Electronic Device Use: A Review of the Literature on Addictive Behaviors

Background

Using devices while driving contributes to crash severity and increases crash risk by up to 30 times, and about 90 percent of all drivers consider this behavior to be very or extremely dangerous. However, large proportions of drivers continue to use devices on the road, and some engage in excessive, frequent, and dependent device use that is more severe than what the typical driver does. This raised concerns that device use may be an "addiction" since drivers continue to engage in risky behavior despite awareness of the risks. This project was initiated to determine if this behavior is an addiction per se, why it persists, and what countermeasures to consider.

Implementation

The contractor began this project by synthesizing the most recent research on problematic device use while driving. To obtain data sources, reviewers consulted academic, government, and private-sector material from disciplines including human factors, traffic safety, psychology, and demography. More than 270 sources were reviewed in detail, with 155 sources critically reviewed using a structured document summary template. The result is a multi-disciplinary, current compendium of the literature on problematic device use while driving that will support the planning and conduct of future research, safety programs, countermeasure implementation, and policy decisions.

Results

This project reveals that many drivers use devices while driving, but there is a small group of problematic users who exhibit excessive, frequent device use. However, this behavior doesn't qualify as "addictive." These users are more likely to have certain demographic and personality traits, and several countermeasures are needed to reduce their compulsive and dangerous behavior.

Results for Typical Drivers

- **How common is it to use an electronic device while driving?** Device use while driving is prevalent, though this phenomenon has almost exclusively been studied in terms of cellphones. Observational studies estimate that about 10 percent of drivers are distracted by cellphones during a typical daylight moment in the United States, while an additional 14 percent are distracted by non-technological sources.

  A large proportion of drivers use their cellphones in hands-free mode while driving. Yet, behavior involving physical interaction with cellphones is rapidly increasing relative to other forms of cellphone use while driving. This has several causes, including the relative social acceptability of functions like navigating and playing music, and the compelling design of devices and applications.

- **Who uses electronic devices when they drive?** Young drivers show the highest rates of driver distraction. This is partly because adolescent brains are still developing, which makes them more likely to take risks, seek rewards, and make decisions on impulse. More highly educated people are also significantly more likely to drive distracted and women are slightly more likely to drive distracted.

  Certain drivers are also more likely to use their device while driving if they're in a comfortable context. This may happen because they're in a simple driving environment, they're driving on familiar roads, there is a lighter police presence, or they don't have any passengers.

- **What are the consequences of using an electronic device while driving?** In 2018 about 1 percent of all U.S. motor vehicle crash fatalities involved drivers who were distracted by cellphones. Additionally, handheld cellphone interactions result in crash odds ratios from approximately 3.0 to 10.0 relative to driving without a secondary task. This is because operating devices can require extended glances away from the roadway and manual manipulation of the device. The full consequences of electronic device use are unknown since distraction detection technologies are under development and many existing data sources rely on self-reporting.

Results for Drivers Who Are Excessive, Frequent Device Users

■ **Can electronic device use be addictive?** Electronic device use does not qualify for the formal definition of addiction described in the Diagnostic and Statistical Manual of Mental Disorders, commonly called DSM-5. This is because dependent device users aren't proven to demonstrate three aspects of addiction, including: (1) a diminished recognition of significant problems with one's own behavior and relationships, (2) an inability to consistently abstain, and (3) an impairment in behavioral control.

However, device dependency can mimic some aspects of addiction, since dependent users report a craving for their phone, they rely on cellphones to relieve distress, and their emotions are highly influenced by their phones. Some device users also have changes in their brain chemistry that are like those of an addict. To describe this type of device dependency, it is recommended to use the term "problematic device use."

■ **What makes someone more likely to engage in problematic device use while driving?** Young people and women are more likely to be problematic device users. Less educated people are also more likely to engage in problematic device use, even though they are less likely to engage in average levels of device use. Additionally, certain traits related to personality and self-esteem increase the likelihood that someone will take a pathway toward problematic device use.

The "extraversion pathway" is the most direct path to problematic device use while driving since extraverted risk-takers overvalue the social rewards of phone use relative to the risks of distracted driving. However, users with low self-esteem and low impulse control may also engage in this behavior to reassure themselves or satisfy a habitual desire. See Table 1 for a summary of the risk factors for problematic device use.

Table 1. Summary of Risk Factors Associated With an Increased Likelihood of Problematic Device Use

Trait	Dimension Associated With Problematic Device Use
Age	Younger age
Gender	Female gender, though this is inconclusive
Education	Lower education and socioeconomic status
Personality	Anxiety, impulsivity, extraversion, sensation-seeking
Self-Esteem	Low self-esteem

■ **How does electronic device design contribute to problematic device use?** "Addictive design" may also exacerbate the problems associated with problematic device use by capitalizing on a user's desires for entertainment, accomplishment, or social interaction. See Table 2 for examples of these "addictive design" features.

Table 2. Examples of "Addictive Design" Features

	"Addictive Design" Feature
Individual rewards	Personalizing the feed based on a user's interests and past interactions
	Creating endless scrolling and streaming
	Creating achievements or tokens that stack up, incentivizing more time on the application
Social rewards	Creating social comparison features, including "likes" and "shares"
	Providing feedback to let messengers know when a user has read their message

Countermeasures to Reduce Problematic Device Use

There are three kinds of countermeasures to reduce problematic device use:

1. **Information-enhancing:** This strategy involves providing people with information about their usage time and the consequences of their behavior, in terms of both their safety risk and their well-being. This information can be quantitative (e.g., number of hours spent on one's phone) or qualitative (e.g., evidence that excessive phone use is harming sleep quality). However, there is insufficient evidence to demonstrate that information-enhancing efforts are enough to reduce driver distraction on their own.

2. **Behavior-reinforcing:** This strategy involves imposing restrictions on use, such as an automatic phone lockout after a given amount of usage time per day or a ban on cellphone use in the bedroom during normal sleeping hours. Such restrictions have mostly been studied in non-driving contexts but could be applied in the vehicle, e.g., by apps that lock phone functionalities when they detect that the vehicle is in motion. Behavior restrictions reinforce people's goals to limit their device use.

3. **Capacity-building:** This strategy involves encouraging people to pursue activities that allow them to overcome the underlying issues that led to their problematic device use, while also gaining self-regulation skills and engaging in a pastime that does not involve cellphone use. Capacity-building activities include psychotherapy, yoga, meditation, participating in sports, playing music, or making art.

Discussion and Conclusion

Moving forward, it's clear that more comprehensive data sources are required to fully evaluate the extent and severity of problematic device use while driving. Nevertheless, this project advances the current understanding of problematic device use in several ways. First, this project establishes that problematic device use has some similarities to addiction, but it doesn't qualify as an addiction. Second, certain demographic traits and personality traits make some-

one more likely to be a problematic user. Third, phones and applications can contribute to this problem if they are created with an "addictive design." Fourth, there are several countermeasures that may reduce problematic device use while driving.

The challenge for typical users and, especially, for problematic device users, is to convince them that their perceived driving skills and the current driving environment do not make their device use behavior while driving acceptable. This effort will involve countermeasures of multiple types, including traffic safety programs that resemble typical efforts against distracted driving, strategies for reducing people's device use in daily life, and, perhaps, a reduction in the prevalence and power of "addictive design" technologies designed to grab and hold users' attention without regard for whether the user is driving.

How to Order

The final report, *Electronic Device Use: A Review of the Literature on Addictive Behaviors* (Report No. DOT HS 813 461), can be downloaded at https://rosap.ntl.bts.gov. Janice Hartwill-Miller was the task order manager for this project.

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