Resources and Tools to Reduce Multiple Risky Driving Behaviors

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16. Abstract

There is growing recognition that drivers involved in fatal crashes are often engaged in multiple risky behaviors – not wearing a seat belt, speeding, and driving impaired (FARS, 2020). Research has established associations between impulsivity and multiple risky driving behaviors (Bıçaksız & Özkan, 2016b). While the association between impulsivity and various risky driving behaviors is established in the literature, there is limited understanding of how to address impulsivity and the underlying beliefs and behaviors of individuals engaging in multiple risky driving behaviors. The proposed research seeks to address this gap by creating and testing an intervention designed to address impulsivity and other factors to improve driver behaviors.

Based on a summary of the literature regarding factors associated with multiple risky driving behaviors and behavioral interventions that addressed specific high-risk driving behaviors (speeding, impaired driving, seat belt use, and distracted driving), a brief intervention was created to reach drivers who engage in multiple risky behaviors. A randomized controlled trial was conducted, with 43 college student participants. Overall, no significant difference was found between intervention and control participants in risky driving behavior or other study variables (e.g., impulsivity, emotional intelligence, beliefs), likely due to a small sample size and inadequate power. Results demonstrated that intervention participants did utilize selected strategies following the intervention and continued utilizing strategies three months later. Recommendations and guidance that traffic safety professionals can use to make more informed decisions about strategies to address multiple risky driving behaviors and improve traffic safety are provided and a resource was created to help traffic safety stakeholders engage young adults in growing skills and utilizing practical strategies to reduce engagement in multiple risky driving behaviors.

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1 INTRODUCTION

There is growing recognition that drivers involved in fatal crashes are often engaged in multiple risky behaviors – not wearing a seat belt, speeding, and driving impaired or distracted (*FARS*, 2018). To reach our collective goal of zero deaths on our nation's roadways, we must seek to understand factors associated with multiple risky driving behaviors and then develop and test interventions that can effectively reduce these risky driving behaviors and improve overall driving safety.

This project proposed to develop and test a brief intervention designed to address multiple risky driving behaviors. This report summarizes tasks 1- 4 of the project. Task 1 included a summary of the literature to understand factors associated with multiple risky driving behaviors including cognitive factors, affective factors, motivational factors, and contextual factors. It was found that many factors affecting risky driving must be considered in combination as they overlap and are related to one another (Al-Tit, 2020; Bachoo et al., 2013; Iversen & Rundmo, 2002).

Behavioral interventions that addressed specific high-risk driving behaviors (speeding, impaired driving, seat belt use, and distracted driving) and associated factors associated with multiple risky driving behaviors were also reviewed. Finally, as this project included designing and implementing an intervention to reduce multiple risky driving behaviors, various delivery methods were explored including mobile health technologies, brief interventions, and vehicle safety monitoring systems. To support the design, implementation, and evaluation of a brief intervention designed to reduce multiple risky driving behaviors, Task 1 also included the creation of a curriculum outline, an implementation plan, and an evaluation plan.

Task 2 included content creation for a brief intervention to reach drivers who engage in multiple risky behaviors. Task 2 included the development of an assessment tool designed to gather information about multiple risky driving behaviors and factors associated with multiple risky driving behaviors, the implementation of a pilot test of the intervention, and the development of a plan for a full experimental design study to be implemented in Task 3.

Task 3 included the implementation of a randomized controlled trial to test the brief intervention designed to reduce multiple risky driving behaviors. During Task 3, college students who engaged in multiple risky driving behaviors were recruited to participate in the study. Participants were randomized to intervention and control conditions and completed baseline surveys. Then, intervention participants completed learning sessions and received text message reminders. Following the sessions, all participants completed two additional surveys (following the sessions and 3-month follow-up). Task 3 included quantitative and qualitative results.

Finally, Task 4 included the development of a resource to support traffic safety professionals in reducing multiple risky driving behaviors among young adults and recommendations and guidance based on what was learned from testing the brief intervention about how traffic safety professionals can address multiple risky driving behaviors.

The results of each task are summarized in this final report.

2 TASK 1 – LITERATURE REVIEW

The purpose of Task 1 was to conduct a literature review of published research to

- Understand the multifaceted nature of impulsivity (what impulsivity is, kinds of impulsivity, etc.), how impulsivity is measured, and the relationship between impulsivity and high-risk driving behaviors.
- Review other factors like sensation seeking, affinity for risk, risk awareness, and substance use disorders as these factors may be important in the development of an intervention that addresses multiple risky driving behaviors.
- Explore ways to reduce impulsivity and other factors associated with multiple risky driving behaviors.
- Inform the development of a successful intervention that influences multiple risky driving behaviors.

In addition to a review of the literature, Task 1 included two outlines (a curriculum outline and an implementation and evaluation plan outline) that supported the development, implementation, and evaluation of a brief intervention designed to reduce multiple risky driving behaviors.

2.1 Background

According to the Fatality Analysis Reporting System (FARS), from 2014 to 2018 there were over 10,350 drivers involved in fatal crashes who were simultaneously unrestrained, speeding, and under the influence of alcohol (*FARS,* 2018). Drivers engaging in multiple risky behaviors (such as not using a seat belt, speeding, and driving impaired) may require more intensive interventions than are typically provided to drivers who are cited for any one of these risky behaviors in isolation.

Research evidence suggests there are associations between multiple risky driving behaviors (K. Li et al., 2013; B. Simons-Morton et al., 2016). For example, one study revealed that risky drinking was associated with risky driving behaviors among youth (e.g., driving under the influence of alcohol, speeding, tailgating, talking on a cell phone, sending text messages, etc.) and recommended addressing them in combination as these behaviors may be linked by similar underlying belief systems like the affinity for risk or impulsiveness (B. Simons-Morton et al., 2016). Another study found low-risk perception and high impulsivity were significant risk factors for a variety of risky behaviors such as infrequent seat belt use, drinking and driving, riding with an impaired driver, binge drinking, and speeding for the thrill, among patients at a trauma center who had experienced unintentional blunt trauma. Similarly, among people with driving violations, impulsivity was associated with both impaired driving and exceeding speed limits (Paaver et al., 2006).

Impulsivity influences various risky driving behaviors (Bıçaksız & Özkan, 2016b). Traffic impulsivity is defined as "the tendency to act quickly and inaccurately or act quickly and accurately without considering and elaborating on the future consequences while driving" (Bıçaksız & Özkan, 2016b, p. 220). Traffic impulsivity "may involve the inability to wait in traffic, expressing anger and aggression to others while driving, speeding, using a cell phone while driving, close following, and making sudden accurate or inaccurate maneuvers without considering consequences" (Bıçaksız & Özkan, 2016b, p. 220).

While the association between impulsivity and various risky driving behaviors is established in the literature, there is a gap in understanding how to address impulsivity and the underlying beliefs and behaviors of individuals engaging in multiple risky driving behaviors. The proposed research seeks to address this gap by creating and testing an intervention designed to reduce traffic impulsivity to improve driver behaviors.

A review of the Transportation Research International Documentation database revealed that interventions designed to address traffic impulsivity to improve driver behaviors are limited. Two studies were found that focused on the same brief intervention addressing impulsivity and driving behaviors with young novice drivers (Eensoo et al., 2018; Paaver et al., 2013). Researchers found the brief intervention improved traffic behavior for novice drivers in the initial study. After participating in the initial intervention, the researchers conducted a follow-up study and tracked traffic violations and traffic crashes for a period of four years. Results from this follow-up study revealed that the benefits of participating in the intervention remained; "speeding, drunk driving, and involvement in traffic accidents were significantly lower in the intervention group" (Eensoo et al., 2018, p. 19). These findings suggest that brief interventions focused on impulsive behavior may be an important strategy to address multiple risky driving behaviors.

While the proposed brief intervention focuses on traffic impulsivity, it is also important to recognize that traffic impulsivity is not the only factor influencing multiple risky driving behaviors. Other underlying beliefs and behaviors such as sensation seeking, affinity for risk, and risk awareness may also be involved. In addition, research shows that drivers with multiple incidences of impaired driving often have a substance use disorder (LaPlante et al., 2008). Therefore, an intervention that seeks to address multiple risky driving behaviors may need to include elements of screening and referral to treatment.

Characteristics such as psychological reactance may also influence the decisions of drivers engaging in multiple risky driving behaviors. An intervention will likely need to address this characteristic. This project can utilize previous research that has been done by the Traffic Safety Culture Pooled Fund to decrease reactance (Otto et al., 2021). Designing an intervention with these factors and characteristics in mind will be important to addressing multiple risky driving behaviors.

2.2 Methods

To obtain research articles for this review, a keyword search was conducted using databases that cover published academic research (e.g., Google Scholar, TRID database, and Montana State University Library search engines Academic Search Complete and EBSCO). The search was limited to peer-reviewed and publicly available literature published in English after 2000.

Word search and phrase combinations included: "high-risk driving behaviors," "factors associated with unsafe driving," "personal risk recognition," "driving risk perception," "multiple risky driving behaviors," "traffic impulsivity," "impulsivity and driver behavior," "impulsivity scales," "impulsiveness and driving," "brief interventions," "seat belt intervention," "distracted driving intervention," "impaired driving intervention," and "behavioral traffic interventions."

Once articles were reviewed for relevance, additional keywords were used in combination to narrow the search. Additionally, the reference lists of relevant articles were reviewed for other potentially relevant articles that may have been missed with the keyword searches.

After a review of available search engines, we chose to use Research Rabbit, which is a new search platform with smart functions to construct, apply, and organize literature services. For example, this platform automatically sends email updates about new literature that has been published on specific topics of interest. Research Rabbit uses Microsoft Academic as its primary search engine, which is a new tool for conducting literature reviews that use algorithms based on artificial intelligence. As an example, its searches are based on the semantic meaning of chosen keywords rather than just the specific words used.

2.3 Results

High-risk drivers make up approximately 6% of the driving population but account for a disproportionate number of crashes and near crashes (Guo & Fang, 2013). Research findings suggest that the consequences associated with high-risk driving (i.e., driving violations, traffic crashes, traffic injuries, and fatalities) are substantial (Dahlen et al., 2005; Oltedal & Rundmo, 2006). There is growing recognition that drivers involved in fatal crashes are often engaged in multiple risky behaviors – not wearing a seat belt, speeding, and driving impaired (*FARS*, 2018). Those engaging in multiple risky driving behaviors may require more intensive or different interventions than are typically provided to drivers who are cited for any one of these risky behaviors in isolation. To reach our collective goal of zero deaths on our nation's roadways, we must seek to understand factors associated with multiple risky driving behaviors and then develop and test interventions that can effectively reduce these risky driving behaviors and improve overall driving safety.

In this review of the literature, several factors associated with multiple risky driving behaviors are reviewed. One such factor that is of particular interest is impulsivity. Impulsivity is a primary focus because it is a factor amenable to change and is a trait that overlaps and is associated with other factors that affect risky driving (Al-Tit, 2020). While impulsivity is the primary focus of this review of literature, other salient cognitive, affective, motivational, and contextual factors associated with multiple risky driving behaviors are also reviewed.

2.3.1 Impulsivity

Impulsivity is broadly viewed as "the inability to withhold or stop a response in the face of negative consequences; preference for a small immediate reward versus a larger but delayed one; acting without forethought or before all necessary information is available; novelty/sensation - seeking and an increased propensity to engage in risky behaviors" (Bari et al., 2011, pp. 380–381). Other definitions include a tendency toward quick and unplanned reactions without considering consequences to oneself or others (Dickman, 1990; Moeller et al., 2001) and the tendency to display maladaptive behaviors and impaired decision-making (de Wit, 2009).

Impulsivity is considered a multidimensional construct (Bari et al., 2011; Stanford et al., 2009). However, consensus on what dimensions of impulsivity are of most interest has not been reached

and varies from study to study (Bıçaksız & Özkan, 2016b; Kocka & Gagnon, 2014). For example, Barratt (1985) identified three dimensions of impulsiveness: motor impulsiveness -- the tendency to act without thinking; cognitive impulsiveness – the sub-trait of making quick decisions; and non-planning impulsiveness – the inability to plan ahead, a lack of forethought. Whiteside and Lynam (2001) suggested four distinct psychological processes that lead to impulsive behavior including urgency, lack of premeditation, lack of perseverance, and sensation seeking. Urgency refers to the "tendency to commit rash or regrettable actions as a result of intense negative affect" (Whiteside & Lynam, 2001, p. 677). Lack of premeditation refers to the tendency to not deliberate or carefully think about the consequences of one's actions before engaging in the action (Whiteside & Lynam, 2001). Lack of perseverance refers to the inability to "stay with a task until completion and avoid boredom" (Whiteside & Lynam, 2001, p. 677). Sensation-seeking refers to the "tendency to seek excitement and adventure" (Whiteside & Lynam, 2001, p. 677). The dimensions of interest in understanding the concept of impulsivity vary; however, some commonly identified subcomponents of impulsivity have emerged including behavioral inhibition, impaired decision-making, risk-taking, and impaired planning (Bari et al., 2011; Bıçaksız & Özkan, 2016b).

Because impulsivity has been conceptualized to include various dimensions of behaviors, it is not surprising that specific measures of impulsivity have been developed to account for this variation. Table 1 lists some of the most common impulsivity measures.

Table 1. Examples of Impulsivity Measures

Measurement Constructs	Dimensions of Impulsive Behavior (Impulsivity Subscales)	Source
I-7 Impulsiveness Questionnaire	Impulsiveness, Venturesomeness, and Empathy	(Eysenck et al., 1985)
I-5 Impulsiveness Questionnaire	Narrow Impulsivity, Risk Taking, Liveliness, and Non-Planning	(Eysenck & Eysenck, 1977)
Barratt Impulsiveness Scale (BIS-11)	Attentional Impulsiveness, Motor Impulsiveness, and Non-Planning Impulsiveness	(Patton et al., 1995)
Impulsive driver behavior scale (IDBS)	Urgency, Lack of Premeditation, Lack of Perseverance, and Functional Impulsivity	(Bıçaksız & Özkan, 2016a)
EASI-III Impulsivity Scales	Inhibitory Control, Decision Time, Sensation-seeking, and Persistence	(Buss & Plomin, 1975; Griffin et al., 2018)
Dickman's Functional and Dysfunctional Impulsivity Scales	Functional Impulsivity and Dysfunctional Impulsivity	(Dickman, 1990)

Impulsivity is generally viewed as counterproductive and maladaptive. However, it has been argued that impulsivity is not always negative but can be beneficial in some situations (Dickman, 1990). Categorizing impulsivity into two types, dysfunctional and functional, can account for this variation and result in a fuller understanding of the concept (Dickman, 1990). Dysfunctional impulsivity "represents the tendency to engage in rapid, error-prone information processing because of an inability to use a slower, more methodical approach" (Dickman, 1990, p. 101). Dysfunctional impulsivity might look like saying or doing something without thinking through the consequences or deciding without considering options that might be available. The consequences of dysfunctional impulsivity are generally negative and associated with personality traits like disorderliness and lack of concern for facts (Dickman, 1990). In contrast, functional impulsivity "represents the tendency to engage in rapid, error-prone information processing (i.e., to act with relatively little forethought) when such a strategy is rendered optimal" like in situations that require quick decision making and immediate action (Dickman, 1990, p. 101). For example, impulsivity may be optimal in a situation where a time-limited opportunity is presented, and without a quick decision, one would lose their chance to take advantage of the opportunity. Functional impulsivity is associated with other personality traits like enthusiasm and adventurousness and is generally viewed as a positive trait (Dickman, 1990).

2.3.1.1 Impulsivity in the Context of Traffic Safety

Impulsivity is a relevant concept to understanding behaviors in various contexts (Bari et al., 2011; Stanford et al., 2009). According to Bicaksiz and Ozkan, "driving is one of the contexts where impulsivity can be expressed because of its self-paced nature (i.e., a driver usually decides how to act in traffic). Hence, investigation of impulsivity in the driving context has a potentially important role in the explanation of driver behaviors" (2016a, p. 339).

Impulsivity in the context of traffic safety has been termed "traffic impulsivity" (Bıçaksız & Özkan, 2016b). Traffic impulsivity is defined as

> the tendency to act quickly and inaccurately or act quickly and accurately without considering and elaborating on the future consequences while driving. Specifically, it may involve the inability to wait in traffic; expressing anger and aggression to others while driving; speeding; using a phone while driving; close following; and making sudden accurate or inaccurate maneuvers without considering consequences. (Bıçaksız & Özkan, 2016b, p. 220)

Researchers commonly agree that impulsivity is a personality construct associated with high-risk driving behaviors (e.g., speeding, following too closely, driving while impaired) and negative outcomes associated with high-risk driving including aberrant driver behaviors, driver anger/aggression, driving under the influence of alcohol, traffic crashes, and traffic violations (Beanland et al., 2014; Bıçaksız & Özkan, 2016b; Eensoo et al., 2010; González-Iglesias et al., 2012; Hatfield et al., 2017; Paaver et al., 2006). Drivers categorized as having more risky driving behaviors score higher on impulsive behaviors than those categorized as having safe driving behaviors (Barati et al., 2020).

Studying impulsivity as a multidimensional construct versus a unidimensional one is key to understanding behaviors and their associated outcomes within the driving context. In a study examining the effects of five impulsivity-like traits (premeditation, perseverance, sensation seeking, negative urgency, and positive urgency) on driving outcomes (including: driving errors, lapses, violations, use of a cell phone while driving, traffic citations, and traffic collisions), Pearson et al. (2013) found all five impulsivity traits were related to multiple risky driving outcomes, although there were distinct relationships between the different traits and outcomes. Positive urgency, or the tendency to act impulsively when experiencing positive feelings, was the strongest predictor of risky driving outcomes in this study (Pearson et al., 2013). Positive urgency was "significantly associated with driving errors, driving lapses, and driving violations" (Pearson et al., 2013, p. 146). Similarly, negative urgency (the tendency to act impulsively when experiencing negative feelings) was also significantly associated with these three driving outcomes and was additionally associated with using a cell phone while driving (Pearson et al., 2013). Premeditation "was significantly negatively correlated with driving errors, driving violations, and cell phone driving" (Pearson et al., 2013, p. 146). Sensation seeking was only related to certain unsafe driving behaviors, specifically, driving violations and cell phone driving (Pearson et al., 2013).

Studying both dysfunctional and functional impulsivity in the driving context is insightful as they have different relationships with different driver behaviors (Bıçaksız et al., 2019; Bıçaksız & Özkan, 2016b; Paaver et al., 2006). Paaver et al. (2006) found, in general, high-risk drivers had higher scores in both functional and dysfunctional impulsivity; however, the expression of both subtypes (functional and dysfunctional) of impulsivity was different among different behaviors. For example, drunk driving was associated with maladaptive types of impulsivity, and exceeding speed limits was associated with functional impulsivity and to a lesser degree dysfunctional impulsivity (Paaver et al., 2006). Likewise, dysfunctional impulsivity has been shown to be associated with errors and lapses, whereas functional impulsivity has been shown to be negatively associated with errors and lapses (Bıçaksız & Özkan, 2016a). These results indicate that understanding the nuances inherent in the conceptualization of impulsivity may be important in considering interventions that influence the behaviors of people engaging in multiple risky driving behaviors.

2.3.2 Other Factors Associated With Multiple Risky Driving Behaviors

Other salient factors associated with multiple risky driving behaviors include cognitive factors, affective factors, motivational factors, and contextual factors. Many of these factors that affect risky driving must be considered in combination as they overlap and are related to one another (Al-Tit, 2020; Bachoo et al., 2013; Iversen & Rundmo, 2002). An intervention that seeks to address multiple risky driving behaviors may need to consider the influence of these factors. Table 2 provides an overview of the factors that are associated with specific high-risk driving behaviors. The factors examined here are not comprehensive, but they represent factors commonly identified in relationship to multiple risky and unsafe driving behaviors.

2.3.2.1 Cognitive Factors

Cognitive factors commonly associated with multiple risky driving behaviors include sensation seeking and risk perceptions.

2.3.2.1.1 Sensation Seeking

Sensation seeking has been defined as "a trait characterized by the pursuit of novel, diverse, and extreme experiences" (Hennessy, 2011, p. 150). Some researchers have categorized sensation seeking as a subdimension of impulsivity (Eysenck & Eysenck, 1977); other researchers have argued that impulsivity and sensation seeking are distinct constructs (Bıçaksız & Özkan, 2016a). Cheng et al. (2012) suggested that even though impulsivity and sensation seeking are similar concepts, what motivates risk-taking behavior is different. Their research revealed that "a high level of sensation seeking leads to risk-taking behavior because of the thrill it provides, whereas impulsivity has the same consequences but for different reasons; the individuals simply lack the self-control to refrain from engaging in high-risk activity" (Cheng et al., 2012, p. 597).

A large body of literature has studied sensation seeking and its relationship with risky driving behaviors and consequences (Akbari et al., 2019; Al-Tit, 2020; Bachoo et al., 2013; Dahlen & White, 2006; Iversen & Rundmo, 2002). In a systematic review of literature of 40 studies, only four did not find a significant association between sensation seeking and some aspect of risky driving including speeding, unsafe passing, and drinking and driving (Jonah, 1997, p. 660). In a recent meta-analysis, Akbari et al. (2019) found significant positive relationships between risky driving behaviors and sensation seeking. Other risky driving behaviors and consequences linked to sensation seeking include ignorance of traffic rules (Iversen & Rundmo, 2002) and moving citations and traffic crashes (Dahlen & White, 2006). Further, research has found that those high in sensation seeking perceive risky driving behaviors to be less dangerous than those with lower sensation seeking scores (Jonah, 1997).

In considering sensation seeking as a factor associated with multiple risky driving behaviors, Hennessey (2011) suggested that caution must be taken as much of the traffic safety literature regarding risky and unsafe driving tends to focus on younger drivers who lack driving experience and who developmentally are primed for added risk taking compared to older adults. Thus, because sensation seeking is strongly associated with age and other developmental variables, the construct of sensation seeking and its relationship with risky and unsafe driving may be inflated (Hennessy, 2011).

2.3.2.1.2 Risk Perceptions

Risk perceptions can be defined as "the subjective experience of risk in potential traffic hazards" (Deery, 1999, p. 226; Machin & Sankey, 2008, p. 542). Risk perception can be categorized into cognitive-based risk perceptions also known as "rational" risk perceptions and emotion-based risk perceptions also known as "affective" risk perceptions (Rundmo & Iversen, 2004). Cognitive-based risk perceptions include how a person perceives and processes information in traffic safety (Rundmo & Iversen, 2004), for example, how probable one perceives a traffic crash to be or how risky one assesses speeding on specific road conditions to be. Emotion-based risk perceptions include feelings related to thinking about traffic-related risks (Rundmo & Iversen,

2004). Affective risk perceptions include feelings like fear, anxiety, worry, excitement, irritation, and other emotional reactions that occur when assessing a potential traffic risk.

There is a large body of research that has studied perceived risk and its association with risky traffic-related behaviors (Bingham et al., 2007; Dionne et al., 2007). Low risk perceptions are associated with riskier traffic behaviors including impaired driving, infrequent seat belt use, and speeding (Dionne et al., 2007; Ryb et al., 2006). Li et al. (2021) found that risk perceptions and sensation seeking were influential in shaping truck drivers' intentions to engage in risky driving behavior with attitude being a mediating variable.

However, some research suggests that risk perceptions are a weak predictor of risk behavior (Ulleberg & Rundmo, 2003). While it seems as though increasing awareness of risks would inherently lead to more accurate risk perceptions, some research suggests increasing awareness of risks may not be sufficient to change a person's risk perceptions (Falk & Montgomery, 2007). It may be necessary to heighten the cognitive and emotional awareness of the consequences of risky traffic behaviors to modify beliefs and change behavior (Falk & Montgomery, 2007).

2.3.2.2 Affective Factors

Affective factors often associated with multiple risky driving behaviors include driving anger and aggression and the Big 5 personality factors (i.e., extraversion, agreeableness, neuroticism, conscientiousness, and openness).

2.3.2.2.1 Driving Anger and Aggression

Driving anger and aggression and their relationship with high-risk driving behaviors have been studied frequently. Driving anger and aggressive driving are considered significant problems in traffic safety and are reflected in Strategic Highway Improvement Plans across the country. The concept of driving anger originated from studying problem anger in a wide range of settings and recognizing that situations like driving could trigger anger (Deffenbacher et al., 2016). Driving anger is defined as becoming angry while driving (Deffenbacher et al., 2016). Common triggers of driving anger include being slowed down or obstructed from progressing as expected (impedance), being put at risk by other drivers' unsafe behaviors, and encountering hostile or inconsiderate drivers (Deffenbacher et al., 2016). Impedance is the most common situation that evokes driving anger, but perceived discourtesy of other drivers often evokes the most anger (Deffenbacher et al., 2016).

Researchers suggest that those high in driving anger become angrier more often when driving and are more prone to evaluate the driving situation in a more hostile way than those with low driving anger (Deffenbacher et al., 2016). Further those scoring high on driving anger are more aggressive drivers and are at greater risk of negative consequences such as crashes and injuries (Deffenbacher et al., 2016). In a meta-analysis of risky driving behaviors and personality characteristics, Akbari et al. (2019) found a significant positive correlation between risky driving behaviors and driving anger.

Aggression in traffic has been conceptualized as "actions intended to physically, psychologically, or emotionally harm another within the driving environment" (Hennessy, 2011,

p. 151). Aggression in traffic could look like "yelling, swearing, purposely tailgating, leaning on the horn, and roadside confrontations" (Hennessy, 2011, p. 151). Aggression has also been defined as "dangerous driving behaviors regardless of intent, such as speeding, weaving through traffic, and using the shoulder to pass" (Hennessy, 2011, p. 151).

Driving anger and aggression are often studied in combination with impulsivity (Dahlen et al., 2005; Mirón-Juárez et al., 2020). For example, poor impulse control is a common underlying trait of impulsivity; likewise, self-control is a key component of driving anger and its expression of that anger (Dahlen et al., 2005; Mirón-Juárez et al., 2020). Research suggests that drivers reporting higher impulsivity are also more likely to express anger while driving (Dahlen et al., 2005; Mirón-Juárez et al., 2020). Mirón-Juárez et al. (2020) found that "impulsivity had a moderate capacity to predict the degree of anger expressed by drivers" (p. 79). Berdoulat et al. (2013) suggested that the three personality domains of "driving anger, aggressiveness and impulsiveness are involved in a complementary manner in the prediction of driving behavior, violations, and aggressive violations" (p. 765).

2.3.2.2.2 Big 5

The Big Five personality factors include extraversion, agreeableness, neuroticism, conscientiousness, and openness. In a meta-analysis of the correlation between personality characteristics and risky driving behaviors, significant relationships between risky driving behaviors and the big five personality factors were found (Akbari et al., 2019). For example, risky driving behavior had a negative relationship with agreeableness and a positive relationship with neuroticism (Akbari et al., 2019). In other words, individuals most likely to engage in risky driving behaviors are low in agreeableness, but high in neuroticism (Akbari et al., 2019). While these two personality factors were significantly related to risky driving, the results of this meta-analysis found no significant relationships between risky driving behavior and extraversion, conscientiousness, or openness (Akbari et al., 2019).

2.3.2.3 Motivational Factors

Motivational factors commonly associated with multiple risky driving behaviors include reward sensitivity and tolerance of deviance.

2.3.2.3.1 Reward Sensitivity

Sensitivity to punishment and reward is a motivational factor associated with risky driving behavior (Constantinou et al., 2011; Scott-Parker & Weston, 2017). Understanding the role of sensitivity to reward in traffic safety is new, although the idea that rewards motivate learning and behavior is not new. There is an abundance of literature in the field of psychology regarding the role of rewards and punishment in motivating and modifying behavior. Behaviors that are considered rewarding are more likely to be repeated, and behaviors that are considered punishing are less likely to be repeated (Scott-Parker & Weston, 2017, p. 94). In a synthesis of the literature regarding the role of reward sensitivity in risky driving and risky decision making, it was found that those with greater reward sensitivity were found to engage in risky driving behaviors, risky decision making, and other risky health-related behaviors more than individuals with lower reward sensitivity (Scott-Parker & Weston, 2017). With this factor in mind, interventions that

rely on punitive consequences may not be as impactful for those who are less sensitive to punishment and may need to instead use strategies that find ways of rewarding positive and safe traffic behaviors for high-risk drivers (Constantinou et al., 2011; Scott-Parker & Weston, 2017).

2.3.2.3.2 Tolerance of Deviance

Tolerance of deviance is defined as "the acceptance of behaviors that most others consider wrong or immoral" (Shope, 2006, p. i10). People with a high tolerance of deviance (those who do not consider deviant behavior to be wrong) engage in more risk-taking driving behaviors (Patil et al., 2006) and have a higher probability of poor driving outcomes (Bingham & Shope, 2004; Shope et al., 2003).

2.3.2.4 Contextual Factors

Contextual factors such as demographic variables, substance use behaviors, and psychological reactance are also included in this review of literature.

2.3.2.4.1 Demographic Variables

The characteristics of high-risk drivers are well identified and include the group of drivers "who are young, inexperienced, and recidivists with higher crash rates than others" (Habtemichael & de Picado-Santos, 2013, p. 307). Contextual factors that influence multiple risky driving behaviors like age and sex have been well documented. Young drivers have a crash rate that is three times higher per mile driven than drivers ages 20 and older (Insurance Institute for Highway Safety, 2021). Younger drivers have less experience at the driving task and perceive less risk in engaging in risky driving behaviors (Rhodes & Pivik, 2011). Gender differences are also found in the literature on multiple risky driving behaviors (Patil et al., 2006). Males are more likely than females to engage in risky driving behaviors (Bachoo et al., 2013; Shope et al., 2001). Further, males have higher rates of traffic crashes (Shope et al., 2001). While age and gender are not modifiable factors, when developing interventions to reduce multiple risky driving behaviors, keeping strategies that can reach these demographics in mind may be important.

2.3.2.4.2 Substance Use

Traffic safety research in the last quarter of 2020 found that 56% of drivers involved in serious injury and fatal crashes tested positive for at least one substance (National Highway Traffic Safety Administration [NHTSA], 2021). Driving under the influence of substances is associated with multiple risky driving behaviors such as speeding, riding with someone who has been drinking alcohol or using other drugs, and aggressive driving (Bingham & Shope, 2004; Patil et al., 2006). Additionally, research shows that drivers with multiple incidences of impaired driving often have a substance use disorder (LaPlante et al., 2008), and risky driving behaviors occur more frequently among individuals who experience substance use problems (Bingham & Shope, 2004).

Research examining correlations between substance misuse and impulsivity in the driving context can also provide insight. In a study of people diagnosed with alcohol dependence, Jakubczyk et al., (2013) found those who score higher on impulsiveness scales engage in more

risky behaviors and have significantly more traffic crashes after drinking alcohol. Impulsivity was the most important predictor of risky behaviors in this study (Jakubczyk et al., 2013). Moreover, Curran et al., (2010) investigated the influence of impulsivity on drivers who engage in driving under the influence/driving while intoxicated (DUI/DWI) and found that those who have been convicted of DUI/DWI have higher levels of sensation seeking and impulsivity than those in the non-DUI/DWI group (p. 93). Considering the established research connection between impulsivity and problematic substance use and multiple risky driving behaviors, creating an intervention designed to improve multiple risky driver behaviors will need to include elements of substance use screening and referral to treatment.

2.3.2.4.3 Psychological Reactance

Psychological reactance is "an unpleasant motivational arousal that emerges when people experience a threat to or loss of their free behaviors" (Steindl et al., 2015, p. 205). It has been suggested that when a person's choices (freedoms) are threatened or lost, reactance is elicited, and the person may be motivated to respond in ways that reestablish those freedoms (Quick & Stephenson, 2007). In a study done by the Traffic Safety Culture Pooled Fund to better understand psychological reactance regarding two traffic safety behaviors (wearing a seat belt and driving aggressively), it was found that those who rarely or never used a seat belt exhibited more situational psychological reactance (a situational response to a perceived threat) but not trait reactance (a characteristic or trait that some are more prone to have than others); those who frequently drove aggressively exhibited more proneness and situational psychological reactance (Otto et al., 2021). While additional research is needed to understand the nuances of psychological reactance in the context of traffic safety, it may be a critical component of multiple risky driving behaviors and strategies to consider reducing psychological reactance in the development and design of an intervention.

Table 2 provides an overview of the factors associated with specific risky driving behaviors.

Table 2. Factors Associated With Specific Risky Driving Behaviors

Factors	**Speeding**	**Impaired Driving**	**Seat Belt Use**	**Distracted Driving**	**Other**	**Sources**
Impulsivity	X	X	X	X	X Aggressive Driving	(Paaver et al., 2006; Pearson et al., 2013; Ryb et al., 2006)
Sensation Seeking	X	X		X	X Unsafe Passing, Ignorance of Traffic Rules	(Akbari et al., 2019; Dahlen & White, 2006; Iversen & Rundmo, 2002; Jonah, 1997; Pearson et al., 2013)

Risk Perceptions	X	X	X	X	X Tailgating, Driving fast just for the thrill of it	(Bingham et al., 2007; Dionne et al., 2007; Ivers et al., 2009; Ryb et al., 2006)
Attitudes & Beliefs	X	X	X	X		(Bachoo et al., 2013; Elliott & Armitage, 2009; Fylan et al., 2006; Kong et al., 2013; Z. Li et al., 2021; Schneider et al., 2017; Venkatraman et al., 2021; Webb & Sheeran, 2006)
Driving Anger	X				X Rule violations	(Akbari et al., 2019; Deffenbacher et al., 2016; Iversen & Rundmo, 2002)
Aggression	X				X Weaving through traffic, Using Shoulder to Pass, Rule Violations	(Constantinou et al., 2011; Ulleberg & Rundmo, 2003)
Big 5	X		X	X	X Aggressive Driving	(Akbari et al., 2019)
Reward Sensitivity	X	X				(Scott-Parker & Weston, 2017)
Tolerance of Deviance	X	X	X		X Aggressive Driving	(Bingham & Shope, 2004; Patil et al., 2006)
Demographics	X			X	X Aggressive Driving	(Atombo et al., 2017; Constantinou et al., 2011; Scott-Parker & Weston, 2017)
Substance Use	X	X			X Aggressive Driving	(Bingham & Shope, 2004; LaPlante et al., 2008; Patil et al., 2006)
Psychological Reactance		X	X			(Otto et al., 2021; Richards et al., 2021)

2.3.3 Strategies to Reduce Risky Driving Behaviors, Impulsivity, and Other Factors

To inform the development of a successful intervention to address multiple risky driving behaviors, strategies to reduce risky driving behaviors, impulsivity, and other factors associated with risky driving behaviors are included in this review.

2.3.3.1 Speeding

While deterrence strategies (i.e., enforcement) and engineering strategies are common strategies to address speeding, other strategies that account for the "human, psychological, and emotional factors in speeding" are gaining momentum (Venkatraman et al., 2021, p. 189). Research suggests that strong predictors of speeding behavior are intentions, attitudes, perceived

behavioral control, and self-efficacy (Fylan et al., 2006). It has been suggested that effective interventions to reduce speeding should target:

- "attitudes (beliefs and values) towards speeding;
- beliefs about the acceptability and ubiquity of speeding;
- the driver's responsibility for their own speed choice;
- perceptions of the likelihood of being detected;
- perceptions of the benefits of speeding and the negative consequences of being caught or of crashing;
- perceived barriers to driving at an appropriate speed;
- the way in which speeding makes drivers feel;
- drivers' perceptions of their ability to drive at an appropriate speed; and
- when and where drivers will reduce their speed." (Fylan et al., 2006, pp. 6–7)

Further, the perceived benefits of speeding may be as important as the perceived risks of speeding; thus, interventions might need to "undermine the perception that speeding is associated with benefits" and "promote the idea that there are costs, other than crashing, associated with speeding" (Fylan et al., 2006, p. 8). It has also been suggested that interventions should "promote the idea that drivers have control over the speed they adopt and that barriers to driving slowly are easy to overcome; undermine the effect of normative pressure on driving fast; and promote the affective benefits of driving more slowly" (Fylan et al., 2006, p. 8). Understanding different types of speeders, their motivations to speed, and their attitudes about speeding is also important so that interventions can be tailored (Fylan et al., 2006; Venkatraman et al., 2021).

Behavioral intervention efforts to reduce speeding identified in *Countermeasures that Work: A Highway Safety Countermeasure Guide for State Highway Safety Offices* sought to consider the factors associated with drivers who speed (Venkatraman et al., 2021). One such effort was specific to targeting impulsiveness (see Section 4.3.5 for more information on this intervention). Another intervention included an intensive personal intervention that focused on attitudes, skills, and knowledge relating to crash risk among young adult males (Venkatraman et al., 2021). This intervention included six skill coaching sessions that focused on driver skills. The focus of the sessions included coaching on specific driving skills of interest to participants and addressing deficiencies that contribute to their risky behavior (Tapp et al., 2013). In addition to the coaching sessions, an in-vehicle recording device was used to give drivers feedback on their driving performance. The intervention was designed using social marketing as a platform to motivate and engage participants rather than traditional strategies such as fear appeals, punitive strategies, or stand-alone educational components (Tapp et al., 2013). While this study was small, research results showed improvement in driving skills among participants; however, it was suggested that further studies with a larger number of participants are needed (Tapp et al., 2013).

Another intervention to address speeding included elements of feedback and goal setting as reinforcers to reduce speed violations (Newnam et al., 2014). In this study, participants had data devices installed in their vehicles to monitor speeding behavior. Then, participants received weekly feedback on their speeding performance. Each week, participants were given information on the percentage of time they spent within the speed limit and exceeding the speed limit, how

their behavior compared to other drivers in the intervention, and their safety rank compared to other drivers in the intervention. Participants also did goal setting exercises to encourage them to reduce their speeding violations for the next week (Newnam et al., 2014). Results showed this behavior modification intervention did reduce overall over-speed violations (Newnam et al., 2014).

2.3.3.2 Impaired Driving

Common strategies to reduce impaired driving include laws, enforcement, prosecution and adjudication, treatment and monitoring, and prevention (Venkatraman et al., 2021). Among the prevention strategies identified in *Countermeasures that Work: A Highway Safety Countermeasure Guide for State Highway Safety Offices,* screening coupled with brief intervention is considered an effective countermeasure to address alcohol-impaired driving (Venkatraman et al., 2021). Screening, brief intervention, and referral to treatment (SBIRT) is an approach that has been widely used in a variety of settings to reduce the negative consequences associated with substance misuse (Agerwala & McCance-Katz, 2012). SBIRT is considered an effective countermeasure to address alcohol-impaired driving (Venkatraman et al., 2021). The focus of SBIRT is to offer early intervention services and referral to treatment for individuals who are at risk of developing substance use disorders (SUDs) or who have already developed SUDs.

SBIRT has three primary components: screening, brief intervention, and referral to treatment. Screening includes an assessment of an individual's substance use. Brief screening tools such as the CAGE and Alcohol Use Disorders Identification Test (AUDIT: Saunders et al., 1993) are commonly used. If the person indicates problematic substance use or a pattern of use that may lead to problems, then a brief intervention is provided (Agerwala & McCance-Katz, 2012). Brief interventions vary in length from one interaction lasting only a few minutes to multiple sessions over time and are often based on motivational intervening strategies that seek to bolster an individual's motivation to lower their risk of developing a substance use disorder or change their substance use behavior (Agerwala & McCance-Katz, 2012). Referral to treatment is also an option for individuals who need more intensive services including counseling to address a substance use disorder.

In a meta-analysis examining the effectiveness of brief interventions to reduce driving after drinking, Steinka-Fry et al. (2015) found that compared to those who did not participant in brief alcohol interventions, those who did participate reported reduced drinking and driving and related consequences and suggested brief interventions may be a promising intervention to reduce impaired driving. Further, recognizing that substance misuse is associated with multiple risky driving behaviors, it will be important to provide an intervention that includes elements of screening and referral to treatment.

2.3.3.3 Seat Belt Use

Like other high-risk behaviors, common countermeasures to improve seat belt use include laws, enforcement, communications, and outreach (Schneider et al., 2017; Venkatraman et al., 2021). Brief interventions have also been used to increase seat belt use (Fernandez et al., 2008). For

example, a study tested a brief motivational intervention to increase self-reported seat belt use among patients in an emergency department (Fernandez et al., 2008). In this study, the intervention was adapted from an alcohol/substance use brief intervention, took approximately 5 to 7 minutes to administer, and incorporated common elements of motivational interviewing including "1) establishing rapport with the client; 2) asking permission to discuss the high-risk behavior; 3) exploring pros and cons of engaging in high-risk behavior; 4) eliciting the gap between actual and desired health outcomes; and 5) assessing readiness to change on a ruler scaled from 1 (not ready) to 10 (ready)" and creating an action plan for change based on the client's goals (Fernandez et al., 2008, p. 421). The results of the study showed that those in the "intervention group had significantly higher improvements in mean seat belt use scores than the control group at 3-month follow-up" (Fernandez et al., 2008, p. 422). At six-month follow up, the differences were sustained; those in the intervention group had greater mean seat belt use scores than those in the control group (Fernandez et al., 2009).

Research shows driver motivations, habits, and routines are strongly correlated with seat belt use (Schneider et al., 2017). Studies have also found that unfavorable attitudes and beliefs toward seat belt use predict less frequent seat belt use (Watson & Austin, 2021). See section 4.3.7 for more information about modifying attitudes, normative beliefs, and control beliefs. While there are limited research studies that focus on specific seat belt interventions, research on factors associated with seat belt use has revealed some interesting findings that may be considered in designing an intervention. One study revealed that instead of viewing seat belt use as a binary where either one does or does not use a seat belt, seat belt use behavior should be viewed on a continuum that is influenced by various situations and circumstances (Schneider et al., 2017). For example, some people are highly motivated to wear a seat belt but have not yet developed a habit of doing so and don't have a stable routine to support the behavior, while others are not motivated to wear a seat belt and have beliefs supportive of not engaging in the behavior (Schneider et al., 2017). Thus, interventions seeking to increase seat belt use will require a variety of strategies tailored to the specific audience.

2.3.3.4 Distracted Driving

Law enforcement strategies and environmental and vehicular strategies (i.e., rumble stripes, visible road signs, vehicle warning technology) are common to address distracted driving (Venkatraman et al., 2021). Among the behavioral strategies identified in *Countermeasures That Work: A Highway Safety Countermeasure Guide for State Highway Safety Offices*, employee distracted driving programs were listed as a countermeasure, but their effectiveness has not been determined because there is a lack of evidence (Venkatraman et al., 2021). One such employee-based intervention is *Just Drive – Take Action Against Distraction.* This work-based intervention was designed to increase awareness of the dangers of distracted driving, decrease distracted driving, and encourage safe driving behaviors among employees. In a study to understand the impact of the Just Drive intervention, Hill et al. (2020) found that participants had a significant increase in knowledge about distracted driving risks and intended to change their distracted driving behaviors. At a three month follow up, participants reported changes in their distracted driving behaviors (Hill et al., 2020).

Other interventions to influence distracted driving behavior have been attempted with varying success. In a five-week, peer-led educational intervention that included video, group discussion, and a presentation about distracted driving (i.e., what distracted driving is, why young drivers are at high risk of distracted driving, ways to avoid distraction, distracted driving laws), it was found that those in the intervention group, compared to the control group, had increased knowledge about distracted driving and decreased distracted driving behaviors including cell phone use and sending text messages while driving (Berlin et al., 2021). Another intervention for distracted driving used an evidence-based interactive distracted driving website to engage parents in having conversations with their teens about distracted driving (Ehrlich et al., 2020). The intervention, Drive Smart, included three components in the intervention. First, there was a parent/teen toolkit that included a parent/teen driving agreement, informational brochure, and a cell keeper bag (Ehrlich et al., 2020). Second, there was an interactive educational program that included distracted driving scenarios and safe driving tips. And third, there was a list of phone apps teens could download to prevent a cell phone from working while the vehicle is in motion (Ehrlich et al., 2020). Results from a study of the Drive Smart intervention suggested that parents rarely talk with their children about distracted driving and that the tools such as the parent/teen agreement in the Drive Smart intervention was a good starting place to initiate those important conversations (Ehrlich et al., 2020).

A study conducted by Fournier et al. (2016) tested an intervention to decrease cell phone use while driving on a university campus. The intervention involved fear-based appeals, pledges, and behavioral prompts. The campaign consisted of thumb bands that read, “It can W8,” a pledge sheet for students to sign, and flyers. The fear-based appeal was delivered in the form of flyers that depicted the image of a little girl on a roadway with a message that said, “You tell my mom you only looked away for a second.” This was followed by a call to action to “Wear your thumb band to remind yourself and others that IT CAN W8.” Following the intervention, the researchers noted a significant decrease in drivers talking on a cell phone. However, the researchers observed an increase in drivers texting.

2.3.3.5 Impulsivity

Given the research that impulsivity is a factor associated with multiple risky driving behaviors, a review of the literature was conducted to understand how to influence impulsive behaviors. It has been suggested that interventions to address impulsivity should seek to increase the ability to delay gratification or inhibit behaviors (Chamorro et al., 2012). However, the literature on interventions that target impulsivity is sparse. Only one intervention designed to target impulsiveness in drivers was found, but the results of this intervention appeared promising to reduce multiple risky driving behaviors among novice drivers (Eensoo et al., 2018; Paaver et al., 2013).

The brief intervention designed to reduce impulsiveness in novice drivers was conducted as part of a driving school where students were divided into two groups (Paaver et al., 2013). One group received the intervention, and one group was considered the control group and did not receive the intervention. A total of 1,866 students participated in the study.

The brief intervention included education on impulsivity (i.e., different types of impulsivity, how impulsivity is related to risk-taking, how to recognize impulsiveness in oneself, and situational factors that could potentially trigger impulsive behavior) and group work that focused on identifying psychological factors involved in traffic crashes, assessing one's own risk, and focusing on ways to decrease risk including teaching skills such as self-monitoring and self-regulation (Paaver et al., 2013).

In the year following the intervention period, students were monitored for a variety of traffic behaviors including at-fault (active) crashes, not-at-fault (passive) crashes, speeding, drunk driving, and general traffic risk (crashes and penalties for any violations) (Paaver et al., 2013). When comparing those in the intervention group to those in the control group, those in the control group were cited for more speeding violations than those in the intervention group. Those who participated in the intervention had decreased odds of being cited for speeding by half (Paaver et al., 2013). The intervention did not have a significant effect on the other traffic offenses. However, when the intervention group was compared to all subjects (those in the control group and those who were assigned to the intervention group but did not complete the intervention), the intervention group had fewer speeding violations, fewer passive crashes, and fewer drunk driving incidents (Paaver et al., 2013).

A follow-up study after the initial intervention tracked traffic violations and traffic crashes for a period of four years. Results revealed that the benefits of participating in the intervention remained; "speeding, drunk driving, and involvement in traffic accidents were significantly lower in the intervention group" (Eensoo et al., 2018, p. 19).

While interventions to reduce impulsivity in traffic safety are limited, understanding other strategies that have been used to reduce impulsivity in general may be insightful. Emotion regulation training has been cited as a potentially effective way to reduce impulsivity (Aazam et al., 2014; Asgari & Matini, 2020; Malekimajd et al., 2016).

Emotion regulation is defined as changing one's response to emotions to better their wellbeing (Gross, 2002). Emotion regulation training can reduce impulsivity (Aazam et al., 2014; Asgari & Matini, 2020; Malekimajd et al., 2016). For example, in a study of juvenile offenders, Malekimajd and colleagues (2016) found that emotion regulation training reduced impulsivity, increased positive affect, and decreased negative affect. Two other studies (Aazam et al., 2014; Asgari & Matini, 2020) found that emotion regulation training reduced impulsivity in both individuals who smoked and individuals with a substance use disorder. Emotion regulation training has also been used as a strategy to reduce anger (Massah et al., 2016).

Gross's (2002) process model of emotion regulation is a commonly utilized model to reduce and control negative emotions and amplify positive emotions associated with various high-risk behaviors. Gross's process model of emotion regulation identifies a process for how to regulate or change a person's emotions. The process includes five strategies to regulate emotions: situation selection (making choices that will influence how one feels), situation modification (tailoring a situation to change how it will affect one's feelings), deployment of attention (deciding what to focus on or give attention to), change of cognitions (attaching meaning to the

situation that will influence how one feels), and modulation of experiential, behavioral or physiological response (changing how one feels after feelings have already been experienced) (Gross, 2002).

A traffic safety example can be used to illustrate Gross's process model of emotion regulation. Consider a person who tends to get angry while driving, especially when there is traffic congestion. Recognizing that the person gets angry while driving when there are more people on the road, the person chooses to change their commute to work to avoid the bulk of traffic (situation selection). Choosing to commute at a time that is less busy, the person recognizes the carpool lane is moving more smoothly and chooses to use that lane to avoid getting angry (situation modification), realizes that this is saving time (deployment of attention), and begins to think about their commute in a more positive way (change of cognition). When getting cut off in traffic by another driver, the person experiences anger but instead of reacting negatively by tailgating or speeding up, they modify their response to their anger by taking some deep breaths and continuing to drive in a safe manner (modulation of response). The process of emotion regulation training is to identify emotions accurately, teach skills to regulate emotions (problem-solving, attention modification, conflict resolution, emotion expression, mindfulness-based practices, etc.), and then learn to employ those skills/strategies that change the impact of emotions on a person's behavior.

2.3.3.6 Risk Perceptions

Literature suggests that "when interventions successfully change risk perceptions, health behavior change often results" (Ferrer & Klein, 2015, p. 85). However, a meta-analysis conducted by Sheeran et al. in (2014) found that while heightening risk perceptions did change health behaviors, the effects were small. This research also clarified that multiple components of risk perception must be heightened. These elements include anticipatory emotion, anticipated emotion, and perceived severity (Sheeran et al., 2014). To have a greater effect on health behaviors, interventions that heighten risk perceptions through messaging need to make the individual "(a) believe there is a risk, (b) feel worried about the threat, (c) feel guilty if they do not act, and (d) believe that the harm would be severe" (Sheeran et al., 2014, p. 534). This meta-analysis also found that the most successful risk appraisal interventions addressed multiple elements of risk appraisals and increased coping appraisals. Coping appraisals were defined as "people's belief about the efficacy of the recommended action, their confidence about undertaking that action, and their beliefs about the costs of doing so" (p. 534). Another study (Butters et al., 2012) suggested that changing risk perceptions to address risky driving behavior should be tailored by gender. The study found that females were more concerned with driver safety issues and more supportive of impaired driving countermeasures than males. The authors suggest that "initiatives to build support for such policies or for changing concern for risky driving behaviors need to be conceptualized and designed separately for males and females" (Butters et al., 2012, p. 410).

2.3.3.7 Modifying Mediating Factors

Interventions to change problem behaviors may be more successful when they are designed to focus on modifying the mediating factors that link personality and psychological factors to the

target behaviors (Patil et al., 2006). Attitudes are often found to be mediators (Kong et al., 2013; Z. Li et al., 2021; Ulleberg & Rundmo, 2003). Driver attitudes are related to high-risk behaviors such as speeding (Fylan et al., 2006; Rowe et al., 2016; Venkatraman et al., 2021). Attitudes are also a strong predictor of intention to engage in driving violations including behaviors such as impaired driving and distracted driving (Rowe et al., 2016). Interventions that target drivers' attitudes toward traffic safety to reduce risky driving behavior have been recommended (Bachoo et al., 2013; Kong et al., 2013; Z. Li et al., 2021).

For example, in one study, attitudes were found to be a strong predictor of intention to engage in driving violations including behaviors such as speeding, impaired driving, and distracted driving (Rowe et al., 2016). In this study, behavioral beliefs predicted attitudes toward these driving violations, and it was suggested that interventions seeking to modify behavioral beliefs may be an important focus to reduce risky driving behaviors (Rowe et al., 2016). In a study of truck drivers, attitudes toward risky driving positively influenced intention to drive in a risky way (Z. Li et al., 2021). It was found that attitudes towards risky driving significantly mediated both the relationship between sensation seeking and intention to drive riskily and risk perception and intention to drive riskily (Z. Li et al., 2021). It was recommended that strategies to cultivate negative attitudes toward risky driving may be beneficial such as promoting activities like safety promotions, safety rewards, and safety gatherings (Z. Li et al., 2021).

In the United Kingdom, a national speed awareness course is offered as an alternative to punishment for low-level speeding offenses. One of the main elements of reducing non-compliance with speed limits is to improve driver attitudes (Ipsos MORI et al., 2018) The content for the course is based on a behavioral model and the work of Fylan et al. (2006) regarding predictors of speeding that suggested that speeding behavior is influenced by intentions, attitude, perceived behavioral control, and self-efficacy (Ipsos MORI et al., 2018). In a study of this national speed awareness course, it was found that over a three-year period, the course was more effective at reducing speed reoffending than issuing a fine or penalty points (Ipsos MORI et al., 2018).

Seeking to understand and change normative beliefs and control beliefs may also be targets of intervention. Studies have shown that changes to behavioral, normative, and control beliefs led to changes in intention to engage in a behavior (Elliott et al., 2005; Elliott & Armitage, 2009; Ward et al., 2017). One study showed that reported driving under the influence of cannabis behavior was predicted by willingness and intention to engage in that behavior (Scott et al., 2021). A meta-analysis of 47 experimental tests of intention-behavior relations conducted by Webb and Sheeran (2006) indicated that a medium to large change in intention led to a small to medium change in behavior (Webb & Sheeran, 2006). Normative beliefs are often a target of intervention for behaviors like drinking alcohol, distracted driving, speeding, and other risky driving behaviors (Parker, 2002; Parker et al., 1996). Zhou et al. (2009) found that the young drivers surveyed believed that significant other people would support their use of hands-free mobiles (normative belief), which correlated to an increase in intention to use hands-free mobile phones when driving. Simons-Morton et al. (2012) found that having friends who engage in risky

behaviors reduced young drivers' perceptions about the risk of speeding and concluded that interventions to address perceived risk and perceived norms regarding speeding are needed.

Some interventions have sought to change both control and normative beliefs. A random controlled intervention based on the theory of planned behavior (TPB) was conducted in the United Kingdom to promote reductions in speeding (Elliott & Armitage, 2009). This study had 300 participants with 159 in the control group and 141 in the experimental group. All 300 participants responded to a baseline survey containing items to measure speeding behavior and TPB variables. Following the baseline survey, the experimental group received an eight-page booklet containing information about the risks of speeding and persuasive messages to target specific behavioral, normative, and control beliefs associated with speeding. One month after the intervention (booklet), both groups were given the baseline survey again. The experiment showed no effect on behavioral and normative beliefs, but there was a significant effect on one control belief and measured speeding behavior (Elliott & Armitage, 2009). Most studies on TPB test the predictive validity of the model; this study goes a step further and provides evidence that "drivers' perceptions of control accurately reflect their actual control" (Elliott & Armitage, 2009, p. 126).

Research regarding interventions that reduce risky driving behaviors such speeding, impaired driving, seat belt use, and distracted driving have commonly relied on deterrence strategies (i.e., enforcement) and engineering strategies; however, there is increasing research to suggest that behavioral strategies are increasingly being included as countermeasures to reduce risky driving behaviors (Venkatraman et al., 2021). Behavioral strategies have included elements such as personalized feedback (Newnam et al., 2014); coaching (Tapp et al., 2013); heightening risk perceptions including anticipatory emotion, anticipated emotion, and perceived severity (Sheeran et al., 2014); and focusing on factors such as impulsivity (Paaver et al., 2013). Further, behavioral strategies have focused on attitudes, perceived behavioral control, normative beliefs, and self-efficacy in addition to teaching skills and knowledge relating to risky driving (Elliott et al., 2005; Elliott & Armitage, 2009; Z. Li et al., 2021; Ward et al., 2017). These elements are important considerations for designing an intervention to address multiple risky driving behaviors.

2.3.4 Intervention Delivery Methods

As this project includes both designing and implementing an intervention to reduce multiple risky driving behaviors, various delivery methods are explored including mobile health technologies, brief interventions, and vehicle safety monitoring systems.

2.3.4.1 Mobile Health Technologies

Web-based instruction (WBI) opportunities have increased in popularity over the last decade because they do not require in-person instruction and yet they can deliver standardized educational opportunities (Camden et al., 2019).

Learning Management Systems (LMS) are web-based software systems that can be programmed to deliver educational content on any device, any time, and from anywhere. They are a popular learning platform for providing educational content in business and academic settings. Some

open source LMS systems include Moodle, 360Learning, and ILIAS. Research evidence suggests that web-based learning is as effective as traditional learning instruction (Nguyen, 2015; Sitzmann et al., 2006). Camden et al. (2019) evaluated the effectiveness of an automatic targeted WBI program to reduce risky driving behaviors (i.e., rapid acceleration, hard braking, hard cornering, and speeding) and found that the WBI intervention significantly reduced the rate of risky driving behaviors.

McDonald et al. (2018) developed a web-based intervention to reduce adolescent driver inattention. Using e-learning software to develop the intervention and a Learning Management System (LMS) to deliver the intervention, McDonald and colleagues (2018) were able to create an intervention that participants could complete online without the help of a facilitator. With beta testing and pilot testing, McDonald et al. (2018) conducted a randomized controlled trial to establish feasibility of the web-based intervention. While the initial testing of the web-based intervention to reduce adolescent driver inattention did not find significant effects, the results did indicate the potential for reducing unsafe driving behaviors and it is possible that the small sample size of the study limited the researchers' ability to detect significant differences between groups (McDonald et al., 2021).

Another mobile health technology that has been studied to reduce risky behavior is the use of text messages and mobile phone apps to deliver brief interventions (Ameratunga et al., 2017; Badawy & Kuhns, 2017). Ameratunga et al. (2017) developed a brief text message intervention incorporating brief intervention principles into 16 informational and motivational text messages delivered over four weeks to reduce harmful drinking behavior among adults who had been discharged from an in-patient care setting. In a systematic review of texting and mobile phone app interventions to improve adherence to preventive behaviors in young people, Badawy and Kuhns (2017) found that about half of the studies that were included in the review demonstrated significant improvement in preventive behaviors. Delivering an intervention via text messages or mobile apps may be a strategy that can reach a wide range of people in a convenient and cost-effective way.

Mobile health technology may also be a delivery method that could augment existing programs and infrastructures that are already established, such as driver's education programs and programs for those who have been cited for driving under the influence of substances.

2.3.4.2 Brief Interventions

Brief interventions include providing information about a behavior, understanding the person's perspective on the behavior, and offering feedback for the person to consider regarding ideas to change the specific behavior (Ameratunga et al., 2017, p. 2). Many brief interventions utilize elements of motivational interviewing to resolve ambivalence about changing behavior and to elicit desired behavior changes (Elwyn et al., 2014). The components of motivational interviewing include (1) Engaging, which focuses on building a relationship with the other person to explore their beliefs and feelings, (2) Focusing, which includes deciding on a direction for change, (3) Evoking, which focuses on eliciting the person's motivation for change, and (4) Planning, which includes developing a commitment to change and creating a plan of action (Elwyn et al., 2014).

Brief interventions that use motivational interviewing have been used to address a wide range of behaviors including smoking cessation, weight management behavior, sexual health behavior, adherence to medication, and driver behaviors like seat belt use, speeding, and impaired driving (Fernandez et al., 2008; Frost et al., 2018; Fylan et al., 2006; Steinka-Fry et al., 2015). Further, motivational interviewing has been used as a behavioral intervention for people with multiple health problems and multiple risk factors (Frost et al., 2018). Given the results of brief interventions to improve driver behaviors, brief interventions may be appropriate to address multiple risky driving behaviors.

2.3.4.3 Vehicle Safety Monitoring Systems

In-vehicle monitoring systems (IVMS), also called on-board safety monitoring systems (OBSM), are considered technologies that can monitor driving behavior and provide real-time or retrospective feedback about risky driving behaviors. Feedback about driving behavior is the primary mechanism for behavior change. The underlying assumptions are that providing drivers with feedback about their risky driving behavior will allow them to correct or change their risky driving behavior and providing feedback about their positive and safe driving behaviors will encourage more of those safe behaviors to continue (Horrey et al., 2012). Feedback to drivers can come in the form of "in-cab warning lights, sounds, reports, or by viewing video contents, all of which are intended to help drivers avoid or correct risky driving behaviors" (Bell et al., 2017, p. 125).

Research suggests that vehicle safety monitoring systems may be an effective strategy to reduce risky driving behaviors and encourage safe driving behaviors especially when combined with coaching (Bell et al., 2017; Hickman & Hanowski, 2011). In a study of commercial drivers, drivers who were provided with instant feedback from IVMS regarding harsh vehicle maneuvers like speeding, hard braking, and swerving, along with coaching from supervisors about safe driving practices had significantly fewer risky driving behaviors than those who received feedback from the IVMS alone or those in the control group (Bell et al., 2017). Similarly, another study found that combining in-vehicle safety monitoring systems and behavioral coaching reduced the rate of safety-related events (Hickman & Hanowski, 2011). Combining vehicle safety monitoring technology and coaching from parents or other respected adults may also be an effective strategy to improve driving behavior for young novice drivers, a particularly high-risk group engaging in multiple risky driving behaviors (Farah et al., 2014; McGehee et al., 2007; B. G. Simons-Morton et al., 2013).

Various methods have been used to successfully deliver interventions to reduce risky driving behaviors. In-person experiences, web-based mobile health technologies, brief interventions, and systems that monitor driving behavior and provide synchronous and asynchronous feedback using technology have been explored. To successfully reduce multiple risky driving behaviors, an intervention may need to be more intensive than if the intervention sought to address any single risky driving behavior in isolation. The intervention may need to consider combining various delivery methods to be most effective.

2.4 Intervention Development Plan Outline

2.4.1 Goal of Intervention

The brief intervention will be designed for drivers engaged in multiple risky driving behaviors.

The goal of the brief intervention is to reduce multiple risky driving behaviors and to avoid harmful consequences as a result. Toward this end, the proposed intervention seeks to

- meet the person where they are in the process of behavior change,
- explore cognitions related to multiple risky driving behaviors,
- provide behavioral strategies to increase safe driving behaviors, and
- use strategies that seek to grow a person's motivation.

2.4.2 Intervention Development and Content

2.4.2.1 Theoretical Foundation

The intervention designed for drivers engaged in multiple risky driving behaviors will have a strong theoretical foundation. An Integrated Behavior Model, Motivational Interviewing, Transtheoretical Model of Behavioral Change, Harm Reduction, Cognitive-Behavioral Approach, and a Strengths-Based Perspective are briefly described and will be used in the design of the intervention to reduce multiple risky driving behaviors. Further, the intervention will also focus on impulsivity and risk perceptions as these factors are associated with multiple risky driving behaviors (Barati et al., 2020; Dionne et al., 2007; Ryb et al., 2006).

2.4.2.1.1 Integrated Behavior Model

The integrated behavior model will be used to inform the assessments created for this project and the development of the intervention curriculum regarding behavioral beliefs, normative beliefs, and control beliefs and their relative impact on the multiple risky driving behaviors we are seeking to change. The integrated behavior model brings together several components from models shown to be effective from research (Fishbein & Ajzen, 2010; Gerrard et al., 2008). (See Figure 1.) The integrated behavior model defines several "constructs" that can be measured for an individual. The relative impact of each construct on behavior can be assessed using statistical analytical techniques (such as regression analyses). By understanding which constructs influence decision-making, interventions can be developed to grow these beliefs and thereby influence behavior. Table 3 summarizes each construct.

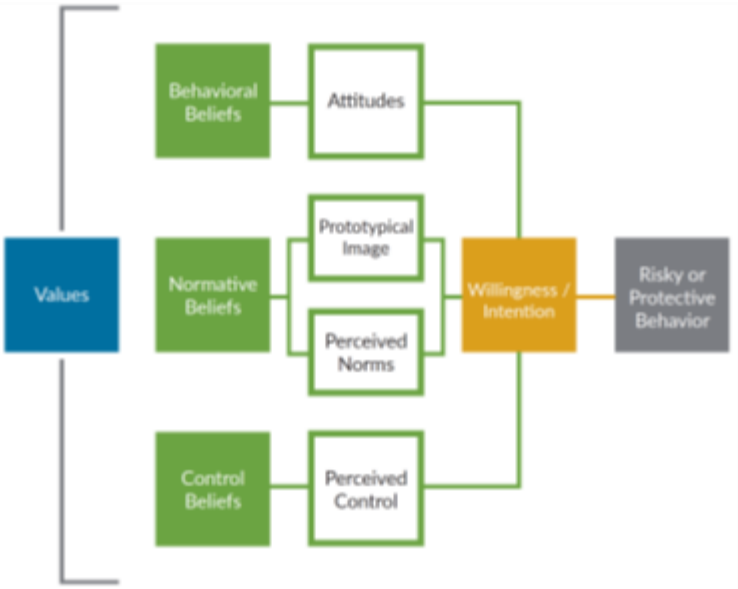

Figure 1. Integrated Behavior Model

Table 3. Definitions of Constructs Used in Integrated Behavior Model

Attitudes	Subjective evaluation of an object or behavior in terms of emotional reaction (e.g., "Speeding is exciting") and perceived utility (e.g., "I can socialize better when I drink").
Behavioral Beliefs	Expectations about the physical and social consequences of a behavior (e.g., "If I speed, I will likely get an expensive fine," "If I drink and drive, my friends will exclude me").
Construct	Constructs are the concepts developed or adopted for use in a particular theory. An example of a construct is "attitude" or "perceived control."
Control Beliefs	Beliefs about my ability to engage or not engage in the behavior based on factors that are either internal or external to oneself (e.g., "Crashes are determined by fate," "It does not matter what I say because my child does not listen to me").
Intention	The deliberate decision to commit a behavior in an anticipated situation (e.g., "I intend to wear my seat belt every time I am in a vehicle").
Normative Beliefs	Beliefs about (1) what behaviors are most common in a group (e.g., "All my friends speed"); (2) what important people in that group expect (e.g., "My parents expect me not to drink"); and (3) what are the shared characteristics of people perceived to typically engage (or abstain) in that behavior.
Perceived Control	Perception of our ability to determine our own behaviors (e.g., "I can choose my own speed in traffic").
Perceived Norms	The behavior believed to be common and expected in a given context (e.g., wearing a seat belt when driving with parents).

Prototypical Image	The stereotype of people perceived to typically engage in the behavior (e.g., "People who speed are cool").
Values	Ideals to which we aspire that define the goals for our behavioral choices and direct the formation of our belief systems (e.g., "I must protect my family," "I desire a life without stress").
Willingness	The predisposition to commit a behavior if an unexpected situation arises (e.g., "I am more willing to speed if everyone else around me is speeding").

2.4.2.1.2 Motivational Interviewing

Motivational Interviewing was developed as a change process that seeks to engage a person in their stage of readiness and help the person explore ambivalence about changing their risky behaviors (Miller & Rollnick, 2002). Motivational interviewing uses Prochaska and DiClemente's stages of change model to assess a person's readiness for change and then seeks to match their intervention to the person's motivation (Dimeff et al., 1999).

The intervention created to reduce multiple risky driving behaviors will use Miller and Rollnick's (2002) motivational interviewing approach and specifically their "FRAMES" to structure the content development process for the brief intervention. The FRAMES has been used in other interventions to reduce risky behaviors (Dimeff et al., 1999) and is adapted here to include:

- **F**eedback – information about multiple risky driving behaviors, risks, normative behavior
- **R**esponsibility – emphasis placed on the person's responsibility for change
- **A**dvice – simple advice on what to change
- **M**enu (of options) – provision of a range of options to select from
- **E**mpathy – ability to see the situation from the person's perspective, while also maintaining a perspective outside their reality
- **S**elf-efficacy – the person's belief in his or her ability to make successful changes

2.4.2.1.3 Transtheoretical Model of Behavioral Change

Prochaska and Di Clemente's Transtheoretical Model of Behavioral Change (TTM) suggests that change occurs over time through stages, not all at once (DiClemente, 2018). Thus, efforts to change behavior may be more successful if the effort seeks to meet the person where they are and recognizes that change is not a linear process but one that includes progress and regression (DiClemente, 2018). TTM can be used to create new behaviors, modify existing behaviors, and stop detrimental behaviors (DiClemente, 2018). TTM has been used to assess the stages of change in high-risk driving behaviors (Khadem-Rezaiyan et al., 2017). In the stages of change model, five stages are identified (DiClemente, 2018):

1. Precontemplation – when "a person is unaware (or under aware) of risks or problems associated with a particular behavior" (Dimeff et al., 1999, p. 34), the person is not considering a change, or not intending to take action to change soon (DiClemente, 2018).
2. Contemplation – when "a person begins to recognize that some hazards and/or problems exist and gives through to making a change in his or her behavior but has not yet made a firm commitment to change" (Dimeff et al., 1999, p. 34), a person conducts a cost/benefit analysis regarding their current behavior (DiClemente, 2018).
3. Preparation – when a person takes steps or prepares for change (DiClemente, 2018). "Preparation combines intention with behavior and usually follows once ambivalence is resolved or diminished" (Dimeff et al., 1999, p. 35).
4. Action – when a person has taken specific actions to make a change and "modifies his or her behavior and/or environment in order to overcome the problem" (Dimeff et al., 1999, p. 35).
5. Maintenance – when a person takes actions to "support and maintain the behavioral gains that have been made" (Dimeff et al., 1999, p. 35), and the behavior is integrated into the individual's lifestyle (DiClemente, 2018).

It has been suggested that intervention strategies that don't align with an individual's readiness can result in psychological reactance and render change unlikely (Brehm & Brehm, 1981; Dimeff et al., 1999). The intervention created to reduce multiple risky driving behaviors will assess readiness for change so that strategies can be matched to the individual's readiness for change.

2.4.2.1.4 Harm Reduction

A harm reduction approach acknowledges that change occurs over time, not all at once (Dimeff et al., 1999). It is a "strategy directed at an individual or groups that aims to reduce the harms associated with certain behaviors" (Canadian Paediatric Society, 2008, p. 53). A harm reduction approach may be considered in the development of the intervention for this project. The goal of harm reduction is to increase knowledge and target the reduction of associated harms rather than the frequency or amount of engagement in a risky behavior (Jenkins et al., 2017). This approach moves beyond abstinence-only and provides individuals with strategies to minimize harm while engaging in risky behaviors (Senserrick et al., 2021). Harm reduction focuses on the damage done by the behavior and not the behavior itself (Brown & Stewart, 2021). Focusing on harm reduction allows room to meet individuals where they are and engage in a collaborative process often through motivational interviewing to identify problems and create solutions. Harm reduction acknowledges the autonomy of the individual and treats individuals with respect (Richards et al., 2021). The choice to reduce engagement in a behavior and then select what strategies to employ comes from the individual. A recent article in the *Journal of Transport and Health* (Senserrick et al., 2021) presented arguments for the incorporation of harm reduction in young driver education. They claim that harm reduction has been successful in youth education of other risky behaviors such as alcohol and drug use and applying some similar concepts to youth driver education may have benefits. While still emphasizing the importance of "abstinence is best" regarding engagement in risky driving behaviors, their arguments highlight some critical issues of inequities, the role of peers and parents, the need to teach risk-compensating behaviors,

and the lack of acknowledgment of youth drivers' lived experiences as reasons to explore a harm reduction approach in traffic safety, especially for youth (Senserrick et al., 2021).

2.4.2.1.5 Cognitive-Behavioral Approach

A cognitive-behavioral approach seeks to help a person identify their thoughts, understand how their thoughts influence behaviors, and provide strategies to manage/change behaviors to reduce high-risk behaviors (Dimeff et al., 1999). In an intervention to address multiple risky driving behaviors, a cognitive-behavioral approach will be used to teach an individual engaging in multiple risky behaviors how to identify thoughts, emotions, and beliefs that are influencing their multiple risky driving behaviors, reshape those cognitions to support safer driving behaviors and understand the individual strategies they could use to engage in safer driving behaviors.

2.4.2.1.6 A Strengths-Based Perspective

A strengths-based perspective suggests that building on one's strengths, skills, and capacities can foster change and "can be used for movement toward their aspirations..." (Saleebey, 2001, p. 78). Through intentional questions that focus on what possibilities exist, efforts to change behavior may be more effective when we seek to nurture a person's strengths and draw on those strengths when engaging in change. Thus, the intervention proposed for this project will use the guiding belief that individuals engaging in multiple risky driving behaviors have unique strengths and capabilities they can draw on to aid them in making changes toward healthier and safer driving decisions and behaviors.

2.4.2.2 Intervention Description

We are proposing an intervention that includes web-based virtual modules and a series of text messages to support participant learning between each module completion. We will seek to develop an intervention that can be delivered by individuals in a wide range of professional roles (e.g., DUI class leaders, and driver's education instructors) and can stand alone or be augmented to accompany an existing program or strategy.

The intervention will target specific factors associated with multiple risky driving behaviors including impulsivity, risk perceptions, and attitudes and beliefs associated with risky driving behaviors.

Participants who are randomized to the intervention will begin and complete the intervention on a rolling basis after consent. An overview of the modules and supportive text messages are outlined:

1. **Module 1 – Overview of Intervention, Education, and Personalized Feedback**
    a. Time Required: 40 minutes
    b. After consent and randomization, participants in the intervention group will have one week to complete Module 1 followed by two weeks to practice the selected strategy
    c. Module 1 Objectives:
        i. Explain the purpose and structure of the intervention and personalized feedback

ii. Provide education about high-risk driving behaviors and risks
iii. Get commitment from participants to participate in the intervention including receiving text messages as well as a commitment to not engage with materials or text messages while operating a motor vehicle
iv. Provide personalized feedback based on baseline assessment
v. Give specific advice about ways to reduce risky driving behaviors (Behavioral Strategies)
    1. Based on personalized feedback, participant selects strategy option(s)
    2. Build motivation and commitment to change
    3. Ask for commitment

d. Text Message Objectives:
    i. Support strategies
    ii. Support behavior change
    iii. Build motivation and commitment to change
    iv. Provide avenue for additional support

2. Module 2 – Strengthening Commitment to Change

a. Time Required: 10 minutes
b. One week to completed Module 2 followed by one week to practice selected strategy
c. Module 2 Objectives:
    i. Review selected strategy
    ii. Check in on selected strategy
        1. Celebrate successes (what worked)
        2. Affirm progress and enhance motivation
        3. Explore what can be changed to increase success
d. Text Message Objectives:
    i. Support strategies
    ii. Support behavior change
    iii. Build motivation and commitment to change
    iv. Provide avenue for additional support

2.4.2.3 Intervention Pilot Testing

To optimize outcomes and make the best use of limited resources, the intervention will be pilot-tested and refined before seeking wider implementation in a randomized controlled trial. We will pilot-test the experience of the intervention group (baseline assessment, intervention, and post-assessment). We will use a Qualtrics-purchased panel to complete the pilot testing.

2.5 Evaluation and Implementation Plan Outline

2.5.1 Study Aim

The current study aims to test the efficacy of a brief intervention designed to reduce multiple risky driving behaviors. The outcomes of interest are speeding, driving under the influence, seat belt use, and distracted driving.

2.5.2 Study Setting and Participants

Participants in this study will be recruited from a university through email advertising and social media postings about the study. Individuals who respond to the study advertisements will be given introductory information about the study and will be screened for eligibility. Eligibility criteria:

- Age 18 or older
- Hold a valid driver's license
- Report driving at least once a week
- Report engaging in at least two risky driving behaviors in the past month

2.5.3 Method and Design

All procedures will be approved by the Montana State University Institutional Review Board for human subjects research before the study begins, and participants will provide informed consent.

We will use a randomized controlled trial design to test if the brief intervention decreases multiple risky driving behaviors. Eligible participants will be randomly assigned to one condition – control or intervention. All participants will complete measures at three-time points – baseline, post-intervention (i.e., immediately following intervention for intervention participants and the same time delay from baseline for control participants), and follow-up (i.e., three months following post-intervention). (See Table 4).

All data will be gathered via self-report, and measures will assess outcomes as well as the beliefs and factors targeted by the intervention. Demographic information will be collected at baseline.

Outcome measures:

1. Speeding
2. Driving under the influence
3. Seat belt use
4. Distracted driving

Associated factors:

1. Impulsivity
2. Risk perception
3. Protective beliefs (control beliefs, normative beliefs)

We will also gather data on the frequency of driving and types of trips (i.e., purpose, length, type of roadway, and geography).

Participants will be offered feedback regarding the scales as a benefit of participation and will also be compensated with a gift card for participation.

Table 4. Timeline for Each Participant

	Week 0	**1**	**2**	**3-4**	**5**	**6**	**7**	**8-19**	**20**
Intervention	Recruitment and screening	Consent, randomize, baseline assessments	Module 1	Mod 1 practice (and texts)	Module 2	Mod 2 practice (and texts)	Post assessments	** 3 months pass*	Follow-up assessments
Control			No treatment						

The total number of participants will be determined with a priori power analysis. Preliminary power analyses suggest a total final sample of 172 participants is necessary for 80% power to detect a small-to-moderate effect (partial $\eta^2 = .03$) with $\alpha \leq .05$ and a .5 correlation between measurements. We will confirm this power analysis during piloting. Additionally, we anticipate participant attrition, which will require us to over recruit to ensure an adequate final sample size.

2.5.4 Hypotheses

We hypothesize that:

1. The brief intervention will result in reduced impulsivity, increased risk perception, and increased protective beliefs.
    a. Compared to participants in the control group, participants in the intervention group will have greater reductions in impulsivity scores.
    b. Compared to participants in the control group, participants in the intervention group will have increases in risk perception and other protective beliefs.
2. The brief intervention will, through reduced impulsivity and/or increased risk perception and protective beliefs, result in participants engaging in fewer high-risk driving behaviors.
    a. Compared to participants in the control group, participants in the intervention group will report fewer high-risk driving behaviors at follow-up. Reductions in high-risk driving behavior will be associated with reduced impulsivity and increased risk perceptions or protective beliefs.

2.5.5 Planned Analysis

The primary analysis will be a repeated measures multiple analysis of variance (MANOVA) with the intervention identified as a between factor. MANOVA is the appropriate main analytical test for both hypotheses and will allow us to test the effect of the intervention on impulsivity, risk perceptions, beliefs, and the four driving behaviors. We will conduct additional correlations and/or regressions to understand the relationship between the variables (e.g., the relationship between impulsivity and driving behaviors).

3 TASK 2 –ASSESSMENT AND BRIEF INTERVENTION

3.1 Assessment

3.1.1 Assessment Development

To develop the initial version of the assessment, we reviewed the instruments used in the literature for the constructs relevant to this study (e.g., driving behaviors, impulsivity, risk perceptions, normative beliefs, etc.). Using the Center for Health and Safety Culture's (CHSC) extensive experience in surveys of driver behaviors and beliefs as well as published research, we chose survey items that met minimum standards psychometrically and that were reasonable to administer to our planned study population (i.e., an online survey of young adults). When published instruments were not available, we used items the CHSC had used successfully in the past whenever possible. Table 5 describes the source of survey items for each study construct. A copy of the assessment instrument is provided as Appendix 8.1.

Table 5. Measures for Study Constructs

Construct	Instrument and Source	Notes and/or adaptation(s)
Speeding	CHSC	Previously used by the CHSC (Otto et al., 2021).
Distracted Driving	Traffic Safety Culture Index (AAA Foundation for Traffic Safety, 2021)	Removed hands-free technology items and added "reached for an object while driving" item.
Seat Belt	CHSC	Similar to widely used national surveys (i.e., National Survey of Drug Use and Health; Youth Risk Behavior Survey).
Driving Under the Influence (DUI)	CHSC	The CHSC has used these same items for recent other work measuring DUI behaviors.
Compensating Behaviors	CHSC	Newly developed for this study to parallel the intervention.
Impulsivity	UPPS-P short version (Cyders et al., 2014)	
Emotional Intelligence	Driver Emotional Intelligence Scale (DEIS) (Ahmed et al., 2021)	DEIS was based on Trait Emotional Intelligence Questionnaire short form (Petrides, 2009).
Risk Perceptions	Traffic Safety Culture Index (AAA Foundation for Traffic Safety, 2021)	Matched to study behaviors.
Injunctive Norm Beliefs	Traffic Safety Culture Index (AAA Foundation for Traffic Safety, 2021)	Matched to study behaviors.
Descriptive Norm Beliefs	CHSC	The CHSC uses similar items in many projects.

Control Beliefs	Elliott & Armitage study on speeding (2009)	Global perceived behavioral control items matched to study behaviors.

3.1.2 Assessment Pilot Testing

The assessment was pilot-tested to determine the internal and test-retest reliability of the measures with the focus population. We used a Qualtrics-purchased panel of young adults (18-25) in the United States to complete the pilot test. The pilot test was reviewed and approved by the Institutional Review Board at Montana State University.

The sample was recruited by inclusion criteria of age 18-25 in the United States, drive a vehicle at least once a week over the last 30 days, and report two or more risky driving behaviors (i.e., speeding, driving distracted, not wearing a seat belt, driving under the influence of alcohol or cannabis). Risky driving behaviors were initially assessed using one representative survey item for each set of behaviors; follow-up items were asked for those who endorsed the behavior.

Eligible participants who completed the initial survey were invited to complete the same survey a second time approximately three weeks later. Altogether, 234 participants completed one or two surveys; 124 completed just the initial survey and did not complete the second survey, while 110 completed both surveys. Time elapsed between survey completions ranged from 16 to 28 days with a Mean of 21.7 days (SD = 3.3). Most participants (79.1%) completed the second survey between 17 and 24 days after the first.

Most participants reported driving a vehicle most days each week (Time 1: 78.6%, Time 2: 85.0%), and at both survey administrations, most respondents described themselves as women (Time 1: 70.9%, Time 2: 72.6%). On average, participants were 22.3 years old and lived in 36 different states. The population density of participants' communities varied; at Time 1, 29.3% reported living in a large city, 33.7% in a suburb near a large city, 25.5% in a small city or town, and 11.5% in a rural area. Time 2 population density responses were similarly distributed. Most survey respondents had received a high school diploma, an associate's degree, or had completed some college but not earned a degree (Time 1: 72.2%, Time2: 69.3%).

In the construction of the instrument, we included items for both aggressive driving and speeding behaviors, as they are closely related and often measured together. In the analyses of the pilot test, we consider the aggressive and speeding items together and the speeding items independently, as speeding is the specific behavior of interest in this multi-risk study.

Table 6 describes the scale and subscale construction and the internal reliability as estimated with Cronbach's alpha (α) for each. Generally, α coefficients less than 0.5 are considered unacceptable and the minimum level is typically 0.7. Applying that guideline to our measures, we find most subscales to have acceptable reliability. Both the subscales for aggressive/speeding behaviors combined and speeding alone have lower reliability than other behaviors and aggressive/speeding combined had greater reliability than speeding alone (.62 vs .41). For emotional intelligence, our results support the use of 29 items (out of 30 total) of the Drivers' Emotional Intelligence Scale (DEIS), consistent with the development research of the instrument (Ahmed et al., 2021). For the secondary outcomes of risk perceptions and injunctive normative

beliefs, the speeding-only subscales had greater reliability than the aggressive/speeding combined. Overall, our pilot results support the conclusion that the scales and subscales have appropriate internal consistency for use with the focus population of this study.

A review of descriptive statistics of each scale also indicated that aggressive/speeding and distracted driving were by far the most reported risky driving behaviors, while not wearing a seat belt and driving under the influence of substances (DUI) were much less frequent.

Table 6. Scale Descriptions and Reliability

Scale/Subscale	Number of items	Scale range (higher scores)[1]	Cronbach's Alpha (Reliability)[2]	*n*
Risky Driving Behaviors	--	0 – 4 (greater frequency)	--	--
Aggressive/Speeding	4		.62	220
Speeding only	2		.41	220
Distracted driving	4		.73	215
Seat belt wearing	3		.73	77
DUI	7		.71	59
Impulsivity	20	1 – 4 (greater impulsivity)	.80	210
Driver Emotional Intelligence Scale (DEIS)	29	1 – 7 (greater emotional intelligence)	.89	206
Self-control	12		.90	207
Emotionality	11		.82	208
Anxiety	6		.80	208
Risk Perceptions	--	1 – 5 (greater risk perceptions)	--	--
Aggressive/Speeding	4		.62	231
Speeding only	2		.72	231
Distracted driving	4		.81	232
Seat belt wearing	3		.87	233
DUI	7		.90	228
Injunctive Norm	--	1 – 5 (greater perceived approval)	--	--
Aggressive/Speeding	4		.75	222
Speeding only	2		.80	222
Distracted driving	4		.87	222
Seat belt wearing	3		.89	222
DUI	7		.96	222
Descriptive Norm	--	0 – 5 (belief that others engage more frequently)	--	--
Aggressive/Speeding	4		.85	218
Speeding only	2		.83	219
Distracted driving	4		.87	218
Seat belt wearing	3		.80	218

DUI	7		.94	218
Control Beliefs	--	1 – 7 (greater perceived control)	--	--
Speeding	4		.87	232
Distracted driving	4		.87	231
Seat belt wearing	4		.92	230
DUI	8		.95	229

Note. [1]Parenthetical description provides interpretation of higher scores. [2] Cronbach's alpha is calculated based on sample at Time 1 only; behavior scales are based on those who endorsed that behavior.

Next, we analyzed the relationship between participants' responses to the survey items at the two different time points. Table 7 shows the means at both Time 1 and Time 2 as well as the correlations and repeated-measures t-test results. In these results, we observe similar means at the two time periods for most scale and subscales. As expected, most of the means across the two time periods are fairly highly correlated and do not differ significantly, indicating stability of measurement over time. Specifically, the measurements for risky driving behaviors are relatively stable, with the most change observed for the DUI measurement, which had only a few respondents. Impulsivity, emotional intelligence, risk perceptions, and control beliefs also showed moderate-to-high correlations and no significant differences between the two time periods. The measurements for injunctive normative beliefs showed more variation between the time periods, with beliefs around DUI behaviors appearing more stable than other beliefs. Overall, results indicate that the measurements are relatively stable across time without any specific intervention. However, because these are measurements of behaviors and cognitions, there is some expected inconsistency or variability across time, underscoring the need for a control group during the trial when attempting to ascertain the impact of an intervention.

Table 7. Scale Means at Time 1 and Time 2 and Correlations and Tests of Differences

Scale/Subscale	Time 1 *M*	Time 2 *M*	R^2	Repeated-measures *t*	*n*
Risky Driving Behaviors					
Aggressive/Speeding	2.38	2.30	.43**	1.20	101
Speeding only	2.80	2.66	.48**	1.88	101
Distracted driving	2.42	2.29	.47**	1.87	93
Seat belt wearing	1.63	1.52	.65**	.78	25
DUI	1.10	0.97	.58+	1.06	18
Impulsivity	2.27	2.26	.79**	.39	98
Driver Emotional Intelligence Scale (DEIS)	4.57	4.59	.72**	-.37	97
Self-control	4.91	4.84	.59**	.73	97
Emotionality	4.39	4.53	.54**	-1.47	97
Anxiety	4.21	4.19	.47**	.14	97
Risk Perceptions					

Aggressive/Speeding	2.92	2.94	.52**	-.29	109
Speeding only	2.80	2.79	.43**	.15	109
Distract	3.40	3.54	.34**	-1.45	109
Seat Belt	3.70	3.78	.53**	-.87	109
DUI	3.98	3.90	.48**	.89	109
Injunctive Norm					
Aggressive/Speeding	2.91	2.77	.20+	1.36	104
Speeding only	2.97	2.79	.16	1.35	104
Distract	2.47	2.40	.17	.58	104
Seat Belt	2.35	2.21	.27*	1.13	104
DUI	1.98	1.92	.43**	.55	104
Descriptive Norm					
Aggressive/Speeding	2.97	2.84	.28*	.91	103
Speeding only	3.07	2.94	.30*	.88	103
Distract	2.97	2.79	.20+	1.21	102
Seat Belt	3.01	2.68	.24+	2.16+	102
DUI	2.07	2.05	.28*	.15	102
Control Beliefs					
Speed	5.55	5.48	.47**	.54	109
Distract	5.41	5.17	.33**	1.56	109
Seat Belt	6.13	6.03	.52**	.83	108
DUI	5.91	5.90	.48**	.10	107

Notes. Includes participants with both Time 1 and Time 2 data. For behaviors, only participants who endorsed that behavior are included. $^{+}p<.05$; $^{*}p<.01$; $^{**}p<.001$

Finally, as the planned intervention includes asking participants to choose harm reduction strategies for risky driving behaviors, the pilot test version of the assessment included items to assess whether participants had considered or tried a variety of harm reduction strategies. Participants responded to the questions, and the variation in their patterns of responding indicated that they were able to answer the questions in a meaningful way.

Pilot test findings support the use of the assessment for the randomized controlled trial to test the effect of the brief intervention. We will use these results to inform refinements to the assessment and to provide needed context in interpretation of the findings of the randomized controlled trial for the intervention.

3.2 Brief Intervention

3.2.1 Brief Intervention Development

To develop the initial version of the brief intervention designed for drivers engaged in multiple risky driving behaviors, we relied on the literature review completed in Task 1 to understand what strategies had been previously tested to reduce the constructs of interest in this study: speeding, impaired driving, non-seat belt use, distracted driving, impulsivity, risk perceptions,

driver emotional intelligence, and other mediating factors. Additionally, we sought to include elements in the brief intervention that would seek to meet the person where they are in the process of behavior change, explore cognitions related to multiple risky driving behaviors, provide behavioral strategies to increase safe driving behaviors, and use strategies that would seek to grow a person's motivation.

We developed content sessions for the brief intervention to be delivered virtually in approximately 5-7 minutes each followed by a series of text messages to support participant learning between each session. All components of the brief intervention were designed to be delivered as a stand-alone intervention or to be augmented to accompany an existing program or strategy. All components of the brief intervention are virtual and do not require a trained professional to implement.

Five sessions were created in total: Emotion Session, Seat Belt Session, Distracted Driving Session, Driving Under the Influence of Substance Session, and Speeding Session. The Emotion Session focused specifically on identifying and regulating emotion, a strategy which seeks to reduce impulsivity. The skill of identifying and regulating emotion was carried into the specific behavior sessions (Seat Belt Session, Distracted Driving Session, Driving Under the Influence of Substance Session, and Speeding Session). The sessions that were specific to a behavior followed a similar format designed to provide education and heighten risk awareness, provide personalized feedback based on the assessment of multiple risky driving beliefs and behaviors, provide normative data about the specific risky driving behaviors, practice identifying and regulating feelings, and provide specific risk mitigating strategies to reduce multiple risky driving behaviors and improve safety.

Additionally, text messages were designed to build motivation and commitment for change, bolster protective beliefs, and encourage participants to practice identifying and regulating emotion. Intervention content can be found in Appendix 8.2. The content of the intervention was based on a theoretical foundation including an Integrated Behavior Model, Motivational Interviewing, Transtheoretical Model of Behavioral Change, Harm Reduction, Cognitive-Behavioral Approach, and a Strengths-Based Perspective. Table 8 shows the logic model created for the proposed intervention.

Table 8. Logic Model Created for the Proposed Intervention

Multiple Risky Driving Behaviors
Strategy: Brief Intervention

Problem Identification / Opportunity	**Strategy Goals** Broad action statements about the purpose(s) of the strategy and what it is intended to accomplish	**Short-Term Outcomes** (e.g., skills, knowledge, beliefs)	**Intermediate Outcomes** (e.g., behaviors)	**Long-Term Outcomes** (e.g., consequences)	**Health Impacts**
Multiple risky driving behaviors result in negative consequences including increased crash risk, serious injuries, and fatalities. There is a gap in understanding how to address impulsivity and the underlying beliefs and behaviors of individuals engaging in multiple risky driving behaviors. Drivers engaging in multiple risky behaviors (such as not using a seat belt, speeding, and driving impaired) may require more intensive or different interventions than are typically provided to drivers who are cited for any one of these risky behaviors in isolation. There is an opportunity to use a harm reduction approach to traffic safety.	Reduce multiple risky driving behaviors to improve safety through a brief intervention that targets specific factors including: impulsivity, risk, perceptions, and attitudes and beliefs. Provide education on multiple risky driving behaviors. Build motivation and commitment for change. Provide personalized feedback about multiple risky driving beliefs and behaviors. Provide specific advice for strategies based on feedback to reduce multiple risky driving behaviors and improve safety.	Understand why multiple risky driving behaviors are particularly problematic. Increase understanding of cognitions and feelings related to risk driving behaviors. Increase commitment to implement a strategy to reduce multiple risky driving behaviors. **Use strategies from intervention (skills to reduce high risk driving)** *P* **Increase knowledge of compensating behaviors** *P* **Increase risk perceptions.** *O* Increase emotional regulation. Increase self-efficacy. **Increase protective beliefs (control, normative).** *O*	Decrease engagement in risky driving behaviors (one or more): **Speeding,** *O* **Distracted,** *O* **Impaired, driving** *O* **Seat belt use.** *O* Based on targeted skills, knowledge, and beliefs, participants may: **Increase risk compensating behaviors.** *O* **Decrease impulsivity.** *O*	Decrease serious injuries and fatalities on roadways. Decrease in citations.	Fewer poor driving outcomes. Improved mental, emotional, and behavioral (MEB) health. MEB is important for individuals to thrive (National Academies of Sciences, Engineering, and Medicine, 2019).

Notes: Bold items will be measured. *P*Process measures; *O*Outcome measures

3.2.2 Brief Intervention Pilot Testing

To optimize outcomes and make best use of limited resources, the intervention components were pilot-tested and refined. We recruited a convenience sample of college students at Montana State University to complete the intervention pilot testing. The intervention pilot study was reviewed and approved by the Montana State University Institutional Review Board (IRB). Participants completed a brief online survey to screen eligibility to participate in the interview process (see Appendix 8.1). The eligibility survey asked about seat belt use, distractions, speeding, and driving under the influence of alcohol and/or cannabis. The voluntary survey was administered from Qualtrics on an encrypted site.

Participants who qualified for the interview were between the ages of 18-25 and reported having engaged in at least two risky driving behaviors in the past 30 days. Participants who qualified were asked to indicate if they were willing to be interviewed and provided their name and email address. Participants were contacted via email to invite them for an interview and were given a copy of the consent form (see Appendix 8.3) and intervention content to review. A total of eight participants completed the interview. Participants were incentivized with a $20 Amazon gift card for participating in the interview. Each participant reviewed two content sessions. All participants reviewed the Emotion Session and then reviewed one of the four high-risk behavior sessions. The interview consisted of a semi-structured interview protocol and lasted approximately 20 minutes (see Appendix 8.4). A summary paragraph for each session is provided. The interview data will be used to refine the intervention content in Task 3.

3.2.2.1 Emotion Session Summary

Eight participants were interviewed about the content of the Emotion Session. Participants thought the content of the emotion session was thought-provoking. The content seemed to bring awareness to how emotions influence behaviors, specifically driving behaviors. Many agreed that feelings impact driving behavior and that this session helped them to make that connection. One participant reflected that this session was a "good way to check themselves" because there are specific examples, and they can practice with their own emotions.

When asked, "What resonated with you?," many participants mentioned the content that discussed how a person feels, what a person can do to change how they feel, and how one can change or react differently if they choose. One participant expressed surprise about how they kept thinking about the content, even the next day: "I actually have been thinking about this since I read it."

The emotion session document did not seem confusing to participants and did not appear to have language choices that did not resonate with participants. Further, the Emotion Session document did not seem to elicit strong feelings after reading the content; however, two participants suggested that the content made them reflect on themselves and their past experiences.

Participants described the tone of the document in a variety of ways and used words such as "relatable," "caring," "instructive," "distant," "light and understanding," "positive reinforcement," "experience oriented," "careful," and "empathetic or consciousness."

While many participants shared that the examples used throughout the Emotion Session were relatable, some participants offered suggestions for making the examples more relatable. For example, one participant shared that making the examples "more specific so I can put myself in that situation" would help. Another suggested that "connecting driving and emotions more" and adding "Here is why you might want to do this… Add more self-motivating statements," would be helpful.

3.2.2.2 Seat Belt Session Summary

Two participants were interviewed about the content of the Seat Belt Session. Overall, the content of the Seat Belt Session was not confusing, was relatable, and the strategy options were doable to participants. It was noted by one participant that the statistics presented in the session were thought provoking: "The stats are terrifying, not in a bad way, but it is eye opening and enlightening. Numbers can help. This is the reality." Another participant suggested that the document made them think: "A lot was common sense, but I appreciated the idea of choosing to focus on one of these strategies. This is a different way to increase awareness. It was a nice extensive list [of strategies]."

While one participant suggested that there wasn't a strong tone in the language, the other participant suggested that this session had "more gravity, and more substance compared to the emotion one." Further, one participant suggested that after reading the content they "didn't have any strong feelings." The other participant suggested that they felt reflective of the content as suggested by the statement: "I reflected on whether I am doing this (the suggested strategies) or if I am part of the problem. I am trying to look at myself critically."

3.2.2.3 Distracted Driving Session Summary

Two participants were interviewed about the content of the Distracted Driving Session. Overall, the content of the Distracted Driving Session was not confusing, the language choices used in the document were relatable, and the strategy options seemed doable to participants. One participant stated, "I think the biggest thing I was thinking about was the list of strategies that I could try. It helped me think about what I was willing to do." Another participant stated that the normative data stood out: "The stats that were provided – I like an even mix of stats and personal motivation. This one had a nice balance." Both participants noted that the strategy options listed varied, and one stated, "You could find something you could do." One participant suggested that the tone of the language "didn't feel clinical or preachy," and that "It doesn't demonize you for possibly having bad driving habits." The other participant suggested that the tone was "informative and applicable."

3.2.2.4 Speeding Session Summary

Two participants were interviewed about the content of the Speeding Session. Overall, the content of the Speeding Session was not confusing, language choices used in the document were relatable, and the strategy options seemed doable to participants.

One participant shared their initial thoughts and feelings about the content and stated, "I do this stuff often you know like passing other vehicles. It is almost like this feeling like you have to

speed. You don't want other people to pass you, so you speed up. Maybe it's a competitive thing." One participant stated that the strategy options provided were "broad and a starting point for someone to pick something they could do to be safer." Another participant shared that the strategies were doable and stated, "Yes, I could definitely monitor my speed more, especially when I feel rushed or frustrated. I probably don't even know that I am increasing my speed because of how I feel. When my friends are in the car with me, I already slow down, I drive safer." When asked how participants felt after reading the content of the Speeding Session, one participant said they "thought some of the numbers [statistics] were scary." Another stated: "I have a tendency to drive too fast. It made me reflect on that and slow down today. It was an eye opener."

3.2.2.5 Driving Under the Influence of Substances Session Summary

Two participants were interviewed about the content of the Driving Under the Influence of Substances (DUI) Session. Overall, the language choices used in the document were relatable, didn't elicit strong feelings after reading the content, and the strategy options seemed mostly doable. One participant stated that while they wouldn't set a reminder to call a taxi before drinking, they would do the other options. Another participant stated, "there is a limit. If I go to dinner and have a beer, I have no qualms about driving." When asked what resonated about the document, one participant stated, "The stats really stuck with me. I knew it was a problem, but I didn't know it was that big of a problem." Another participant stated that they didn't feel the statistic about "Most drivers don't drive under the influence" was totally accurate. The participant stated, "I feel like people drink and drive but don't think they are drunk. Saying most don't drive after being over the legal limit would be more believable." The overall tone of the language used in the document was described as "technical," "helpful, and "uncondescending."

3.2.2.6 Compensation/Participation Questions

In addition to interviewing participants about the content of the sessions, all eight participants were also asked questions about their motivation for participating in virtual sessions, factors that would make participating less appealing, and compensation for participation.

Overall, participants suggested that incentives are important for participation. For example, one participant stated, "Honestly, the incentive is what drove me to this interview and would probably be why I would participate in the sessions." Another participant stated, "Everything that happens with my friend group revolves around incentives." In addition to incentives, it was also suggested that explaining the other benefits of participation might help people decide if they want to participate or not. Another participant suggested: "If you're having trouble reaching people, I know referral incentives are well received, as it might cause one reached person in a group or organization to connect with the rest."

Amazon gift cards were identified by the majority of participants as the preferred vendor for a gift card; although, gas cards and Visa gift cards were also mentioned. It was suggested that to complete three virtual sessions (5-7 minutes each) followed by a series of text messages, participants would appreciate dollar amounts from approximately $5.00 per session up to $15.00 per session. Other participants suggested that $20 for all three sessions would be a reasonable

amount. One participant thought “a name in a drawing would be enough,” but that was not expressed by any other participants.

Participants had a variety of different answers when asked about participating in sessions if they were entered into a raffle for higher value items like ski tickets, concert tickets, or an iPad. One participant said they would do it for a raffle “as long as it didn’t feel ‘scammy.’ And if I trust the source of where it is coming from.” One participant said, “Absolutely, concerts for sure,” Another said, “Ski tickets would be awesome!” One participant said they would participate “if easy and accessible,” and they offered the advice: “Some surveys are too long. Keep it short. 15 or 20 questions max.” Another participant indicated that they probably would not participate for a raffle. They said, “My participation would improve if there was a guarantee of an incentive. If the raffle was really good, like an iPad, I might do it. But it would have to be easy and not take much time if I wasn’t guaranteed something.”

When asked what would make participating less appealing, some participants weren’t sure, but other participants gave specific responses such as the following:

- “As long as everything feels anonymous. I don't want to feel like anything is incriminating”
- “If the survey or the activity was too long. Some people really care about security questions and don’t want things to get too personal.”
- “Biggest one would be not having enough information about the study right away and what the benefits would be to do it. Be really clear about how long this will take also.”
- “Anything that makes accessing it hard or needing cumbersome software to do it. I would not want a face-to-face interaction. I hate WebEx or things like that. I wouldn’t participate with a platform like that.”
- “If I didn’t think my driving was bad, if I didn’t get paid, and if I didn’t think doing these things were a problem I would be less motivated to participate.”

When asked if there was anything else participants would like to share, responses included:

- “Keep the surveys short and easy. I won’t do anything that takes too long or is too much effort.”
- “I think you should make parts of the session virtual, like an informative video or short clip need to add more interactive elements, not just reading on a screen.”
- “It was good.”
- “The documents were informative. It would be cool to see them come together.”

3.3 Randomized Controlled Trial Plan

3.3.1 Study Aim

The study aims to test the efficacy of a brief intervention designed to reduce multiple risky driving behaviors. The outcomes of interest are speeding, driving under the influence, seat belt use, and distracted driving.

3.3.2 Study Setting and Participants

Participants in this study will be recruited from a university through direct email advertising to a random sample of students provided by the university and supplemented if needed by classroom recruitment and social media posting about the study. Individuals who respond to the study advertisements will be given introductory information about the study and will be screened for eligibility. Eligibility criteria:

- Ages 18-25
- Hold a valid driver's license
- Report driving at least once a week
- Report engaging in at least two risky driving behaviors in the past month

3.3.3 Method and Design

All procedures will be approved by the Montana State University Institutional Review Board for human subjects research before the study begins, and participants will provide informed consent.

We will use a randomized controlled trial design to test if the brief intervention decreases multiple risky driving behaviors. Eligible participants will be randomly assigned to one condition – control or intervention. All participants will complete measures at three timepoints – baseline, post-intervention (i.e., immediately following intervention for intervention participants and the same time delay from baseline for control participants), and follow up (i.e., three months following post-intervention). Table 9 provides the estimated timeline for each participant.

Ideally every participant in the intervention group would complete every session and measure at the appropriately scheduled times; however, we recognize that this is not likely to happen. Some participants might start a session and not complete it. Some might complete the first session, but not start the second session, and yet others might be delayed in the timeline. Our goal will be to retain participants in the study as much as possible, and we will seek to collect data regardless of completion at any point in the trial. We plan to send at least two reminder messages (email and text) to participants who are not responsive in each session's timeframe. We will also encourage any participants who finish at least one session to take the post and follow-up assessments. By retaining as much data as possible, we can explore the potential effect of dose, and we will adjust statistical analyses as necessary to account for varying completion timelines.

Table 9. Timeline for Each Participant

	Week 0	**1**	**1**	**2**	**3**	**4**	5	6	7	**8-19**	**20**
Interven-tion	**Recruit and screen**	**Session 1** Consent, randomize, baseline Assess.	**Session 2** emo. regulation	**Session 2** practice (and texts)	**Session 3** 1st behavior	**Session 3** practice (and texts)	**Session 4** 2nd behavior	**Session 4** practice (and texts)	**Session 5** Post assess.	**** 3 month post***	**Follow-up assess.**

Control	**Recruit and Screen**	**Session 1** Consent, randomize, baseline assess.	**No Tx**	**No Tx**	**No Tx**	**No Tx**	**No Tx**	**No Tx**	**Post assess.**	**** 3 month post***	**Follow-up assess.**

All data will be gathered via self-report, and measures will assess outcomes as well as the beliefs and factors targeted by the intervention. Demographic information will be collected.

Primary Outcome Measures:

- Speeding
- Driving under the influence
- Seat belt use
- Distracted driving

Secondary Outcome Measures:

- Impulsivity
- Risk perception
- Protective beliefs (control beliefs, normative beliefs)
- Driver's emotional intelligence
- Increased use of risk-mitigating strategies

We will also gather data on frequency of driving and types of trips (i.e., purpose, length, type of roadway, and geography), alcohol and cannabis use behaviors, crash involvement, citation history. These additional variables will serve as potential covariates in our analyses.

In the original proposal, we proposed a budget of $6000 to incentivize participation in the study and assumed a very small sample of 20-30 participants. However, after completing the literature review and refining and revising the random controlled study plan, we realize that we will need significantly more participants in the study to be able to detect any changes between the intervention and control group. A power analysis suggests a total final sample of 172 participants is necessary for 80% power to detect a small-to-moderate effect (partial $\eta^2 = .03$) with $\alpha \leq .05$ and a .5 correlation between measurements. Additionally, based on a review of literature and previous experience, we anticipate participant attrition, which will require us to over recruit (350 participants) to ensure an adequate final sample size.

Based on pilot study data, incentivizing participation is an important motivator for participation. Table 10 shows the proposed incentive schedule for each participant.

Table 10. Proposed Incentive Schedule for Each Participant

	Week 0	1	1	2	3	4	5	6	7	8-19	20
Intervent-ion	**Recruit and screen**	**Session 1** Consent, randomize, baseline Assess.	**Session 2** emo. regulation	**Session 2** practice (and texts)	**Session 3** 1st behavior	**Session 3** practice (and texts)	**Session 4** 2nd behavior	**Session 4** practice (and texts)	**Session 5** Post assess.	***3 month post***	**Follow-up assess.**
	--	**$10**	**$5**	**$5**	**$5**	**$5**	**$5**	**$5**	**$15**	--	**$15**
Control	**Recruit and Screen**	**Session 1** Consent, randomize, baseline assess.	**No Tx**	**No Tx**	**No Tx**	**No Tx**	**No Tx**	**No Tx**	Post assess.	***3 month post***	**Follow-up assess.**
	--	**$10**	--	--	--	--	--	--	**$15**	--	**$15**

We will use the Computerized Intervention Authoring System, version 3 (CIAS) as the platform for intervention delivery. CIAS is an open-source resource that was funded by the National Institutes of Health, National Institute of Biomedical Imaging and Bioengineering, through an award to Michigan State University (Ondersma et al., n.d.). CIAS is a platform that supports the development of digital behavioral health interventions to be shared with participants and allows data to be collected through the same platform. The CIAS platform includes animated narration and can support other video and audio features for a more interactive intervention experience. While this is a new platform for the CHSC, and one that we have not used before, it is tailored to researchers who are creating and managing interventions and seems to be a good fit based on the design of the random controlled trial outlined in this project.

3.3.4 Hypotheses

We hypothesize that:

1. The brief intervention will result in reduced impulsivity, increased driving emotional intelligence, increased use of harm-mitigating strategies, increased risk perceptions, and increased protective beliefs.
    a. Compared to participants in the control group, participants in the intervention group will have greater reductions in impulsivity scores and greater increases in drivers' emotional intelligence scores.
    b. Compared to participants in the control group, participants in the intervention group will report increased contemplation and use of harm-mitigating strategies.
    c. Compared to participants in the control group, participants in the intervention group will have increases in risk perception and other protective beliefs.
2. The brief intervention will result in participants engaging in fewer high-risk driving behaviors.
    a. Compared to participants in the control group, participants in the intervention group will report fewer high-risk driving behaviors at follow up.

b. Reductions in high-risk driving behaviors are expected to be associated with skills gained through the intervention (e.g., reduced impulsivity, increased emotional intelligence, increased use of strategies, etc.).

3.3.5 Planned Analysis

The primary analysis will be a repeated measure multiple analysis of variance (MANOVA) with the intervention identified as a between factor. MANOVA is the appropriate main analytical test for both hypotheses and will allow us to test the effect of the intervention on impulsivity, emotional intelligence, risk perceptions, beliefs, and the four driving behaviors. We will conduct additional correlations and/or regressions to understand the relationship between the study variables (e.g., the relationship between impulsivity, use of mitigating strategies, and driving behaviors).

4 TASK 3 – TEST BRIEF INTERVENTION

4.1 Study Aim

The study aimed to test the efficacy of a brief intervention designed to reduce multiple risky driving behaviors. The outcomes of interest are speeding, driving under the influence, seat belt use, and distracted driving.

4.2 Participant Recruitment

All procedures were approved by the Montana State University Institutional Review Board for human subjects research before the study began, and participants were provided informed consent (See Appendix 8.5).

Participants were recruited in two cohorts through direct email advertising. Individuals who responded to the study advertisements were given introductory information about the study and were screened for eligibility. In addition to meeting the criteria, the individuals who responded had to provide their email address to participate in the randomized controlled trial. Eligibility criteria:

- Ages 18-25
- Hold a valid driver's license
- Report driving at least once a week
- Report engaging in at least two risky driving behaviors in the past month

Cohort one launched in April 2023 and participants were recruited from a list of emails provided by Montana State University's Office of Planning and Analysis. MSU provided 2,000 randomly selected email addresses for students between the ages of 18 and 25. All four recruitment emails were sent via Constant Contact between April 19th and May 30th, 2023. The total number of participants who took the screening for cohort one was 362 (18.1% response rate) and the number of participants who screened in and provided their email addresses was 99. Of these eligible participants, 38 were assigned to control and 61 were assigned to intervention. In this cohort, participant attrition was a challenge. Of these invited, only 22 completed the baseline survey and only 9 completed the final follow-up survey. Therefore, based on low completion of participants in cohort one, we revised recruitment language (see Appendix 8.6) and incentive amounts and launched a second cohort in hopes to increase participation.

Cohort two launched in October 2023 and participants were recruited from a list of 8,522 student email addresses provided by the University of Montana's Office of Institutional Research. Initial recruitment emails to the first 5,000 potential participants were sent via Constant Contact. We became concerned that individuals were not receiving the Constant Contact email due to it going to their junk or spam folders and decided to change the method of distribution to an outlook email sent from the Center's main montana.edu email address. For the first 5,000 participants, two final recruitment messages were sent from Outlook and all four messages were sent from Outlook for the remaining 3,522 potential participants. Cohort 2 recruitment emails were sent between October 12th and November 8th, 2023. The total number of participants who took the screening survey for cohort two was 587 (6.9% response rate) and the number of participants who screened in and provided their email address was 358.

4.3 Main Study Procedures

We used a randomized controlled trial design to test if the brief intervention decreased multiple risky driving behaviors. Eligible participants were randomly assigned to one condition – control (n= 126) or intervention (n=232). The goal was for all participants to complete measures at three timepoints – baseline, post-intervention (i.e., immediately following intervention for intervention participants and the same time delay from baseline for control participants), and follow-up (i.e., three months following post-intervention). Table 11 provides the timeline for each participant.

Ideally, every participant in the intervention group would complete every session and measure at the appropriately scheduled times; however, we recognized that this was not likely to happen. Invited participants that did not start session 1 within 4 days were sent an additional follow-up email and then another email 7 days later. Of the 358 participants that were invited, 68 participants started session 1. To encourage participants to stay on track, reminder emails were sent throughout the trial to retain as many participants in the study as possible. We sent at least two reminder messages (email and text) to participants who were not responsive in each session's timeframe. We also encouraged any participants who finish at least one session to take the post and follow-up assessments. By retaining as much data as possible, we could explore the potential effect of dose, and we adjusted statistical analyses as necessary to account for varying completion timelines.

Table 11. Timeline for Each Participant

	Week 0	**1**	**1**	**2**	**3**	**4**	5	6	7	**8-19**	**20**
Intervention	Recruitment and screening	Session 1 (Consent, randomize, baseline assessments)	Session 2 (emo. regulation)	Session 2 practice (and texts)	Session 3 (1st ranked behavior)	Session 3 practice (and texts)	Session 4 (2nd ranked behavior)	Session 4 practice (and texts)	Session 5 Post assess-ments	** 3 months post*	Follow-up assessments
Control	Recruitment and Screening	Session 1 (Consent, randomize, baseline assessments)	No Treatment	No Treatment	No Treatment	No Treatment	No Treatment	No Treatment	Post assess-ments	** 3 months post*	Follow-up assessment

Based on the low participation in cohort one, we made the following changes to the incentive schedule:

1. Changed the screener incentive from entry into a raffle to win a $50 Amazon gift card to entry into a raffle to win 1 of 4 $25 Amazon gift cards.
2. Increased the incentive for session one (baseline survey) from $10 Amazon gift card to $15 Amazon gift card ($5 for registering for CIAS and $10 for completing the baseline survey).
3. Increased the incentive for completion of the follow-up survey from $15 Amazon gift card to a $50 Amazon gift card plus entry into a raffle for a $250 Amazon gift card.

These changes are reflected in Table 12.

Table 12. Incentive Schedule for Each Participant

	Week 0	1	1	2	3	4	5	6	7	8-19	20
Intervention	Recruitment and screening	Session 1 (Consent, randomize, baseline assessments) **$15**	Session 2 (emo. regulation) **$5**	Session 2 practice (and texts) **$5**	Session 3 (1st ranked behavior) **$5**	Session 3 practice (and texts) **$5**	Session 4 (2nd ranked behavior) **$5**	Session 4 practice (and texts) **$5**	Post assess-ment **$15**	** 3 months post*	Follow-up assessments **$50** plus entry into a raffle
Control	Recruitment and Screening	Session 1 (Consent, randomize, baseline assessments) **$15**	No Treatment	No Treatment	No Treatment	No Treatment	No Treatment	No Treatment	Post assess-ment **$15**	** 3 months post*	Follow-up assessment **$50** plus entry into a raffle

We used CIAS as the platform for intervention delivery. CIAS is an open-source resource that was funded by the National Institutes of Health, National Institute of Biomedical Imaging and Bioengineering, through an award to Michigan State University (Ondersma et al., n.d.). This was a new platform for the CHSC and required daily management by CHSC researchers. Since participants started the trial on different dates, tracking the participant session completion, incentive distribution, and email reminders required daily downloads and sorting of CIAS participant data.

4.4 Sample

The second cohort comprised the study sample. A total of 43 participants completed the baseline survey and at least one of the subsequent surveys (post-test, which occurred shortly after the last session, or three-month follow-up). Of the 43, 17 participants were randomized to control and 26 to intervention. Participant demographics are presented in Table 13.

Table 13. Participant Demographic Characteristics

	Total Sample (*n*=43)	Control (*n*=17)	Intervention (*n*=26)
Age [*M* (*SD*)]	22.3 (2.7)	22.6 (3.1)	22.1 (2.5)
Gender, man [%]	23.3	0.0	38.5
Gender, woman [%]	74.4	94.1	61.5
Gender, non-binary [%]	2.3	5.9	0.0
Race, white [%]	97.6	100.0	96.0
Ethnicity, Hispanic [%]	9.5	11.8	8.0
State of residence, Montana [%]	83.7	76.5	88.5
Currently live in small city or town [%]	76.7	64.7	84.6
Drive most days each week [%]	81.4	88.2	76.9

Age started driving [*M* (*SD*)]	15.4 (1.1)	14.9 (0.9)	15.3 (1.3)

Based on their baseline responses regarding risky driving behaviors, intervention participants were assigned to modules to address two risky driving behaviors using the following order: speeding, distracted driving, not wearing a seat belt, and driving under the influence. Whichever two behaviors participants endorsed in that order were the behaviors indicated for the participant. Therefore, participants who indicated they had driven distracted and over the speed limit were assigned to modules focused on those two behaviors (even if the participant had also endorsed not wearing their seat belt and/or driving under the influence). Participants who had driven distracted but not over the speed limit were then assigned seat belt modules (if their responses indicated they had not worn their seat belt) or driving under the influence (if they reported wearing their seat belt and also reported driving under the influence), and so on.

Control participants were assigned indicated driving behaviors using the same order to allow for comparisons. See Table 14.

Table 14. Participants' Indicated Driving Behaviors by Condition

	Control	Intervention
Speed and Distraction	16	21
Speed and Belt	-	1
Speed and DUI	-	1
Distraction and DUI	1	3
Total	**17**	**26**

4.5 Outcome Analyses

All three surveys (i.e., baseline, post, follow-up) collected data about the four risky driving behaviors and beliefs and perceptions specific to each driving behavior (e.g., risk perceptions about speeding, distracted driving, not wearing a seat belt, and driving under the influence; control beliefs about all four risky driving behaviors). As needed, survey items were reversed to ensure consistency; across measures, higher scores indicate more frequent endorsement of behaviors and greater beliefs or perceptions.

While we used the DEIS for emotional intelligence in the pilot work, we substituted the Trait Emotional Intelligence Questionnaire Short Form (TEIQue-SF; Petrides, 2009) in the main study. The DEIS was based on the TEIQue-SF and there continues to be greater evidence supporting use of the TEIQue-SF. For both the impulsivity and emotional intelligence scales, Cronbach's alphas demonstrated good reliability. See Table 15 for descriptions of study variables.

Table 15. Study Variables

Variable	Possible Range	Description
1. Risky Driving Behavior	0 – 4, higher values = greater frequency	Composite of two indicated driving behaviors.[1]
2. Risk Perceptions	1 – 5; higher values = greater perceived risk	Composite of risk perceptions for two indicated driving behaviors.[1]

3. Control Beliefs	1-7; higher values = greater perceived control	Composite of control beliefs for two indicated driving behaviors (4 items for speeding, distracted, seat belt; 8 items for dui).
4. Injunctive Normative Beliefs	1 – 5; higher values = greater perceived disapproval	Composite of normative beliefs for two indicated driving behaviors.[1]
5. Descriptive Normative Beliefs	0 – 5; higher values = believe others engage more frequently	Composite of descriptive beliefs for two indicated driving behaviors.[1]
6. Impulsivity	1 – 4; higher values = greater impulsivity	Mean of 20 items; Short UPPS-P Cronbach's alpha at baseline = .78
7. Emotional Intelligence	1 – 7; higher values = greater emotional intelligence	Mean of 30 items; TEIQue-SF Cronbach's alpha at baseline = .90

[1]Number of items for each driving behavior: speeding – 2 items; distracted – 3 items; seat belt – 2 items; dui – 5 items.

Analysis of survey responses was based on composite scores created by averaging the items related to the two indicated driving behaviors for each participant. This approach resulted in each participant having a composite score for their two risky driving behaviors and a composite score for each belief and perception related to those two indicated behaviors. In addition, composite scores were created for the global measures of impulsivity and emotional intelligence, which were not specific to particular driving behaviors and therefore based on the same items for all participants.

Baseline descriptive statistics and correlations for each study variable are presented in Table 16.

Table 16. Descriptive Statistics and Correlations for Study Variables at Baseline

Variable	*M* (*SD*)	2.	3.	4.	5.	6.	7.
1. Risky Driving Behavior	2.30 (.84)	-.25	-.45**	.26	.47**	.02	.01
2. Risk Perceptions	3.54 (.58)		.32*	-.29	.09	-.18	-.01
3. Control Beliefs	5.59 (1.42)			-.18	-.23	-.45**	.25
4. Injunctive Normative Beliefs	1.97 (.73)				.01	-.08	-.05
5. Descriptive Normative Beliefs	3.52 (.84)					-.06	-.10
6. Impulsivity	1.96 (.38)						-.36*
7. Emotional Intelligence	5.20 (.74)						

*p<.05; **p<.01

Consistent with the analytical plan, we first conducted a repeated-measures MANOVA to test the effects of time (i.e., baseline, post, follow-up) by condition (i.e., intervention or control) on the

dependent variables of risky driving behavior, risk perceptions, control beliefs, normative beliefs, impulsivity, and emotional intelligence. Of the 43 participants, 41 provided data at all three timepoints needed for the main analysis. The overall MANOVA was not significant for the time main effect, Wilks' Lambda F (14, 24) = 1.64, p = .14, nor for the time by condition interaction, Wilks' Lambda F (14, 24) = 1.08, p = .42. However, the effect sizes for both were large, with partial η^2 = .49 for the time main effect and partial η^2 = .39 for the time by condition interaction, suggesting that an effect may be present, but tests did not reach significance due to lack of power attributable to inadequate sample size.

To better understand participants' responses over time, we visualized each dependent variable. See Figure 2 for risky driving behavior and Appendix 8.7 for other study variables.

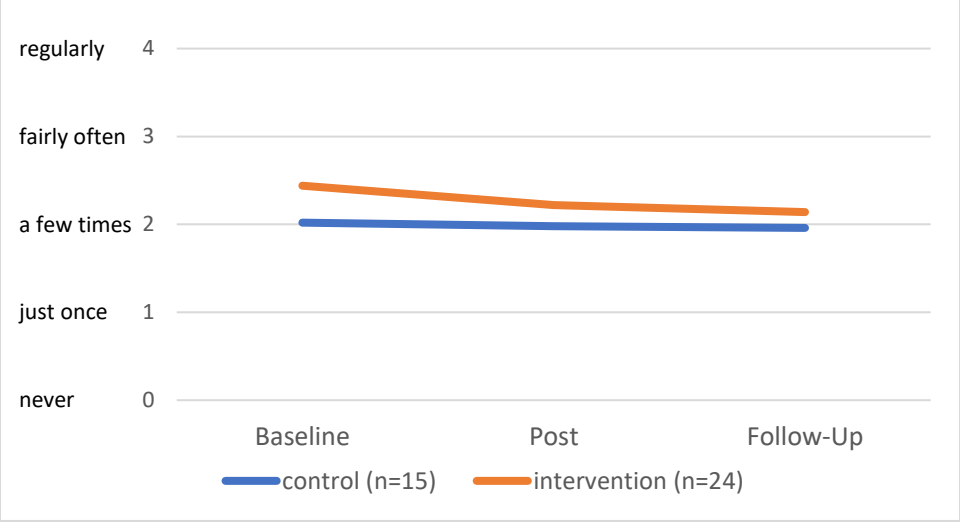

Figure 2. Past 30-day frequency of risky driving behaviors; *not significant*.

4.6 Strategies

During the intervention sessions, participants chose strategies to address their risky driving behaviors. Participants were first presented with *primary* strategies. Primary strategies are intended to directly reduce engagement in risky driving behaviors. For example, a primary strategy for distracted driving is "I will put my phone away and out of reach before I start driving." Participants were asked if they would be willing to try one of multiple primary strategy options. If not, they were then presented with *secondary* strategies designed to reduce harm. Secondary strategies are intended to mitigate the risk of the driving behavior and limit potential negative consequences. Most secondary strategies relied on reducing engagement in the risky driving behavior in higher-risk scenarios. For example, a secondary strategy for distracted driving is "I will choose to not use my cell phone when I am driving in dangerous weather conditions like rain, snow, or ice," and a secondary strategy for seat belt use is "I will wear my seat belt when traveling at high speeds."

Participants chose both primary and secondary strategies. See Table 17.

Table 17. Type of Strategies Selected by Risky Driving Behavior

	n	Primary	Secondary
Speeding	23	56.5%	43.5%
Distracted	24	58.3%	41.7%
Seat belt	1	--	100%
Driving under the influence	4	50.0%	50.0%

At post, most intervention participants reported utilizing selected strategies, with 40% reporting having engaged in their selected strategies for both risky driving behaviors and an additional 52% reporting having engaged in their selected strategies for one risky driving behavior. The remaining 8% thought about engaging in their selected strategies for both risky driving behaviors. At 3-month follow-up, participants continued to utilize the strategies they had selected, with 48% reporting utilizing both strategies and an additional 44% utilizing their selected strategy for one risky driving behavior. This finding demonstrates that participants continued to access strategies three months following receipt of the intervention. See Figure 3.

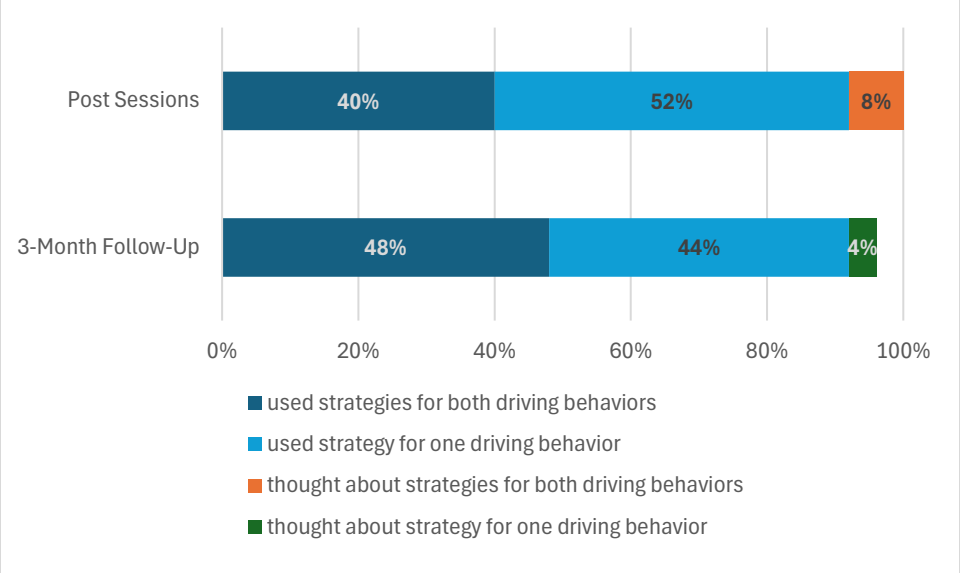

Figure 3. Participants who received the intervention reported utilizing the strategies after session delivery and three months later

4.7 Intervention Participant Feedback

At 3-month follow-up, intervention participants provided feedback about their experience. With a scale from 1 (strongly disagree) to 5 (strongly agree), participants were asked the extent to which they agreed or disagreed with a series of statements. Most participants reported positive experiences, including having learned relevant information and applied the information to their driving. (See Table 18)

Table 18. Participants' Feedback (*n*=25)

Statement	*M* (SD)	% Disagree or Strongly Disagree	% Agree or Strongly Agree
I learned relevant information about driving.	*3.60* (1.04)	8.0	60.0
I think about the information from the sessions when I'm driving.	*3.48* (1.12)	20.0	72.0
I have been able to apply the information from the sessions.	*3.56* (1.04)	12.0	64.0
I am motivated to improve my driving.	*3.68* (1.31)	24.0	68.0
I have changed my driving as a result of participating in this study.	*3.28* (1.21)	20.0	44.0

Asked to describe how their driving has changed, participants described being more aware and attentive while driving, with some participants describing improvements in emotion regulation. Some also described specific changes in their driving behaviors and made comments that reflected a better understanding of risk. Example quotes are provided below.

"I am using my cell phone less, and not following other vehicles as closely.

I am working on being more present and mindful when I am driving, because driving distracted can be dangerous to myself and others."

"I believe my driving has become safer and I am more conscious when I drive. It's amazing what just a little reflection can do to your actions. I'm not perfect now by any means but I do not use my phone at all anymore while driving and I do consider the speed limits and their safety and illegal implications and therefore drive a little slower. I used my seat belt more often too. For an example we were driving back from a neighbor's a mile from our house and I used my seatbelt even when a passenger told me I don't need to, when earlier I might have not wore it.

I am practicing being more aware when I am driving and more in the moment."

"I do not speed so often anymore and I am more aware of my driving. Also think about consequences of bad driving and that helps me not to.

I have been able to focus more on my surroundings and be less stressed while driving."

"I try not to let emotions control my driving.

5 TASK 4 – RECOMMENDATIONS AND GUIDANCE

Through the creation and testing of a brief intervention designed to address multiple risky driving behaviors, much has been learned. Task 4 focused on recommendations and guidance that traffic safety professionals can use to make more informed decisions about strategies to address multiple risky driving behaviors and improve traffic safety.

- The brief intervention was intentionally designed to offer participants a variety of strategies they could select from and utilize during the intervention. Strategies for each behavior included both traditional strategies that focused on primary prevention like *"I will put my phone away and out of reach before I start driving"* and *"I will turn my phone off before I start driving"* and also secondary strategies (those to mitigate risk and reduce harm) like *"I will choose to not use my cell phone when I am driving at high speeds"* and *"I will choose to not use my cell phone when I am driving in dangerous weather conditions like rain, snow, or ice."* Results showed that participants in the brief intervention to reduce multiple risky driving behaviors utilized both primary and secondary strategies to address their risky driving behaviors.

  Those engaging in multiple risky driving behaviors may benefit from recommendations and strategies that allow more choices, including harm reduction strategies. **It is recommended that traffic safety professionals consider providing secondary strategies that mitigate risk and reduce harm in addition to primary prevention strategies when engaging young adults.** Offering more choices may help traffic safety professionals engage with young adults, especially those who may be hesitant to fully engage in the protective behavior being promoted or who are contemplating change versus ready to make a behavior change. Integrating harm reduction strategies alongside primary prevention strategies provides opportunities to meet individuals where they are and reinforces autonomy, a salient developmental milestone for young adults. Further, while harm reduction strategies may not eliminate risky driving behaviors, they can increase safety and might lead to more positive changes over time.

- The brief intervention was designed to provide participants with multiple reminders via text messages to encourage the behaviors they chose to practice throughout the intervention. While most participants were motivated to improve their driving, it is believed that multiple touchpoints to remind participants to engage in the selected strategies was an essential component of sustained engagement. **It is believed that a single-touch method may not be adequate and that traffic safety professionals identify ways to increase dosage, repetition, and reminders to encourage and sustain behavior change, especially among young adults.**

- Interventions to reduce impulsivity in traffic safety are limited; thus, understanding other strategies that have been used to reduce impulsivity in general was insightful. Emotion regulation was identified as a potentially effective way to reduce impulsivity (Aazam et

al., 2014; Asgari & Matini, 2020; Malekimajd et al., 2016). Emotion regulation is defined as changing one's response to emotions to better their well-being (Gross, 2002). The intervention focus was learning to identify and regulate feelings in the context of risky driving behaviors. **It is recommended that traffic safety professionals support emotion regulation among youth and young adults in their communities and states and consider leveraging existing infrastructures to integrate emotion regulation skill-building**. For example, emotion regulation skill building could be integrated into driver's education curriculum or workplace training, etc.

- Recruitment was even more challenging than expected, despite incentives to participate. While participants in the study reported that they were motivated to address their risky driving behaviors, they were unique from most people including those who completed the screener and were eligible for the study but were not motivated to participate in a study about driving. Motivational strategies that recognize a person's autonomy to choose safe or risky driving behaviors, provide opportunities to explore a person's ambivalence about changing their behaviors, and provide choices that align with where a person is in their readiness to change risky driving behavior may support increased motivation and willingness to make a change in their behavior. **It is recommended that traffic safety professionals use strategies to increase motivation to address risky driving behaviors, increase willingness to contemplate driving behaviors, and consider changing driving behaviors.**

- A resource document was created to leverage what was learned from the development of the brief intervention and randomized controlled trial. **The resource document is intended to help traffic safety stakeholders engage young adults in growing skills and utilizing practical strategies to reduce engagement in multiple risky driving behaviors**. This resource helps young adults learn to identify and regulate their feelings, explore cognitions related to multiple risky driving behaviors (speeding, distracted driving, not wearing a seatbelt, and driving under the influence of substances), and learn and use behavioral strategies to increase safe driving behaviors. Further, **examples of ways to reach young adults to distribute this resource and integrate the resource into existing traffic safety efforts are provided**. The resource document is provided as a separate PDF.

- A PowerPoint presentation and poster were created for traffic safety professionals to use to disseminate information learned in this project. The PowerPoint slides and poster are provided as separate PDFs.

6 CONCLUSIONS

Drivers involved in fatal crashes are often engaged in multiple risky behaviors – not wearing a seat belt, speeding, and driving impaired (*FARS*, 2018). Brief interventions designed to address multiple risky behaviors have the potential to improve driving safety (Sommers et al., 2013). Task 1 of this project included a summary of the literature regarding factors (cognitive, affective, motivational, and contextual) associated with multiple risky driving behaviors. Many factors associated with multiple risky driving were identified and through this review, it was revealed that many of the factors that affect risky driving must be considered in combination as they overlap and are related to one another (Al-Tit, 2020; Bachoo et al., 2013; Iversen & Rundmo, 2002).

Specific behavioral interventions that addressed high-risk driving behaviors and associated factors were also reviewed in the literature. Behavioral interventions to reduce speeding, impaired driving, seat belt use, and distracted driving were reviewed along with interventions that address factors associated with multiple risky driving behaviors. Behavioral interventions are gaining popularity, and lessons about these interventions to address specific high-risk driving behaviors in isolation can be learned and used to inform the development of an intervention to reduce multiple risky driving behaviors. Finally, as this project included designing and implementing an intervention to reduce multiple risky driving behaviors, various delivery methods were explored in the literature including mobile health technologies, brief interventions, and vehicle safety monitoring systems. In addition to a review of the literature, outlines to support the development, implementation, and evaluation of the brief intervention were created.

The literature review and outlines were used in the development of a survey assessment tool and in the creation of a brief intervention to reach drivers who engage in multiple risky behaviors in Task 2 and a randomized controlled trial was implemented in Task 3. College students who engaged in multiple risky driving behaviors were recruited for the trial; 43 participants enrolled and completed the study. Overall, no significant difference was found between intervention and control participants in risky driving behavior or other study variables (e.g., impulsivity, emotional intelligence, beliefs), likely due to a small sample size and inadequate power. Results demonstrated that intervention participants did utilize selected strategies following the intervention and continued utilizing strategies three months later. Participants also provided feedback about the intervention, reporting satisfaction with intervention and describing positive impacts of participating. They described increased attention during driving, improved awareness of emotions and the effect on driving, increased risk perceptions, and reduced engagement in risky driving behaviors.

Through the creation and testing of a brief intervention designed to address multiple risky driving behaviors, much was learned. Task 4 focused on recommendations and guidance that traffic safety professionals could use to make more informed decisions about strategies to address multiple risky driving behaviors and improve traffic safety. It was recommended that traffic safety professionals consider providing secondary strategies that mitigate risk and reduce harm in addition to primary prevention strategies when engaging young adults. It was recommended that traffic safety professionals identify ways to increase dosage, repetition, and

reminders to encourage and sustain behavior change, especially among young adults as a single-touch method may not be adequate. It was recommended that traffic safety professionals support emotion regulation among youth and young adults in their communities and states and consider leveraging existing infrastructures to integrate emotion regulation skill-building. It was recommended that traffic safety professionals use strategies to increase motivation to address risky driving behaviors, increase willingness to contemplate driving behaviors, and consider changing driving behaviors.

In addition to recommendations for traffic safety professionals, a resource document was created to leverage what was learned from the development of the brief intervention and randomized controlled trial. The resource document is intended to help traffic safety stakeholders engage young adults in growing skills and utilizing practical strategies to reduce engagement in multiple risky driving behaviors. The resource document helps young adults learn to identify and regulate their feelings, explore cognitions related to multiple risky driving behaviors (speeding, distracted driving, not wearing a seatbelt, and driving under the influence of substances), and learn and use behavioral strategies to increase safe driving behaviors. Examples of ways to reach young adults to distribute this resource and integrate the resource into existing traffic safety efforts are also provided. A PowerPoint presentation and poster were created for traffic safety professionals to use to disseminate information learned in this project.

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8 APPENDICES

8.1 Appendix A. Assessment

Initial Qualification and Screening

These questions are about driving a vehicle. Please think about cars, SUVs, vans, pickups, and other trucks. Do not include buses, motorcycles, or ATVs/UTVs.

Drive In the last 30 days, how often have you driven a vehicle?

Never	Less than once a week	About once a week	A few times a week	Most days each week
0	**1**	**2**	**3**	**4**

Age How old are you?

Less than 18 years	18-21 years	22-25 years	26-29 years	30 years or older
1	**2**	**3**	**4**	**5**

Participant is eligible and continues to driving behavior screen if:
drive ≥ 2
age range 18-25

If not eligible: Thank you for your interest in this survey.

Driving Behavior Screen

For each of the following, please think about your driving over the last 30 days.

In the past 30 days while driving how often have you…?

		Never	Just once	More than once
Screen1	Stopped for a pedestrian in a crosswalk?	0	1	2
Speed	Driven more than 10 mph over the speed limit on roads with speed limits between 35 and 65 mph?	0	1	2
Screen2	Slowed down and/or moved over for a bicyclist?	0	1	2

Distract1	Driven while holding and talking on a cell phone?	0	1	2
Distract2	Driven while reading a text or an email on a cell phone?	0	1	2
Distract3	Driven while manually typing or sending a text message or email?	0	1	2
Screen3	Turned off your phone or used "Do Not Disturb"?	0	1	2

Belt	Driven while not wearing a seat belt?	0	1	2
Screen4	Asked other people in the vehicle to put on a seat belt?	0	1	2
Screen5	Came to a complete stop at a stop sign when there was no one else around?	0	1	2

DUI1	Driven while you felt high from using marijuana?	0	1	2
DUI2	Driven while you felt buzzed or drunk from drinking?	0	1	2
Screen6	Gotten a ride instead of driving because you felt intoxicated from marijuana and/or alcohol?	0	1	2

Participant is eligible and continues to full survey if any TWO of the following:
speed1 = 2
distract3 = 2
belt1 = 2
dui1 or dui2 = 2

If not eligible: Thank you for your interest in this survey.

If eligible:
Thanks for answering the questions. Based on your responses, we would like to invite you to participate in a study occurring over the next several weeks to reduce risky driving and improve safety.

Most young adults in Montana care about creating positive change for themselves, their community, and their state. One positive change that young adults can make that impacts everyone is to reduce risky driving behaviors. This study includes a series of virtual sessions to reduce risky driving behaviors by improving skills and providing tools.

Everyone who chooses to be part of the study will be asked to take three surveys over a period of approximately three months, and some study participants will also be asked to participate in a few short learning sessions and receive some short and informative text messages.

We know your time is valuable. Proceeding with the survey indicates your consent to participate, and we will compensate you with a $10 Amazon gift card for your time to complete the remaining survey questions.

Full Survey (Baseline, Post, and 3-Month Follow-Up)

Impulsivity (Short UPPS-P)

For each statement, indicate how much you agree or disagree with the statement.
1 (agree strongly) – 4 (disagree strongly)
impulse1 I generally like to see things through to the end.
impulse2 My thinking is usually careful and purposeful.
impulse3 When I am in a great mood, I tend to get into situations that could cause me problems.
impulse4 Unfinished tasks really bother me.
impulse5 l like to stop and think things over before I do them.
impulse6 When I feel bad, I will often do things I later regret in order to make myself feel better now.
impulse7 Once I get going on something I hate to stop.
impulse8 Sometimes when I feel bad, I can't seem to stop what I am doing even though it is making me feel worse.
impulse9 I quite enjoy taking risks.
impulse10 I tend to lose control when I am in a great mood.
impulse11 I finish what I start.
impulse12 I tend to value and follow a rational, "sensible" approach to things.
impulse13 When I am upset, I often act without thinking.
impulse14 I welcome new and exciting experiences and sensations, even if they are a little frightening and unconventional.
impulse15 When I feel rejected, I will often say things that I later regret.
impulse16 I would like to learn to fly an airplane.
impulse17 Others are shocked or worried about the things I do when I am feeling very excited.
impulse18 I would enjoy the sensation of skiing very fast down a high mountain slope.
impulse19 I usually think carefully before doing anything.
impulse20 I tend to act without thinking when I am really excited.

Risky Driving Behaviors

For each of the following, please think about your driving over the last 30 days.

100 = never; 101 = just once; 2 = a few times; 3 = fairly often; 4 = regularly

aggressive1 How often have you passed a vehicle that is driving/going about the posted speed limit?
aggressive2 How often have you driven so close to the vehicle in front that it might be difficult to stop in an emergency?
speed1 How often have you driven more than 10 mph over the speed limit on roads with speed limits between 35 mph and 50 mph?
speed2 How often have you driven more than 10 mph over the speed limit on roads with speed limits between 55 mph and 65 mph?

100= never; 101= just once; 2 = a few times; 3 = fairly often; 4 = regularly

distract1 How often have you driven while holding and talking on a cell phone?
distract2 How often have you driven while reading a text or an email on a cell phone?
distract3 How often have you driven while manually typing or sending a text message or an email?
distract4 How often have you reached for an object while driving with the vehicle in motion?

For each of the following, please think about whether you wore a seat belt over the last 30 days when you were in a vehicle other than a bus.

0 = never; 1 = seldom; 2 = sometimes; 100= usually; 101 = always

belt1 When you were the driver, how often did you wear a seat belt when you were within a few miles of your home?
belt2 When you were the driver, how often did you wear a seat belt when you were many miles away from your home?
belt3 How often did you wear a seat belt as a passenger?

For the following questions, please think about whether you drove after drinking alcohol and/or using marijuana over the last 30 days.

100 = never; 1 = once; 2* = more than once.
*if 2, pop up for "Please estimate the number of days (in the last 30) that you... _____"

In the last 30 days, how many times did you…
duica drive within 2 hours of consuming marijuana AND alcohol (any amount of each)?
duic1 drive within 2 hours of consuming only marijuana (any amount)?
duia1 drive within 2 hours of consuming only alcohol (any amount)?
duic2 drive while you felt high from marijuana?
duia2 drive while you felt buzzed or drunk from drinking?
duic3 use marijuana while driving?
duia3 drink alcohol while driving?

Strategies

Thinking back over the last month, have you thought about or considered doing any of the following driving behaviors? Have you done any of the following (in the last month)?

Only items that correspond to risky driving behaviors that were endorsed above.

In the last 30 days, while driving…	Check if you have *thought about* doing this	Check if you have *done* this.
Wearing my seatbelt in dangerous weather conditions like rain, snow, or ice	**compt1**	**compd1**
Wearing my seatbelt when at high speeds	**compt2**	**compd2**
Wearing my seatbelt when my friends are in the vehicle	**compt3**	**compd3**
Keeping speed at or below the speed limit after drinking alcohol or using marijuana	**compt4**	**compd4**
Not using my phone in dangerous weather conditions like rain, snow, or ice	**compt5**	**compd5**
Using my phone only if my speed is low	**compt6**	**compd6**
Using my phone only if my vehicle is stopped	**compt7**	**compd7**
Putting my phone out of reach before I start driving	**compt8**	**compd8**
Asking a passenger to manage my phone (read and respond to texts, use a map, etc.)	**compt9**	**compd9**
Coordinating alternative transportation in advance of drinking alcohol or using marijuana	**compt10**	**compd10**
Not speeding when others are in my vehicle	**compt11**	**compd11**
Not speeding in dangerous weather conditions like rain, snow, or ice	**compt12**	**compd12**
Not speeding on the interstate	**compt13**	**compd13**
Setting a reminder to call a taxi or schedule a rideshare (e.g., Uber, Lyft, etc.) when drinking alcohol or using marijuana	**compt14**	**compd14**
Not drinking alcohol or using marijuana when I will be driving with others in the vehicle	**compt15**	**compd15**
Not drinking alcohol or using marijuana when I will be driving in dangerous weather conditions like rain, snow, or ice	**compt16**	**compd16**
Not drinking alcohol or using marijuana when I am going on interstate	**compt17**	**compd17**
Wearing my seatbelt after drinking alcohol or using marijuana	**compt18**	**compd18**
Creating more distance between my vehicle and the vehicle in front of me	**compt19**	**compd19**
Being more attentive to what is going on around me	**compt20**	**compd20**
Deciding not to have any passengers in my vehicle so I can better concentrate when driving	**compt21**	**compd21**

Risk Perceptions

How dangerous do you feel the following driving behaviors are?
1 = not at all dangerous; 2 = slightly dangerous; 3 = moderately dangerous; 4 = very dangerous; 5 = extremely dangerous

rpaggress1 … passing a vehicle that is driving/going about the posted speed limit?
rpaggress2 … driving so close to the vehicle in front that it might be difficult to stop in an emergency?
rpspeed1 … driving more than 10 mph over the speed limit on roads with speed limits between 35 mph and 50 mph?
rpspeed2 … driving more than 10 mph over the speed limit on roads with speed limits between 55 mph and 65 mph?
rpdistract1 … driving while holding and talking on a cell phone?
rpdistract2 … driving while reading a text or an email on a cell phone?
rpdistract3 … driving while manually typing or sending a text message or an email?
rpdistract4 … reaching for an object while driving with the vehicle in motion?
rpbelt1 … as the driver, not wearing a seat belt when you are within a few miles of home?
rpbelt2 … as the driver, not wearing a seat belt when you are many miles away from home?
rpbelt3 … not wearing a seat belt as a passenger?
rpduica … driving within 2 hours of consuming marijuana AND alcohol (any amount of each)?
rpduic1 … driving within 2 hours of consuming only marijuana (any amount)?
rpduia1 … driving within 2 hours of consuming only alcohol (any amount)?
rpduic2 … driving while feeling high from marijuana?
rpduia2 … driving while feeling buzzed or drunk from drinking?
rpduic3 … using marijuana while driving?
rpduia3 … using alcohol while driving?

Control Beliefs

cbspeed1	I have the ability to drive within the speed limit.	1 (I definitely do not) – 7 (I definitely do)
cbspeed2	If it were entirely up to me, I am confident I will be able to drive within the speed limit.	1 (strongly disagree) – 7 (strongly agree)
cbspeed3	How confident are you that you will be able to drive within the speed limit?	1 (not at all confident) – 7 (extremely confident)
cbspeed4	For me, driving within the speed limit would be…	1 (difficult) – 7 (easy)
cbdistract1	I have the ability to drive and not use my phone.	1 (I definitely do not) – 7 (I definitely do)
cbdistract2	If it were entirely up to me, I am confident I will be able to drive and not use my phone.	1 (strongly disagree) – 7 (strongly agree)
cbdistract3	How confident are you that you will be able to drive without using your phone?	1 (not at all confident) – 7 (extremely confident)
cbdistract4	For me, driving without using my phone would be…	1 (difficult) – 7 (easy)

cbbelt1	I have the ability to always wear my seat belt while driving.	1 (I definitely do not) – 7 (I definitely do)
cbbelt2	If it were entirely up to me, I am confident I will be able to always wear my seat belt while driving.	1 (strongly disagree) – 7 (strongly agree)
cbbelt3	How confident are you that you will be able to always wear your seat belt while driving?	1 (not at all confident) – 7 (extremely confident)
cbbelt4	For me, always wearing my seat belt while driving would be…	1 (difficult) – 7 (easy)
cbduia1	I have the ability to not drive within 2 hours after drinking any alcohol.	1 (I definitely do not) – 7 (I definitely do)
cbduia2	If it were entirely up to me, I am confident I will be able to not drive within 2 hours after drinking any alcohol.	1 (strongly disagree) – 7 (strongly agree)
cbduia3	How confident are you that you will be able to not drive within 2 hours after drinking any alcohol?	1 (not at all confident) – 7 (extremely confident)
cbduia4	For me, not driving within 2 hours of drinking any alcohol would be…	1 (difficult) – 7 (easy)
cbduic1	I have the ability to not drive within 2 hours of using any amount of marijuana.	1 (I definitely do not) – 7 (I definitely do)
cbduic2	If it were entirely up to me, I am confident I will be able to not drive within 2 hours of using any amount of marijuana.	1 (strongly disagree) – 7 (strongly agree)
cbduic3	How confident are you that you will be able to not drive within 2 hours of using any amount of marijuana?	1 (not at all confident) – 7 (extremely confident)
cbduic4	For me, not driving within 2 hours of using any amount of marijuana would be…	1 (difficult) – 7 (easy)

Injunctive Norms

1 (strongly disapprove) – 5 (strongly approve)

How much do you believe people who are important to you would approve or disapprove if you were to…

inaggress1 … pass a vehicle which is driving/going about the posted speed limit?
inaggress2 … drive so close to the vehicle in front that it might be difficult to stop in an emergency?
inspeed1 … drive more than 10 mph over the speed limit on roads with speed limits between 35 mph and 50 mph?
inspeed2 … drive more than 10 mph over the speed limit on roads with speed limits between 55 mph and 65 mph?
indistract1 … drive while holding and talking on a cell phone?
indistract2 … drive while reading a text or an email on a cell phone?
indistract3 … drive while manually typing or sending a text message or an email?
indistract4 … reach for an object while driving with the vehicle in motion?

inbelt1 … as the driver, not wear a seat belt within a few miles of home?
inbelt2 … as the driver, not wear a seat belt many miles away from home?
inbelt3 … not wear a seat belt as a passenger?
induica … drive within 2 hours of consuming marijuana AND alcohol (any amount of each)?
induic1 … drive within 2 hours of consuming only marijuana (any amount)?
induia1 … drive within 2 hours of consuming only alcohol (any amount)?
induic2 … drive while feeling high from marijuana?
induia2 … drive while feeling buzzed or drunk from drinking?
induic3 … use marijuana while driving?
induia3 … use alcohol while driving?

Descriptive Norms

0 (never); 1 (occasionally); 2 (sometimes); 3 (regularly); 4 (often); 5 (always)

In your opinion, when driving, how often do MOST drivers your age...

dnaggress1 … pass a vehicle which is driving/going about the posted speed limit?
dnaggress2 … drive so close to the vehicle in front that it might be difficult to stop in an emergency?
dnspeed1 … drive more than 10 mph over the speed limit on roads with speed limits between 35 mph and 50 mph?
dnspeed2 … drive more than 10 mph over the speed limit on roads with speed limits between 55 mph and 65 mph?
dndistract1 … drive while holding and talking on a cell phone?
dndistract2 … drive while reading a text or an email on a cell phone?
dndistract3 … drive while manually typing or sending a text message or an email?
dndistract4 … reach for an object while driving with the vehicle in motion?
dnbelt1 … as the driver, wear a seat belt within a few miles of home?
dnbelt2 … as the driver, wear a seat belt many miles away from home?
dnbelt3 … wear a seat belt as a passenger?
dnduica … drive within 2 hours of consuming marijuana AND alcohol (any amount of each)?
dnduic1 … drive within 2 hours of consuming only marijuana (any amount)?
dnduia1 … drive within 2 hours of consuming only alcohol (any amount)?
dnduic2 … drive while feeling high from marijuana?
dnduia2 … drive while feeling buzzed or drunk from drinking?
dnduic3 … use marijuana while driving?
dnduia3 … use alcohol while driving?

Emotion Regulation (TEIQue-SF)

Please indicate the extent to which you disagree or agree with each of the following statements.

1 (completely disagree) – 7 (completely agree)

TEIQue1	Expressing my emotions with words is not a problem for me.
TEIQue2	I often find it difficult to see things from another person's viewpoint.

TEIQue3	On the whole, I'm a highly motivated person.
TEIQue4	I usually find it difficult to regulate my emotions.
TEIQue5	I generally don't find life enjoyable.
TEIQue6	I can deal effectively with people.
TEIQue7	I tend to change my mind frequently.
TEIQue8	Many times, I can't figure out what emotion I'm feeling.
TEIQue9	I feel that I have a number of good qualities.
TEIQue10	I often find it difficult to stand up for my rights.
TEIQue11	I'm usually able to influence the way other people feel.
TEIQue12	On the whole, I have a gloomy perspective on most things.
TEIQue13	Those close to me often complain that I don't treat them right.
TEIQue14	I often find it difficult to adjust my life according to the circumstances.
TEIQue15	On the whole, I'm able to deal with stress.
TEIQue16	I often find it difficult to show my affection to those close to me.
TEIQue17	I'm normally able to "get into someone's shoes" and experience their emotions.
TEIQue18	I normally find it difficult to keep myself motivated.
TEIQue19	I'm usually able to find ways to control my emotions when I want to.
TEIQue20	On the whole, I'm pleased with my life.
TEIQue21	I would describe myself as a good negotiator.
TEIQue22	I tend to get involved in things I later wish I could get out of.
TEIQue23	I often pause and think about my feelings.
TEIQue24	I believe I'm full of personal strengths.
TEIQue25	I tend to "back down" even if I know I'm right.
TEIQue26	I don't seem to have any power at all over other people's feelings.
TEIQue27	I generally believe that things will work out fine in my life.
TEIQue28	I find it difficult to bond well even with those close to me.
TEIQue29	Generally, I'm able to adapt to new environments.
TEIQue30	Others admire me for being relaxed.

Driving History

	Have you ever…	Yes, within the last year	Yes, 1-3 years ago	Yes, more than 3 years ago	No, never
		1	**2**	**3**	**0**
ticket1	Gotten a speeding ticket?				
ticket2	Gotten a ticket for a moving violation other than speeding?				
crash	Gotten into a car accident or crash?				

suspend	Had your license suspended or revoked?				

Demos

state What state do you live in?

rurality Which of the following best describes the place where you currently live?
a large city; a suburb near a large city; a small city or town; a rural area

edu What is the highest level of education you have completed?
Less than high school diploma; high school diploma/GED; associate degree; some college, no degree; bachelor's degree; master's degree; doctorate or professional degree

drive2 At what age did you start driving?

drive3 What kind of vehicle do you drive most often?
Car/sedan; SUV/crossover/minivan; pickup truck; motorcycle; commercial vehicle; other, please specify: _____

Additional Items for Follow-Up Survey Only:

All Participants

I am a better driver than most other drivers. *Strongly disagree (1) - Strongly agree (7)*

Choose one or more races that you consider yourself to be

- *White or Caucasian*
- *Black or African American*
- *American Indian/Native American or Alaska Native*
- *Asian*
- *Native Hawaiian or Other Pacific Islander*
- *Other*
- *Prefer not to say*

Are you of Spanish, Hispanic, or Latino origin?

- *Yes*
- *No*

There may be additional research opportunities, such as interviews or short surveys. Can we contact you to invite you to participate in the future?

- *Yes*
- *No*

Intervention Only:

Thinking about the sessions and your experience in this study, did you experience any change? This might include changes in your thinking, feeling, or behavior. *Yes* *No*

If yes, please describe the most significant change you experienced. *[open-ended text box]*

Thinking about the sessions you completed a few months ago...

Strongly disagree (1) - Strongly agree (5)

- I learned relevant information about driving.
- I think about the information from the sessions when I'm driving.
- I have been able to apply the information from the sessions.
- I have changed my driving as a result of participating in this study.
  - If agree or strongly agree go to open-ended question, "Please briefly describe how you have changed your driving."
- I am motivated to improve my driving.

Open-ended:

- Would you recommend this kind of educational experience to a friend or a peer? Why or why not?
- What was your biggest take-away from participating in this study?

8.2 Appendix B. Intervention Content

Intervention content for five learning sessions was developed including emotion identification/regulation content, seat belt content, speeding content, distracted driving content, and driving under the influence content. The details of the intervention content are provided. Please note items in italics are instructions and will not be seen by participants.

Emotion Identification/Regulation Content

Thanks for taking the survey. Within 3 days, you will be compensated with a $10 Amazon gift card to the email address you provided.

We would like you to participate in a series of learning sessions and receive some short informative text messages over the next few weeks to grow your skills in reducing risky driving behaviors.

Each session takes about 5 to 10 minutes to complete. For participating in each session, you will receive $10 added to an Amazon gift card. Completing all the sessions will get you a total of $30. The Amazon gift card will be sent to you upon completion of your final session.

Please enter your phone number to receive text messages for this study.

> *TEXT Message Reminders*:
> Text 1: Just a reminder. If you are still interested in participating in the driving study, being compensated for your time, and you haven't already completed your session, you still have time to log in: XX.
>
> Text 2: This is your last chance to complete the learning session and remain in the driving study. Log in here: XX to complete your session and be compensated for your time.

Thanks for taking the survey. We appreciate your time. To begin the next session, please click "go to dashboard" below, click on your intervention, and start the first session. If you choose to wait, please log back in within the next 7 days to complete the next session.

Thank you for starting your first learning session. This session focuses on learning to identify and regulate your feelings. You may be asking yourself, what does identifying my feelings and learning to regulate those feelings have to do with my driving? A lot actually. Studies show having increased social and emotional skills is associated with safer driving. So, by practicing the skills you learn today, you can reduce risky driving behaviors. How cool is that?
Your participation in this session is voluntary and you can stop at any time. For completing this session, you will be compensated $10 toward your Amazon gift card.
As a college student**,** you have a lot going on. You may be living on your own for the first time, balancing school, work, a social life, and paying your own expenses (and we know gas, groceries, and rent can cost a lot!). College life can be challenging and figuring it all out doesn't come easy. Sometimes, it can leave you feeling anxious, stressed, or frustrated.

Understanding your feelings is important. Feelings can influence the decisions you make and the actions you take every day. For example, if you feel angry when driving, you might speed, honk your horn at another driver, or decide not to let another driver into traffic in front of you. If you feel happy when driving, you might slow down for the bicycle riding on the shoulder of the road or wait patiently for someone to turn. Understanding how you feel can help you to make different choices about how you behave in any situation, including while driving.

The feelings you have can be experienced differently depending on the situation. Here's an example of how a feeling like frustration might be experienced.

	A frustrated feeling might be a 2 out of 10, like when you find out the class you need to take is only offered at 8am. How annoying!
	Or it might be a bit stronger, a 5 out of 10, like when you've spent a lot of time on a paper and gotten a lower grade than expected. Ahhhh!
	Or, it could be even stronger, an 8 out of 10, like when you find out you need to buy one more textbook for a class – and it is $120. Your blood starts to boil, and it makes you see red!

Understanding feelings is a skill, and it takes practice. Here's how you can do it.

- Tune in and try to identify your feelings. "Is this a frustrated feeling, or is this a feeling of anger – or maybe I'm scared?"
- Try to describe it.
    - "How would I rate the intensity of this feeling on a scale of 1-10?"
    - "Does this feeling give me a physical reaction? Is it a sick feeling, like having an upset stomach?"
    - "Does it remind me of anything? Is it similar to how I felt when I lost my keys the other day?"

How you feel about something can impact what you do, but you can change your feelings in any situation and at any time (even before you are in the situation). Learning to change how you feel is a skill and takes practice. Here's how you can do it.

- You can change how you think.
    - If you are feeling overwhelmed, instead of thinking about all the homework you need to get done, you could think about how much you are learning and enjoying the class.
- You can change what you do.

- If you are feeling stressed, instead of sitting home and ruminating on what is bothering you, you could go for a walk and breathe some fresh air. Fresh air and body movement help clear your head.
- If you are feeling annoyed by your roommate interrupting your study time (even with your headphones on!), take a few deep breaths.

Now it's your turn to practice.

Think about a recent situation you experienced while driving (Think about someone not letting you merge into traffic, someone honking their horn at you, someone driving REALLY slowly and backing up traffic, etc.). Can you picture this situation in your head?

What was the situation?

- Tune in and try to identify your feelings. "Was this an annoyed feeling, or was this a feeling of anxiety – or maybe you were stressed?"
  - What was the feeling? (*Open-Ended Response)*
- Try to describe it.
  - "How intense was this feeling on a scale of 1-10?"
  - "Did this feeling give me a physical reaction?"
  - "Did it remind me of anything?" (*Open-Ended Response)*

Now, consider how you could change the feeling you identified.

- You can change how you <u>think</u>.
  - If you were feeling annoyed: Instead of thinking the person that cut you off in traffic is rude, you could think how that person is probably in a hurry to get somewhere important.
  - If you were feeling frustrated: You could remind yourself that you aren't in a hurry to get to your destination and it's OK that traffic is moving slower than usual.
  - How could you <u>think</u> about the situation differently? (*Open-Ended Response*)

- You can change what you <u>do</u>. Changing what you do can include doing something in the moment to change how you feel (e.g., taking a few deep breaths), doing something before you are in the situation (e.g., leaving early to avoid feeling rushed), or doing something to avoid a situation where you are likely to have a strong feeling (e.g., taking a different route home).
  - If you were feeling upset by someone pulling out in front of you: Take a few deep breaths.
  - If you were feeling anxious: You could leave earlier to arrive on time.
  - If you were feeling angry: You could avoid rush hour traffic.
  - You could plan your work schedule so that you leave at a time when traffic is less busy to avoid the angry feelings you have when facing heavy traffic.
  - What could you <u>do</u> to change how you feel in this situation before you get into the situation, or to avoid the situation? (*Open-Ended Response*)

Understanding how you feel, how your feelings impact your behavior, and how to change how you feel are skills you can practice and get better at.

And, these skills can be helpful in every area of your life – dealing with a difficult professor, responding to an upset customer at work, or deciding what to do when you are driving.

Consider how your feelings impact your behavior. And consider how you can change what you think or what you do to change how you feel.

Over the next few weeks, we are going to be talking about risky driving behaviors. Each session will focus on one risky driving behavior that you have been engaging in the past 30 days. Thanks for completing this session.

You will be compensated $10 toward an Amazon gift card.

We will send you a few informative text messages throughout the next week. The more you practice identifying your feelings, the easier it will become. You got this!

We will also reach out to you when it is time to complete your next session.

*Text messages sent over the next week***:**

EmoText1: Common feelings include angry, frustrated, happy, and excited. Have you been practicing the skill of identifying your feelings in everyday situations?

EmoText2: Start to notice your feelings. Consider how your feelings impact your behavior. Consider how you can change what you think or what you do to change how you feel.

EmoText3: Think about the last time you drove. Can you identify how you were feeling? Can you recall how your feelings impacted your driving?

EmoText4: A quick reminder: Changing what we think or what we do can change how we feel in any situation.

Text 5: It's time to start your next session. Please log on within the next 7 days to stay in the study and get more money added to your gift card. Log in here <insert CIAS link>.

Seat Belt Content

Thanks for taking the survey. Within 3 days, you will be compensated with a $10 Amazon gift card to the email address you provided.

We would like you to participate in a series of learning sessions and receive some short informative text messages over the next few weeks to grow your skills in reducing risky driving behaviors.

Each session takes about 5 to 10 minutes to complete. For participating in each session, you will receive $10 added to an Amazon gift card. Completing all the sessions will get you a total of $30. The Amazon gift card will be sent to you upon completion of your final session.

Please enter your phone number to receive text messages for this study.

> *TEXT Message Reminders*:
> Text 1: Just a reminder. If you are still interested in participating in the driving study, being compensated for your time, and you haven't already completed your session, you still have time to log in: https://msu.cias.app/
>
> Text 2: This is your last chance to complete the learning session and remain in the driving study. Log in here: https://msu.cias.app/ to complete your session and be compensated for your time.

Thanks for taking the survey. We appreciate your time. To begin the next session, please click "go to dashboard" below, click on your intervention, and start the first session. If you choose to wait, please log back in within the next 7 days to complete the next session.

Thank you for starting your first learning session. This session focuses on learning to identify and regulate your feelings. You may be asking yourself, what does identifying my feelings and learning to regulate those feelings have to do with my driving? A lot actually. Studies show having increased social and emotional skills is associated with safer driving. So, by practicing the skills you learn today, you can reduce risky driving behaviors. How cool is that?
Your participation in this session is voluntary and you can stop at any time. For completing this session, you will be compensated $10 toward your Amazon gift card.

As a college student**,** you have a lot going on. You may be living on your own for the first time, balancing school, work, a social life, and paying your own expenses (and we know gas, groceries, and rent can cost a lot!). College life can be challenging and figuring it all out doesn't come easy. Sometimes, it can leave you feeling anxious, stressed, or frustrated.

Understanding your feelings is important. Feelings can influence the decisions you make and the actions you take every day. For example, if you feel angry when driving, you might speed, honk your horn at another driver, or decide not to let another driver into traffic in front of you. If you feel happy when driving, you might slow down for the bicycle riding on the shoulder of the road or wait patiently for someone to turn. Understanding how you feel can help you to make different choices about how you behave in any situation, including while driving.

The feelings you have can be experienced differently depending on the situation. Here's an example of how a feeling like frustration might be experienced.

	A frustrated feeling might be a 2 out of 10, like when you find out the class you need to take is only offered at 8am. How annoying!

	Or it might be a bit stronger, a 5 out of 10, like when you've spent a lot of time on a paper and gotten a lower grade than expected. Ahhhh!
	Or, it could be even stronger, an 8 out of 10, like when you find out you need to buy one more textbook for a class – and it is $120. Your blood starts to boil, and it makes you see red!

Understanding feelings is a skill, and it takes practice. Here's how you can do it.

- Tune in and try to identify your feelings. "Is this a frustrated feeling, or is this a feeling of anger – or maybe I'm scared?"
- Try to describe it.
    - "How would I rate the intensity of this feeling on a scale of 1-10?"
    - "Does this feeling give me a physical reaction? Is it a sick feeling, like having an upset stomach?"
    - "Does it remind me of anything? Is it similar to how I felt when I lost my keys the other day?"

How you feel about something can impact what you do, but you can change your feelings in any situation and at any time (even before you are in the situation). Learning to change how you feel is a skill and takes practice. Here's how you can do it.

- You can change how you <u>think</u>.
    - If you are feeling overwhelmed, instead of thinking about all the homework you need to get done, you could think about how much you are learning and enjoying the class.

- You can change what you <u>do.</u>
    - If you are feeling stressed, instead of sitting home and ruminating on what is bothering you, you could go for a walk and breathe some fresh air. Fresh air and body movement help clear your head.
    - If you are feeling annoyed by your roommate interrupting your study time (even with your headphones on!), take a few deep breaths.

Now it's your turn to practice.

Think about a recent situation you experienced while driving (Think about someone not letting you merge into traffic, someone honking their horn at you, someone driving REALLY slowly and backing up traffic, etc.). Can you picture this situation in your head?

What was the situation?

- Tune in and try to identify your feelings. “Was this an annoyed feeling, or was this a feeling of anxiety – or maybe you were stressed?”
- What was the feeling? (*Open-Ended Response)*
- Try to describe it.
    - “How intense was this feeling on a scale of 1-10?”
    - “Did this feeling give me a physical reaction?”
    - “Did it remind me of anything?”

Now, consider how you could change the feeling you identified.

- You can change how you <u>think</u>.
    - If you were feeling annoyed: Instead of thinking the person that cut you off in traffic is rude, you could think how that person is probably in a hurry to get somewhere important.
    - If you were feeling frustrated: You could remind yourself that you aren’t in a hurry to get to your destination and it’s OK that traffic is moving slower than usual.
    - How could you <u>think</u> about the situation differently? (*Open-Ended Response*)

- You can change what you <u>do</u>. Changing what you do can include doing something in the moment to change how you feel (e.g., taking a few deep breaths), doing something before you are in the situation (e.g., leaving early to avoid feeling rushed), or doing something to avoid a situation where you are likely to have a strong feeling (e.g., taking a different route home).
    - If you were feeling upset by someone pulling out in front of you: Take a few deep breaths.
    - If you were feeling anxious: You could leave earlier to arrive on time.
    - If you were feeling angry: You could avoid rush hour traffic.
    - You could plan your work schedule so that you leave at a time when traffic is less busy to avoid the angry feelings you have when facing heavy traffic.
    - What could you <u>do</u> to change how you feel in this situation, before you get into the situation, or to avoid the situation? (*Open-Ended Response*)

Understanding how you feel, how your feelings impact your behavior, and how to change how you feel are skills you can practice and get better at.

And, these skills can be helpful in every area of your life – dealing with a difficult professor, responding to an upset customer at work, or deciding what to do when you are driving.

Consider how your feelings impact your behavior. And consider how you can change what you think or what you do to change how you feel.

Over the next few weeks, we are going to be talking about risky driving behaviors. Each session will focus on one risky driving behavior that you have been engaging in the past 30 days. Thanks for completing this session.

You will be compensated $10 toward an Amazon gift card.

We will send you a few informative text messages throughout the next week. The more you practice identifying your feelings, the easier it will become. You got this!

We will also reach out to you when it is time to complete your next session.

Text messages sent over the next week:

EmoText1: Common feelings include angry, frustrated, happy, and excited. Have you been practicing the skill of identifying your feelings in everyday situations?

EmoText2: Start to notice your feelings. Consider how your feelings impact your behavior. Consider how you can change what you think or what you do to change how you feel.

EmoText3: Think about the last time you drove. Can you identify how you were feeling? Can you recall how your feelings impacted your driving?

EmoText4: A quick reminder: Changing what we think or what we do can change how we feel in any situation.

Text 5: It's time to start your next session. Please log on within the next 7 days to stay in the study and get more money added to your gift card. Long in here https://msu.cias.app/.

Speeding Content

Depending on whether or not the participant is receiving this session first or second, they will get either number 1 or 2:

1. Welcome back! In the last session, you took a survey and completed a session that focused on skills to identify feelings, understand how those feelings impact your behavior, and how you can change how you feel by changing what you think and changing what you do.

In this session, we will suggest some ways to help reduce a specific risky driving behavior. Your participation in this session is voluntary and you can stop at any time.

For completing this session, you will be compensated $10 toward your Amazon gift card.

This session will take approximately 5 minutes.

Ready? Let's start.

2. Welcome back! In the last session, you focused on a strategy that can help to reduce one risky driving behavior.

In this session, we will suggest some specific ways that can help to reduce another risky driving behavior. Your participation in this session is voluntary and you can stop at any time.

For completing this session, you will be compensated $10 toward your Amazon gift card.

This session will take approximately 5 minutes.

Ready? Let's start.

You answered a lot of questions about speeding and other aggressive driving behaviors on the survey.
AggresssiveMessage1a (If response to aggressive1 and aggressive 2 is never) Based on your responses in the past 30 days you have not driven aggressively. That's fantastic. Like you, most drivers don't drive aggressively.

AggressiveMessage 1b (If responses to aggressive 1 and aggressive2 is 1-4) Based on your responses in the past 30 days you have driven aggressively. Most drivers don't drive aggressively.

Move to aggressivemessage2

Aggressivemessage2
You might be wondering what exactly aggressive driving is. Aggressive driving is considered any unsafe driving behavior that a person does on purpose that is intended to be negative. Those include behaviors like tailgating someone, not yielding (when you probably should), preventing other drivers from passing, running stop signs, yelling or honking, and cutting off other drivers in traffic on purpose (Yikes!).

Aggressive driving is considered a leading cause of traffic crashes, and some research suggests that aggressive driving may be a cause in approximately 56% of crashes where someone dies.

Move to speeding

Speeding

Based on your responses, in the past 30 days, you have driven over the speed limit.

SpeedMessage1
Did you know that speeding is a major factor in traffic crashes? In 2019 alone, speeding was involved in approximately one-third of all traffic fatalities.

In Montana, speed was listed as a contributing factor in crashes over 19,000 times in four years. (That's a lot!)

Let's check in and practice identifying your feelings about speeding and understanding how your feelings might impact whether you decide to speed while driving or not.
Think about the last time you were speeding?

Can you picture this in your head?

What was the reason you decided to speed?

- Tune in and try to identify your feelings. "Was this an excited feeling, or was this a feeling of frustration – or maybe I was aggravated?"
- What was the feeling? (*Open-Ended Response*)
- Try to describe it.
    - "How intense was this feeling on a scale of 1-10?"
    - "Did this feeling give me a physical reaction?"
    - "Did it remind me of anything?"

Now, consider how you could change the feeling you identified.

- You can change how you <u>think</u>.
    - If you were feeling frustrated: You could remind yourself that you aren't late and you have plenty of time to get to your destination.
    - If you were feeling aggravated: You could remind yourself that you have had a great day, and it's OK that traffic is moving slower than usual.
    - How could you <u>think</u> differently about speeding? (*Open-Ended Response*)
- You can change what you <u>do</u>.
    - If you were feeling excited: You could take a few deep breaths.
    - If you were feeling aggravated: You could take a walk or listen to some music before driving.
    - What could you <u>do</u> to change how you feel about speeding? (*Open-Ended Response*)

Your feelings can influence your behaviors, like whether you decide to speed or not. Changing what you think or changing what you do are skills that can change how you feel, and these are skills you can practice and get better at.

After spending some time learning about speeding and identifying some of the feelings you might have about speeding, do you feel like you can commit to not speeding when driving? <yes, no, not sure>

Response- <yes>: Wonderful! Please pick an option that can support you not speeding when you drive.

1. I will monitor my speed especially when I am feeling anxious and/or upset.
2. I will check on my speed when I see a speed limit sign.

Move to speedmessage2

Response - <If no/not sure>: Okay. There are still ways you can reduce the potential consequences of speeding. Here are a few options you could try over the next few weeks.

3. I will choose to not speed when I drive with others in the vehicle.
4. I will choose to not speed when I am driving in dangerous weather conditions like rain, snow, or ice.
5. I will choose to not speed when I am driving on the interstate.
6. I am not comfortable with any of these choices.

If <responses c –e>, move to speedmessage2
If <response f>, move to speedmessage3

Speedmessage2
You have selected <insert strategy choices 1-9>. Over the next few weeks, try it out. See how it works. Adjust if needed. You got this!

Move to Session 3 or 4 Conclusion

Speedmessage3
Okay, so you are not quite ready to commit to an option that involves choosing not to speed. Don't worry. We have a few other ideas.

Here are a few options to consider (that can still increase safety). Please pick one option to try over the next few weeks.

7. I will choose to create more distance between my vehicle and the vehicle in front of me.
8. I will choose to be more attentive to what is going on around me.
9. I will choose not to have any passengers in my vehicle.

Move to speedmessage2

Session 3 Conclusion

Thanks for completing this session.

You will be compensated $10 toward your Amazon gift card. (Reminder: You will receive your gift card after completing all three learning sessions.)

We will send you a few text messages throughout the next week to encourage you to practice and let you know when it's time to complete your next session.

Text messages sent over the next week:

speedText1: You selected the following strategy <response 1-9>. Hopefully you have had the chance to practice this while driving. The more you practice the easier it will be. You got this!

speedText2a: *(If inspeed1 is a 1 or 2)* You said that people who are important to you would disapprove if you were to drive more than 10 mph over the speed limit on roads with speed limits between 35 mph and 50 mph. It is clear people care about you; drive the speed limit for them.

SpeedText 2b: *(If inspeed1 is a 3-5)* Speeding increases your risk of a traffic crash. Consider driving the speed limit for the people who care about you.

SpeedText 3: Driving somewhere today? Identify how you feel. Consider how those feelings might impact how you drive. Consider how you could change what you think or what you do to change how you feel.

Text 4: It's time to start your next session. Please log on within the next 7 days to stay in the study and get more money added to your gift card. Log in here: https://msu.cias.app/

Session 4 Conclusion
Thanks for completing your final session and congratulations. We will send a $30 Amazon gift card to you. Please be on the lookout for an email in the next week to invite you to take another survey and be compensated with a $15 Amazon gift card.

Distracted Driving Content

Depending on whether or not the participant is receiving this session first or second, they will get either number 1 or 2:

1. Welcome back! In the last session, you took a survey and completed a session that focused on skills to identify feelings, understand how those feelings impact your behavior, and how you can change how you feel by changing what you think and changing what you do.

In this session, we will suggest some ways to help reduce ta specific risky driving behavior. Your participation in this session is voluntary and you can stop at any time.

For completing this session, you will be compensated $10 toward your Amazon gift card.

This session will take approximately 5 minutes.

Ready? Let's start.

2. Welcome back! In the last session, you focused on a strategy that can help to reduce one risky driving behavior.

In this session, we will suggest some specific ways that can help to reduce another risky driving behavior. Your participation in this session is voluntary and you can stop at any time.

For completing this session, you will be compensated $10 toward your Amazon gift card.

This session will take approximately 5 minutes.

Ready? Let's start.

Distracted driving was one of the behaviors you answered a lot of questions about in the survey. Based on your responses, in the last 30 days, you have driven distracted. Distracted driving can occur when you are holding and talking on your cell phone, reading a text or email on your cell phone, or manually typing or sending a text message or email. In addition to using your cell phone while driving, you can also be distracted by reaching for an object while your vehicle is in motion. These behaviors take your attention away from the road and can lead to devastating consequences.

distractedMessage1
We know it can be hard to stay focused on one task at a time. We are used to using our phones a lot too! We know you care about being connected, but we also know you care about the people around you.

Did you know, most drivers your age don't typically read a text or an email or send a text or an email on their phone when they are driving?

Even though most people don't do things that can distract them while driving, in 2020, there were still 3,142 people who died in a distraction-related crash.

Throughout Montana, there are local ordinances that do not allow distracted driving.

Move to distractedmessage2

distractedMessage2a
If response to rpdistract2 or 3 is > 1. On the survey, you said that it was dangerous to drive distracted. We agree! A large survey found that most people feel very unsafe if their driver is sending or reading emails or texts.

DistractedMessage2b If response to rpdistract2 or 3 =1 A large survey found that most people feel very unsafe if their driver is sending or reading emails or texts. Spend a minute and reflect on the people in your vehicle. Consider driving engaged for them.

distractedMessage3
There is a lot to pay attention to while driving. Since we text so often, it can feel easy and like it doesn't interfere with our ability to concentrate. But distracted driving is dangerous – texting while driving more than doubles your odds of being in a crash.

Let's check in and practice identifying your feelings about distracted driving and understanding how your feelings might impact your decisions about driving distracted.

Think about the last time you were driving distracted?

Can you picture this in your head?

What was the reason you decided to drive distracted?

- Tune in and try to identify your feelings. "Was this a worried feeling, or was this a feeling of indifference – or maybe I was restless?"
- What was the feeling? (Open Ended Response)
- Try to describe it.
    - "How intense was this feeling on a scale of 1-10?"
    - "Did this feeling give me a physical reaction?"
    - "Did it remind me of anything?"

Now, consider how you could change the feeling you identified.

- You can change how you <u>think</u>.
    - If you were feeling worried about missing out on the text message that just came in: You could remind yourself that you could respond when you get to where you're going.
    - If you were feeling indifferent about whether to answer your phone while driving or not: You could tell yourself you only have a few minutes before you stop and then you can call them back and give your full attention to the person.
    - How could you <u>think</u> about distracted driving differently? (*Open-Ended Response*)
- You can change what you <u>do</u>.
    - If you were feeling restless about not checking your text messages: You could take a few breaths.
    - If you were feeling impatient: You could pull over to a safe location and then check your phone.
    - What could you <u>do</u> to change how you feel about distracted driving? (*Open-Ended Response*)

Your feelings can influence your behaviors, like whether you decide to do something that can distract you while driving or not. Changing what you think or changing what you do are skills that can change how you feel, and these are skills you can practice and get better at.
After spending some time thinking about distracted driving and identifying some of the feelings you might have about distracted driving, do you feel like you can commit to not engaging with your phone while driving? *<yes or no or not sure>*

Response <yes> Great! Please pick an option that can support you not using your cell phone while driving.

1. I will put my phone away and out of reach before I start driving.
2. I will turn my phone off before I start driving.
3. I will set my phone to "Do Not Disturb" before I start driving.

Move to distractmessage4

Response - <If no/not sure>: Okay. There are still ways you can reduce the potential harm that can happen if you drive distracted. Here are a few options you could try over the next few weeks.

4. I will choose to not use my cell phone when I am driving at high speeds.
5. I will choose to not use my cell phone when I am driving in dangerous weather conditions like rain, snow, or ice.
6. I will choose to hand my phone to a passenger to manage my phone (read and respond to texts, use a map, etc.). This way I won't miss any important calls, texts, or emails.
7. I will choose to only look at my phone when I am stopped.
8. I am not comfortable with any of these choices.

If <responses c –f>, move to distractmessage4
If <response g>, move to distrctmessage5

Distractmessage4
You have selected <*insert strategy choices 1-11*>. Over the next few weeks, try it out. See how it works. Adjust if needed. You got this!

Move to Session 3 or 4 Conclusion

Distractmessage5
Okay, so you're not quite ready to commit to an option that involves not driving distracted. Don't worry. We have a few other ideas.

Here are a few options to consider (that can still increase safety). Please pick one option to try.

9. I will choose to create more distance between my vehicle and the vehicle in front of me.
10. I will choose to be more attentive to what is going on around me.
11. I will choose not to have any passengers in my vehicle.

Move to Distractmessage4

Session 3 conclusion

Thanks for completing this session.

You will be compensated $10 toward your Amazon gift card.

We will send you a few text messages throughout the next week to encourage you to practice and let you know when it's time to complete your next session.

Text messages sent over the next week:

distractText1: You selected the following strategy <response 1-11>. Hopefully you have had the chance to practice this while driving. The more you practice, the easier it will be. You got this!

distractText2a: (*If indistract 3 response was 1 or 2*). You said that people who are important to you would disapprove if you were to drive and text. Choosing to drive without using your cell phone increases safety. Drive engaged for the people you care about.

Distractedtext2b:(*If indistract 3 response was 3-5)* Spend a minute and reflect on the people who care about you like your parents and your friends. Consider driving engaged for them.

Distractedtext3: Instead of reaching for your phone while driving, identify how you feel. Consider how those feelings influence your behavior. Consider how you could change what you think or what you do to change how you feel.

Text 4: It's time to start your next session. Please log on within the next 7 days to stay in the study and get more money added to your gift card. Log in here: https://msu.cias.app/

Session 4 Conclusion

Thanks for completing your final session and congratulations. We will send a $30 Amazon gift card to you. Please be on the lookout for an email in the next week to invite you to take another survey and receive a $15 Amazon gift card.

Driving Under the Influence Content

Depending on whether or not the participant is receiving this session first or second, they will get either number 1 or 2:

1. Welcome back! In the last session, you took a survey and completed a session that focused on skills to identify feelings, understand how those feelings impact your behavior, and how you can change how you feel by changing what you think and changing what you do.

In this session, we will suggest some ways to help reduce a specific risky driving behavior Your participation in this session is voluntary and you can stop at any time.

For completing this session, you will be compensated $10toward your Amazon gift card.

This session will take approximately 5 minutes.

Ready? Let's start.

2. Welcome back! In the last session, you focused on a strategy that can help to reduce one risky driving behavior.

In this session, we will suggest some specific ways that can help to reduce another risky driving behavior. Your participation in this session is voluntary and you can stop at any time.

For completing this session, you will be compensated $10 toward your Amazon gift card.

This session will take approximately 5 minutes.

Ready? Let's start.

Driving under the influence of substances was one of the behaviors you answered a lot of questions about in the survey.
DuicaMessage 1 In the past 30 days you have driven while you felt buzzed and/or high. Most drivers your age don't drive after drinking alcohol and don't drive within one hour of using marijuana.

In Montana, most young adults think driving under the influence of alcohol increases the risk of getting in a crash, and most young adults think driving under the influence of marijuana increases the risk of getting in a crash.

Move to Duicamessage2

Duicamessage2

In Montana, it's illegal to drive under the influence of alcohol and/or marijuana, and the penalties are high with some fines as much as $10,000. And, those fines don't include court fees, attorney fees, treatment fees, and increases in your insurance (Yes, seriously!). And your driver's license gets suspended for 6 months (What a bummer. No thank you.).

Move to duicamessage3

Duicamessage3
In 2020, over 60% of traffic fatalities in Montana involved impaired driving.

In one study, it was found that a driver with a .08 blood alcohol level (BAC) is almost 4 times more likely to be in a crash than a driver who did not have alcohol in their system. (Note to self: Don't drive impaired.)

Let's check in and practice identifying your feelings about driving under the influence of substances and understanding how your feelings might impact your behavior.

Think about the last time you were driving under the influence of substances.

Can you picture this in your head?

What was the reason you decided to drive under the influence of substances?

- Tune in and try to identify your feelings. "Was this an overconfident feeling, or was this a feeling of indifference – or maybe I was worried?"
    - What was the feeling? *(Open Ended Response*)
- Try to describe it.
    - "How intense was this feeling on a scale of 1-10?"
    - "Did this feeling give me a physical reaction?"
    - "Did it remind me of anything?"

Now, consider how you could change the feeling you identified.

- You can change how you <u>think</u>.
    - If you were feeling overconfident: You could think about the costs (and there's a lot of costs) associated with getting ticketed for driving under the influence.
    - If you were feeling worried about what others might think of you deciding not to drive under the influence: You could think about all of the people who would want you to be safe and make that choice.
    - How could you <u>think</u> differently about driving under the influence? (*Open-Ended Response*)
- You can change what you <u>do</u>.
    - If you were feeling overconfident: You could make plans for an alternative ride home before you go out.
    - If you were feeling indifferent: You could give your keys to your friend who has agreed to be a DD (designated driver) tonight.
    - What could you <u>do</u> to change how you feel about driving under the influence? *(Open-Ended Response*)

Your feelings can influence your behaviors, like whether you decide to drive under the influence of substances or not. Changing what you think or changing what you do are skills that can change how you feel, and these are skills you can practice and get better at.
After spending some time thinking about driving under the influence of substances, do you feel like you can commit to making the choice not to drive under the influence of substances? *<yes or no or not sure>*

Response <yes> Great. Please pick an option that can support you not driving under the influence of substances.

1. I will plan for alternative transportation in advance of drinking alcohol or using marijuana.
2. I will go out with a designated driver.
3. I will choose to set a reminder to call a taxi or schedule a ride share (e.g., Uber, Lyft, etc.) when drinking alcohol or using marijuana.

Move to duicamessage 4

Response (If no/note sure) Okay. There are still ways you can reduce the potential consequences of driving under the influence of substances.

4. I will choose not to drink alcohol or use marijuana when I will be driving with others in the vehicle.
5. I will choose not to drink alcohol or use marijuana when I will be driving in dangerous weather conditions like rain, snow, or ice.
6. I will choose not to drink alcohol or use marijuana when I will be driving on the interstate.
7. I am not comfortable with these choices.

If <responses 4-6>, move to duicamessage4

If <response 7>, move to duicamessage5

Duicamessage4
You have selected <*insert strategy choices 1-9*>. Over the next few weeks, try it out. See how it works. Adjust if needed. You got this!

Move to Session 3 or 4 Conclusion

Duicamessage5
Okay, so you are not quite ready to commit to an option that involves choosing not to drive under the influence of substances. Don't worry. We have a few other ideas.

Here are a few options to consider (that can still increase safety). Please pick one option to try over the next few weeks.

8. I will choose to wear my seat belt after drinking alcohol or using marijuana.
9. I will choose not to speed when I drive under the influence.

Move to Duicamessage4

Session 3 conclusion

Thanks for completing this session.

You will be compensated $10 toward your Amazon gift card.

We will send you a few text messages throughout the next week to encourage you to practice and let you know when it's time to complete your next session.

Text messages sent over the next week:

duicaText1: You selected the following strategy <response 1-9>. Hopefully you have had the chance to practice this while driving. The more you practice, the easier it will be. You got this!

DuciaText2a (if induic2 and induia2 response is 1 or 2): You said that people who are important to you would disapprove if you drove under the influence. It is clear that people care about you and your safety; choose not to drive under the influence for them.

duicaText 2b (if induic2 and induia2 response is 3-5) Driving under the influence increases your risk of a traffic crash. Consider choosing not to drive under the influence for the people who care about you.

duicaText3: How do you feel? How could you change what you think or what you do to change how you feel?

Text 4: It's time to start your next session. Please log on within the next 7 days to stay in the study and get more money added to your gift card. Log in here: https://msu.cias.app/

Session 4 conclusion

Thanks for completing your final session and congratulations. We will send a $30 Amazon gift card to you. Please be on the lookout for an email in the next week to invite you to take another survey and receive a $15 Amazon gift card.

8.3 Appendix C. Pilot Intervention Informed Consent

SUBJECT CONSENT FORM FOR PARTICIPATION IN HUMAN RESEARCH AT MONTANA STATE UNIVERSITY (MSU)

Researchers at the Center for Health and Safety Culture (CHSC) are asking you to participate in a research study to help people improve their driving. This form describes this study and explains how you can ask questions. This study is being led by Dr. Kari Finley, a Research Scholar at the CHSC.

What the study is about

The purpose of this research is to help people improve their driving. We want to get your feedback on the content and language we will use in brief virtual activities delivered to college students to help improve their driving. This information will help us improve the activities for future participants.

What we will ask you to do

We will ask you to participate in an interview that will take about 20 minutes. Prior to the interview, we may send you a document to review ahead of time.

Risks and discomforts

We do not anticipate any risks to you from participating in this interview.

Benefits

You may benefit from reflecting on your own risky driving behaviors. The conversation may provide insights that will be helpful. Information from this study will be used to improve activities to help people improve their driving and will benefit future participants.

Funding

This project is funded through a grant to Montana State University's Center for Health and Safety Culture from Montana Department of Transportation and the Federal Highway Administration (FHWA). There are no costs to you. Your participation will not impact your relationship with Montana State University or the state of Montana.

Compensation for participation

If you choose to participate, you will receive a $20 Amazon gift card.

Audio recording

We will audio record the conversation and use the recording to develop a transcription. Following transcription, the audio recording will be deleted. By participating in the interview, you agree to be recorded.

Privacy/Confidentiality/Data Security

Your name, email address, and any other identifying information will be removed from the transcriptions and not stored. Access to the data will be limited to Center staff who are working on this project. Data will be analyzed for common themes, and results will be reported in

summary format. We may use brief direct quotes to illustrate themes but will ensure they do not contain detail that may identify you.

Taking part is voluntary
Your participation is voluntary. You may choose to not participate with no penalty or impact on your relationship with MSU or the CHSC. If you choose to participate in the interview, you may skip any questions you do not wish to answer or discontinue your participation at any time.

Follow-up studies
We may contact you again to request your participation in a follow-up study. As always, your participation will be voluntary, and we will ask for your explicit consent to participate in any of the follow-up studies.

If you have questions
The main researcher conducting this study is Kari Finley, PhD, a Research Scholar at the CHSC. You may contact her at kari.finley@montana.edu. You will also have a chance to ask questions of the interviewer before the interview. If you have any questions or concerns regarding your rights as a subject in this study, you may contact the Institutional Review Board (IRB) for Human Participants at 406-994-4706 or access their website at http://www.montana.edu/orc/irb/index.html.

Consent
Proceeding with this research or interview indicates your consent to participate. Researcher Documentation of Interview Consent:
Yes
No
Date:

APPROV 06/2022
IRB #KF060622-EX

8.4 Appendix D. Interview Protocol

Interviewer to introduce self, thank person for their time, confirm receipt of informed consent, and ask if any questions.

Ask if person is willing to participate and be recorded.
If not willing to participate, thank them for their time and end conversation.
If willing to participate but not be recorded, take notes throughout interview and after.
If yes to both, "I'll now turn on the recording."

Prior to this interview, we sent you a document to review. This document is a part of a virtual activity that we plan to implement with college students in the Fall. We would like your feedback about the content and language.

1. What were your initial thoughts and feelings about the content?
    a. What resonated with you?
    b. What parts were confusing?
    c. Were there any language choices that did not resonate with you?
    d. What were your feelings after reading the content? Or, how did you feel after reading the content?
    e. What was the overall tone of the language used (e.g., friendly, approachable, sarcastic, hopeful, negative etc.)
    f. Did the examples used throughout the document feel relatable?
    g. Did the strategy options provided seem doable to you? (Sessions 3 and 4 only)
2. How interested or motivated would you be to participate in virtual sessions to improve your driving? (explain virtual sessions would be based on the content they reviewed)
3. What are some reasons you'd want to participate? (probe for motivations)
4. What would make participating less appealing?
5. If you were asked to complete three virtual sessions, each session being 5-7 minutes long, followed by a series of text messages to encourage you to practice what you learned in the session, how much would you like to be compensated for participating?
6. If you received a gift card, what vendors would you like to get one from?
7. If you were asked to complete an online survey, would you participate if you were entered into a raffle to receive highly value items like ski tickets, concert tickets or an iPad?
8. If not, what would you prefer to receive?
9. Is there anything else you'd like to share about the content of this activity?

Thank you again for your time today.

8.5 Appendix E. Intervention Informed Consent

SUBJECT CONSENT FORM FOR PARTICIPATION IN HUMAN RESEARCH AT MONTANA STATE UNIVERSITY (MSU)

Researchers at the Center for Health and Safety Culture (CHSC) are asking you to participate in a research study to help people improve their driving. This form describes this study to you and explains how you can ask questions. This study is being led by Dr. Kari Finley, a Research Scholar at CHSC.

What the study is about
The purpose of this research is to understand how to help people improve their driving. We have developed a survey designed to identify your driving behaviors and a series of brief learning sessions and text messages designed to decrease risky driving behaviors. The information we learn in this study will help us understand ways to decrease risky driving.

What we will ask you to do
We will ask you to participate in a survey at three different times throughout the study over the next 6 months. Each survey will take about 15 to 20 minutes. We may also ask you to complete a series of learning sessions and to receive some text messages. Each learning session will take about 5 to 10 minutes to complete.

Risks and discomforts
We do not anticipate any risks to you from participating in this study. We anticipate that this study will be minimally disruptive. However, we do ask questions that may be sensitive and of a personal nature such as questions about driving under the influence of alcohol and cannabis. Participating in surveys and/or learning sessions and text messages may challenge some of your current perceptions and provide opportunities to reflect on some of your driving behaviors. This study also requires a minor time commitment (less than 2 hours of time) over the next 6 months.

Benefits
You may benefit from reflecting on your own risky driving behaviors and as a result decide to make some positive changes in your driving. Information from this study will be used to understand ways to decrease risky driving and help people improve their driving.

Funding
This project is funded through a grant to Montana State University's Center for Health and Safety Culture from Montana Department of Transportation and the Federal Highway Administration (FHWA). There are no costs to you. Your participation will not impact your relationship with Montana State University or the state of Montana.

Compensation for participation
If you choose to participate in the study, you will receive Amazon gift cards for each part that you complete. For registering for an account and starting the first session, you will receive $5. For the surveys, you will receive $10 for the first survey, $15 for the second survey, and $50 for the third survey. Participants that complete the third survey will also be entered into a final raffle for a 1 in 5 chance to win an Amazon gift card (amount to be determined at the end of the study). If you are asked to take part in learning sessions and text messages, you will also receive an Amazon gift card with $10 for each learning session that you complete.

Privacy/Confidentiality/Data Security
All information you provide will be kept confidential. Your name, email address, and any other identifying information will be removed from the collected data and not stored together. Data will be securely stored and access to the data will be limited to Center staff who are working on this project. Results from the study will be reported in aggregate and will not include details that may identify you. After completion of the project, data will be de-identified, securely maintained, and retained for three years.

Taking part is voluntary
Your participation is voluntary. You may choose to not participate with no penalty or impact on your relationship with MSU or CHSC. If you choose to participate in the study, you may discontinue your participation at any time.

If you have questions
The main researcher conducting this study is Kari Finley, PhD, a Research Scholar at CHSC. If participating in the study brings up any distressing thoughts or feelings and you would like to speak with someone, she is happy to provide a referral. You may also contact her if you have any questions about the study. Her email is kari.finley@montana.edu. If you have any questions or concerns regarding your rights as a subject in this study, you may contact the MSU Institutional Review Board (IRB) for Human Participants at 406-994-4706 or access their website at http://www.montana.edu/orc/irb/index.html.

Consent
Proceeding with this research indicates your consent to participate.

APPROVED MSU 01/17/2024
IRB #2023-573

8.6 Appendix F. Intervention Recruitment

EMAIL 1
Subject: Take a Short Driving Survey to be Entered for a Chance to Win a Gift Card

Are you a college student who drives? We want to hear from you! The Center for Health and Safety Culture at Montana State University is conducting a quick survey about driving. By participating, you not only contribute to valuable research but also get a chance to win 1 of 4 **$25 Amazon gift cards!**

Your opinion matters! Here are the details:

- Survey: The survey will take less than 5 minutes to complete. This is a screening survey about driving behaviors that could result in an invitation to participate in a larger study that would compensate you for your time with gift cards!
- Anonymity and Privacy: Your responses are confidential, and all data will be used for research purposes only. Your personal information will not be shared or used for any other purposes.
- Incentive: As a token of our appreciation, you will have the opportunity to enter a drawing for a chance to win 1 of 4 $25 Amazon gift cards.
- Eligibility: To participate, you must be a college student and drive a vehicle at least once a week or more often.
- How to Participate: Simply click on the survey link provided below.
- Survey Link: https://tinyurl.com/MTdrivingsurvey
- Deadline: Please complete the survey by the end of this week.
- Winner Announcement: Four winners of a $25 gift card will be chosen randomly and notified via email.

Thank you for your interest in contributing to our research on driving behaviors. Your participation is valuable, and your insights will help us better understand people's driving actions. Don't miss your chance to win 1 of 4 **$25 gift cards** — start the survey now! https://tinyurl.com/MTdrivingsurvey

If you have any questions, please contact me, Kari Finley. I'm the lead investigator for this research study. My email is: kari.finley@montana.edu.

Thanks,

Kari Finley, Ph.D.
Research Scholar and Co-Director

IRB# 2023-573

EMAIL 2a (sent via constant contact)
Subject: A Reminder to Complete a 5 Minute Driving Survey and Enter for a Chance to Win a Gift Card!
Last week I sent an email inviting you to participate in a quick survey about driving. If you would like to participate in the survey (it takes less than 5 minutes to complete), simply click the survey button below.

Your opinion matters. By participating, you not only contribute to valuable research but also get a chance to win 1 of 4 **$25 Amazon gift cards**!

https://tinyurl.com/MTdrivingsurvey

This is a screening survey that could result in an invitation to participate in a larger study that would compensate you for your time with gift cards! Your responses are confidential, and all data will be used for research purposes only.

If you have already taken the survey, thank you! No further action is required.

It will only take a few minutes of your time!

Thank you,

Kari Finley, Ph.D.
Research Scholar and Co-Director

IRB# 2023-573

EMAIL 2b (sent via outlook)
Are you a college student who drives? We want to hear from you!

Last week I sent an email inviting you to participate in a quick survey about driving. That email might have gone to your spam, and I want to make sure you get the invitation! If you would like to participate in the survey (it takes less than 5 minutes to complete), simply click the survey button below.

Your opinion matters. By participating, you not only contribute to valuable research but also get a chance to win 1 of 4 $25 Amazon gift cards!

This is a screening survey that could result in an invitation to participate in a larger study that would compensate you for your time with gift cards! Your responses are confidential, and all data will be used for research purposes only.

If you have already taken the survey, thank you! No further action is required.

It will only take a few minutes of your time!

Thank you,

Kari Finley, Ph.D.
Research Scholar and Co-Director

IRB# 2023-573

EMAIL 3
Subject: Last chance to be entered for a chance to win 1 of 4 $25 Gift Cards! Take the short driving survey now!

Are you a college student who drives? We want to hear from you!
The Center for Health and Safety Culture is conducting a short survey about driving. This is the last chance to take the survey and enter for a chance to win 1 of 4 **$25 Amazon gift cards!**

The survey takes approximately 5 minutes to complete. This is a screening survey that could result in an invitation to participate in a larger study that would compensate you for your time with gift cards! Your responses are confidential, and all data will be used for research purposes only.

If you would like to participate now, click here: https://tinyurl.com/MTdrivingsurvey

It will only take a few minutes of your time!

Thank you,

Kari Finley, Ph.D.
Research Scholar and Co-Director

IRB# 2023-573

EMAIL 4 (Optional)
Subject: Deadline extended! Please complete a Short Driving Survey in the next 7 days and Enter for a Chance to Win a Gift Card!

Are you a college student who drives? We want to hear from you!
The Center for Health and Safety Culture is conducting a short survey about driving. This is the last chance to take the survey and enter for a chance to win 1 of 4 $25 Amazon gift cards!

The survey takes less than 5 minutes to complete. This is a screening survey that could result in an invitation to participate in a larger study that would compensate you for your time with gift cards! Your responses are confidential, and all data will be used for research purposes only.

If you would like to participate now, click here: https://tinyurl.com/MTdrivingsurvey

It will only take a few minutes of your time!

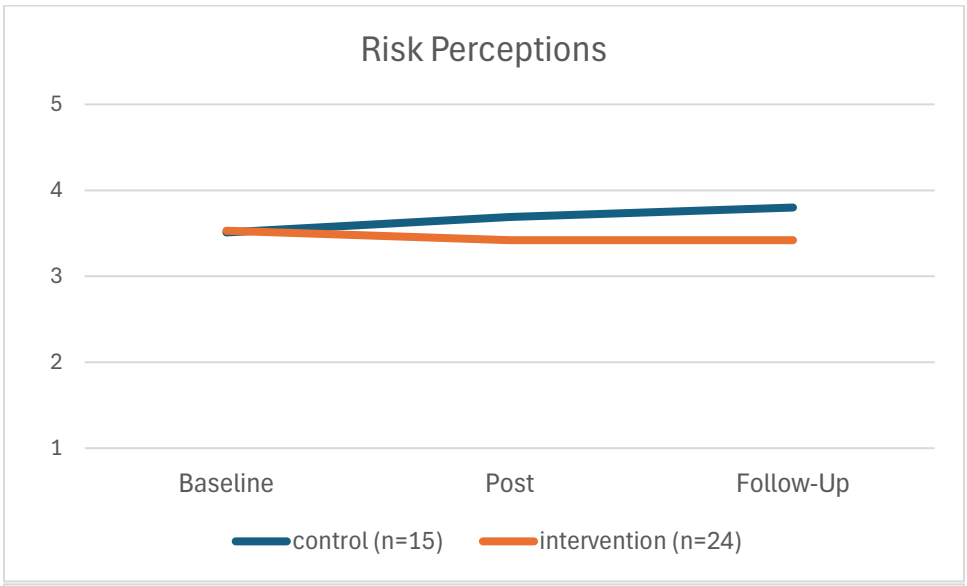
Thank you,

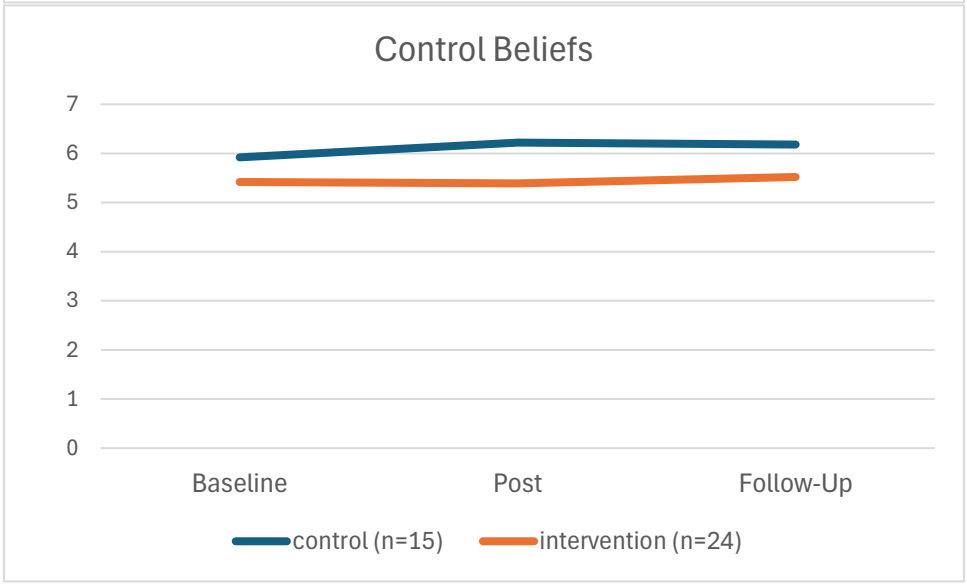
Kari Finley, Ph.D.
Research Scholar and Co-Director

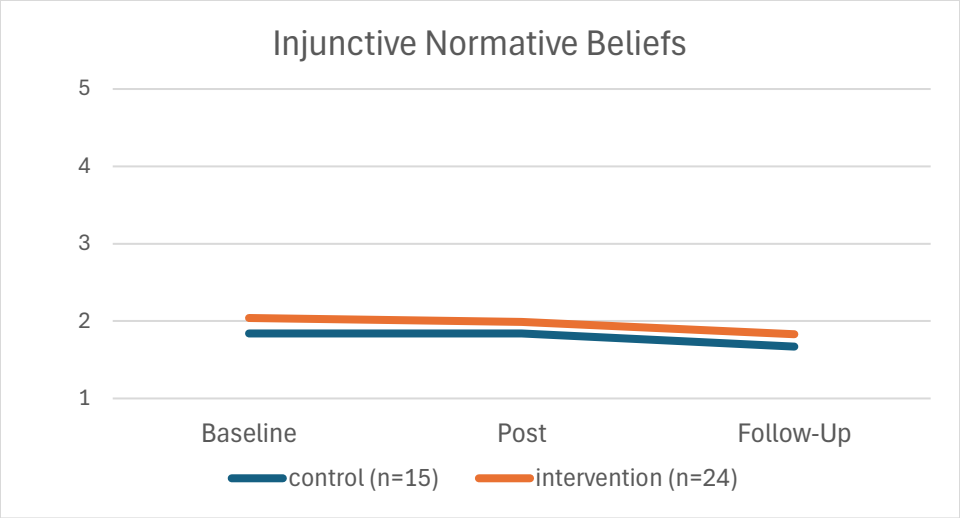
IRB# 2023-573

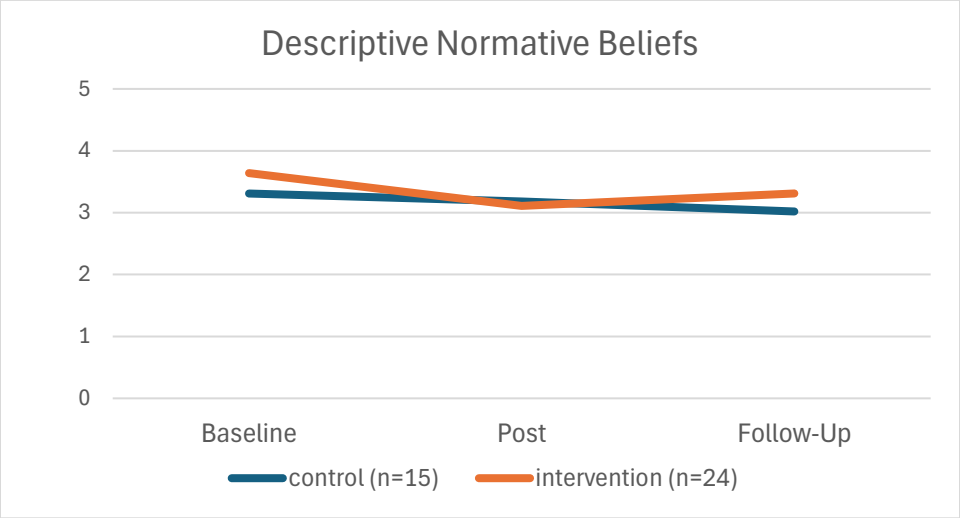
8.7 Appendix G. Visualizations of Study Variables for Control and Intervention

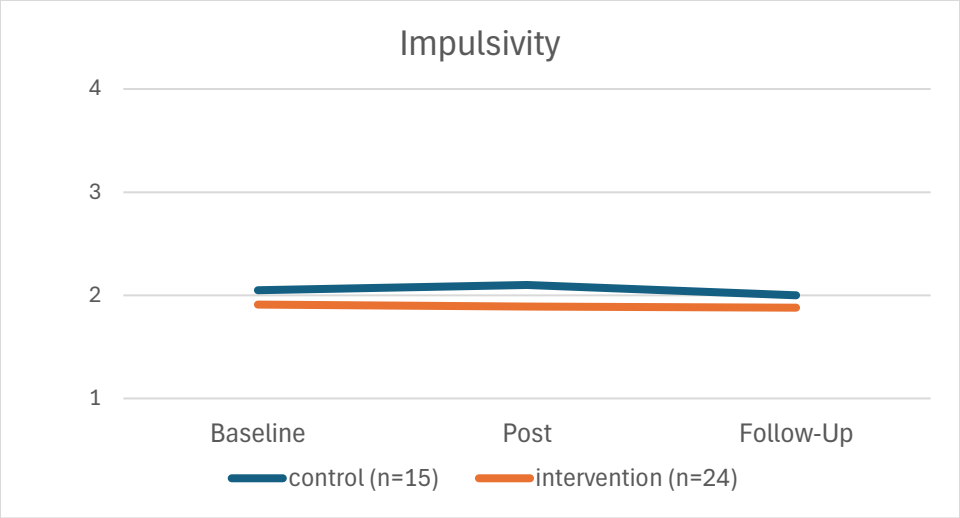
Note: Differences between control and intervention are not statistically significant, nor are changes over time.

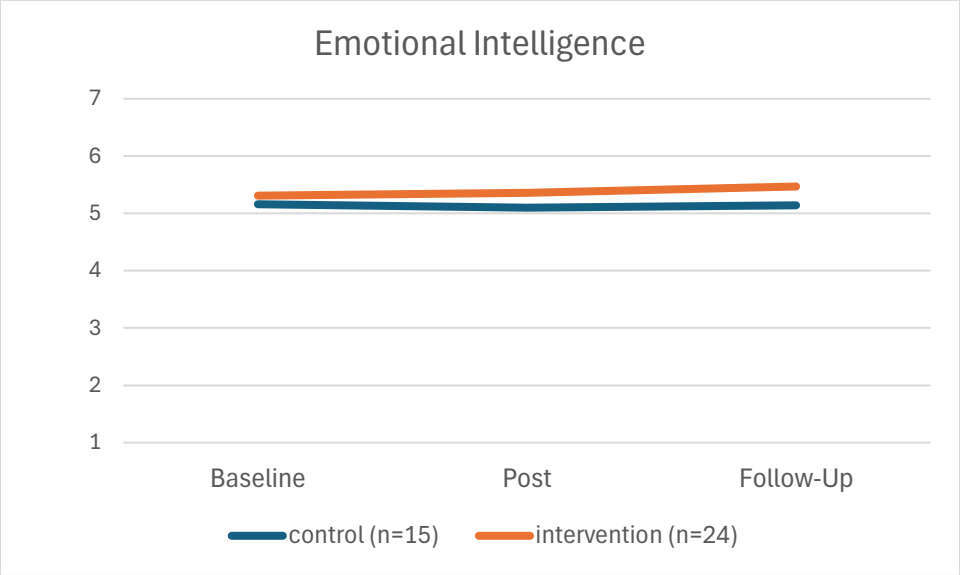





Injunctive Normative Beliefs
5
4
3
2
1
Baseline
Post
Follow-Up
control (n=15)
intervention (n=24)


Descriptive Normative Beliefs
5
4
3
2
1
0
Baseline
Post
Follow-Up
control (n=15)
intervention (n=24)


Impulsivity
4
3
2
1
Baseline
Post
Follow-Up
control (n=15)
intervention (n=24)


Emotional Intelligence
7
6
5
4
3
2
1
Baseline
Post
Follow-Up
control (n=15)
intervention (n=24)