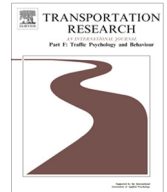




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The influence of roadway situation, other contextual factors, and driver characteristics on the prevalence of driver secondary behaviors



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ABSTRACT

Drivers may modulate their secondary behavior based on roadway or driving demand, but there is little research capturing secondary behaviors in a range of driving situations among a large sample of drivers on actual roadways. Weekday daytime and nighttime roadside observations were conducted of drivers traveling in free-flowing traffic on a straightaway, in a roundabout, and when moving or stopped at a signalized intersection on the same roadway in four Northern Virginia communities. The presence of 12 secondary behaviors were noted for each of the 16,556 drivers observed. Overall, 23% of drivers observed were engaged in some kind of secondary behavior. The most common secondary behaviors were holding (5.1%) or talking on (4.2%) a hand-held cellphone, eating or drinking (3.1%), and talking or singing with a passenger (2.7%). Based on logistic regression analysis, the prevalence of any kind of secondary behavior and of more manually demanding behaviors, like manipulating a hand-held cellphone and eating or drinking, was highest among drivers stopped at red lights and lowest among drivers in roundabouts. Other factors also influenced the prevalence of driver secondary behavior. Drivers were more likely to be eating or drinking and less likely to be talking on a handheld phone in the morning than at others time of the day. Drivers estimated to be 60 and older were least likely to be engaged in any secondary behavior, but drivers younger than 20 and drivers 20–59 years old were equally likely. Drivers with and without passengers were equally likely to be engaged in any secondary behavior, but drivers with passengers were most likely to be talking or singing with the passengers, whereas drivers without passengers were most likely to be eating or drinking or holding, talking on, or manipulating hand-held phones. The current findings in combination with past research suggest that drivers may engage in secondary behaviors when perceived driving demand is reduced, and that roadway demand and contextual variables are important factors to consider when studying driver secondary behavior.

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1. Introduction

Distraction is a common occurrence for drivers with potentially serious consequences. The National Highway Traffic Safety Administration (NHTSA) estimated that in 2013, 10% of fatal crashes, 18% of injury crashes, and 16% of all police-reported crashes involved drivers coded as distracted (NHTSA, 2015). Secondary behaviors are behaviors unrelated to the driving task that often can divert attention away from activities critical for safe driving (Engstrom et al., 2013). Cellphone use is the activity most commonly associated with driver distraction. Dialing, texting, reading and writing emails, and other manual interactions with phones may be especially concerning since they involve visual, manual, and cognitive resources needed to drive safely.

In the most recent national roadside observational survey of electronic device use (Pickrell, 2015), 4.6% of drivers stopped at controlled intersections during the daytime were observed talking on hand-held phones, and 1.7% were manipulating phones or other hand-held electronic devices. Concerns about drivers' use of wireless communication devices has led to laws limiting that use. Talking on hand-held cellphones is banned in 14 states and the District of Columbia, and 46 states and the District of Columbia bar drivers from texting (Insurance Institute for Highway Safety, 2015).

Many controlled experiments have documented the deleterious impact of using cellphones and other secondary behaviors on simulated or instrumented driving performance (e.g., Alosco et al., 2012; Caird, Willness, Steel, & Scialfa, 2008; Horrey & Wickens, 2006). Using data from naturalistic studies that monitor drivers over an extended period of everyday driving, research has linked manual interactions with cellphones with an increased risk of safety-critical events like crashes, near-crashes, and other traffic conflicts (e.g., Farmer, Klauer, McClafferty, & Guo, 2014; Klauer et al., 2014). However, several studies also found that drivers may seek to compensate for any degradations in driving performance by adjusting their driving when engaged in secondary behaviors. For example, drivers using cellphones slow down (Farmer et al., 2014), allow more headway (Drews, Pasupathi, & Strayer, 2008; Strayer & Drews, 2004), and make fewer lane changes (Beede & Kass, 2006).

Drivers also may engage in secondary behaviors when they believe the impact on the driving task may be less. For instance, drivers may delay beginning a secondary behavior when roadway demand is high (e.g., Liang, Horrey, & Hoffman, 2014; Schömig, Metz, & Krüger, 2011) or wait for less demanding situations like when they are stopped. Huisingsh, Griffin, and McGwin (2015) observed drivers at controlled intersections and found that secondary behaviors were more frequent among drivers in stopped vehicles than among drivers in moving vehicles. Similarly, three analyses of video recordings of daily driving found that drivers made phone calls and interacted with their cellphone more often when the vehicle was stopped compared with when it was moving, especially at higher speeds (Farmer et al., 2014; Funkhouser & Sayer, 2012; Metz, Landau, & Just, 2014).

Although previous research suggests that drivers may modulate their secondary behavior based on roadway or driving demand, there is little real-world data capturing driver secondary behaviors in a wide range of driving situations and for a large sample of drivers. Furthermore, most research on the prevalence of driver secondary behaviors has focused on cellphone use, with only a few studies examining the prevalence of other secondary behaviors like eating, drinking, and grooming (e.g., Huisingsh et al., 2015; Klauer et al., 2014; Stutts et al., 2005; Sullman, Prat, & Tasci, 2014).

Other factors apart from the roadway situation may influence driver engagement in secondary behaviors. Metz et al. (2014) analyzed video recordings of daily driving and reported that drivers were less likely to engage in cellphone conversation when a passenger was present. A similar pattern was observed among novice drivers (Foss & Goodwin, 2014). Farmer et al. (2014) found that cellphone interactions were more common among drivers younger than 21 than among those 21 and older, and, in a recent roadside observational study, drivers estimated to be younger than 30 were more likely to be engaged in secondary behaviors than drivers ages 30–50 or older than 50 (Sullman et al., 2014). In contrast, naturalistic research by Klauer et al. (2014) found that the prevalence of various cellphone interactions was similar between novice teenage drivers and adult drivers. In the 2013 national roadside survey, nearly twice as many female drivers as male drivers were manipulating a hand-held device (Pickrell, 2015). However, biological sex differences in drivers' cellphone use were not found in other studies (e.g., Farmer et al., 2014; Hamilton, Arnold, & Tefft, 2013). Certain secondary behaviors also may vary by time of day (e.g., Sullman et al., 2014).

Roadside observational surveys can measure behaviors in a large population of drivers and have been used to estimate the prevalence of cellphone use statewide and nationally in the United States (e.g., Cooper, Ragland, Ewald, Wasserman, & Murphy, 2013; Pickrell, 2015; Wengers, Knodler, Kennedy, & Fitzpatrick, 2013) and to evaluate interventions aimed at changing driver behavior (e.g., Chaudhary, Casanova-Powell, Cosgrove, Reagan, & Willaims, 2012; Chaudhary, Connolly, Tison, Solomon, & Elliott, 2015; McCartt, Braver, & Geary, 2003; McCartt, Hellinga, & Geary, 2006).

A pilot study determined that 14 secondary behaviors could be reliably recorded with moderate to substantial agreement by roadside observers standing at straightaways, controlled intersections, and roundabouts (Kidd, Chaudhary, Cassanova-Powell, McCartt, & Tison, 2015). However, the design did not allow for determining whether the prevalence of secondary behaviors varied across different roadway situations independent of other factors that varied across the situations (e.g., speed limit, roadway features, driver population). In the current study, the prevalence of secondary behaviors was measured in different roadway situations located along the same roadway corridor to minimize the effect of important factors that could influence the prevalence. The prevalence of secondary behaviors was expected to be lower during inherently more demanding roadway situations and higher during less demanding roadway situations. The prevalence of secondary behaviors as a function of other contextual factors like passenger presence, time of day, and driver characteristics also was explored.

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