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, Fox, 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 underestimated, 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 &
hand, and body positioning, the driver’s forward and rear views, and the 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 (sunny/cloudy, 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.
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