primary vehicle accessibility; Gershon et al., 2016; Scott-Parker, Watson, King, & Hyde, 2011; Williams, Leaf, Simons-Morton, & Hartos, 2006). Teens driving their own vehicle tended to engage in more risky driving behaviors compared to teens who shared their vehicle with another family member (García-España, Ginsburg, Durbin, Elliott, & Winston, 2009; Mayhew, Simpson, & Pak, 2003; Prato et al., 2010; Scott-Parker, Goode, & Salmon, 2015; Williams et al., 2006).

Finally, the possible associations between environmental factors (such as time of driving, weather, and roadway conditions) and teens' secondary task engagement while driving have not been clearly determined. Two previous naturalistic driving studies reported no associations between the prevalence of secondary task engagement and characteristics of the driving environment (e.g., road surface conditions, time of drive; Klauer, Dingus, Neale, Sudweeks, & Ramsey, 2006; Stutts, Reinfurt, & Rodgman, 2001). In contrast, data from a roadside observational study indicated that the prevalence of secondary task engagement was greater in less demanding driving environments (Kidd, Tison, Chaudhary, McCartt, & Casanova-Powell, 2016). However, little else is known about driving environment characteristics and teenage drivers' engagement in secondary tasks while driving.

This analysis of naturalistic driving data provides objective assessment of the relative prevalence of secondary task engagement in various driving conditions and examines associations of secondary task prevalence with driving attributes, vehicle ownership, passenger presence, and psychosocial factors.

2. Method

2.1. Participants

A total of 83 newly licensed teenaged drivers (53% females) participated in the study, with an average age of 16.48 years old (SD = 0.33). All participants were recruited in Virginia. Identical twins and teens with diagnosed Attention Deficit Hyperactivity Disorder (ADHD) were excluded from the study. No other selection criteria were applied. Parental consent and teens' assent were obtained according to an approved institutional protocol.

2.2. Vehicle instrumentation

Participants' private vehicles were installed with a Data Acquisition System (DAS) that included a multi-axis accelerometer, Global Positioning System (GPS), as well as video cameras to monitor the driver's face, hand, and body positioning, the driver's forward and rear views, and the car dashboard. Two cameras were used to capture the vehicle interior. Data were collected from 2010 to 2014, for a period of up to 21 months, which included a minimum of 9 months of supervised practice driving and 12 months of provisional licensure.

2.3. Dataset

This dataset was generated based on 6-second video clips from road segments that were sampled at random from each participant. The sampling matrix used for generating this dataset was based on proportion of hours traveled for each subject and yielded 1,060 trips. Each sampled video segment was assessed by two highly experienced coders who determined and documented the driver behavior (including secondary task engagement) and driving characteristics according to a systematic protocol.

2.4. Secondary task

Based on the 6-second video segments, a total of 37 different types of secondary tasks were identified and coded. The secondary tasks were then assigned under 11 categories including: texting/dialing cell phone, external distraction, reaching, interacting with in-vehicle systems, interacting with objects in the vehicle, interaction with a passenger, singing/dancing and talking to self, self-grooming, talking/listening cell phone, food and drink intake, and other.

2.5. Environmental measures

The following factors were documented for each driver and each trip: vehicle ownership, vehicle occupancy, weather conditions (not adverse/adverse), surface conditions (dry/wet), traffic density (free flow/with restrictions), lighting conditions (daylight/dark), road alignment (straight/curved), travel way features (not divided/divided). Vehicle occupants, road conditions, and time of driving were assessed by experienced coders who reviewed every video clip of each recorded trip and identified the driver, passenger presence, number of passengers, and passenger attributes, such as gender and age. Lighting conditions (daylight/dark) were determined by the recorded times of sunrise and sunset of the day the trip occurred.

2.6. Psychosocial survey measures

A battery of questionnaires was administered at licensure, with measures that assessed the following variables: driver's risk perception, sensation seeking, self-reported risky driving, risk-taking friends, friends' substance use (alcohol, tobacco, and other drugs), perceived parental trust, parental restrictions on driving, parental monitoring knowledge, and parental limits on driving. For a detailed description of psychosocial measures, reference Gershon et al. (2016). For all used psychosocial measures, Cronbach's alpha values were ≥0.7.

2.7. Analysis

Two-tailed population proportion tests were used to assess the differences in the proportions of sampled segments with and without any secondary task. Mixed effects logistic regression models with random intercept were used to analyze the association between driving conditions and secondary task prevalence. The mixed effect logistic regression analysis included a total of 78 participants that had at least one sampled video segment in each driving condition (e.g., daylight and darkness). The analysis of the association between passenger presence and secondary task prevalence excluded the category 'interacting with a passenger' to avoid confounding. Finally, Pearson correlations assessed the associations between teens' psychosocial measures and the proportion of secondary task engagement per road segment.

Please cite this article as: Gershon, P., et al., Teens' distracted driving behavior: Prevalence and predictors, *Journal of Safety Research* (2017), https://doi.org/10.1016/j.jsr.2017.10.002