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FEDERAL HIGHWAY ADMINISTRATION

January 2024

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16. Abstract How aggressive driving is defined, what factors precipitate such behavior, and what strategies effectively prevent and reduce the incidence of aggressive driving behavior are not widely understood. The proposed research sought to address these gaps through a two-phase project. The purpose of this project was to support work in Phase 1. A literature review was conducted to identify common definitions of aggressive driving, identify factors that precipitate such behavior, understand previously developed contextual models that explain its occurrence, and identify ways to reduce aggressive driving. A proposed definition of aggressive driving and a contextual model that could be used to represent factors and context that influence aggressive driving behavior was developed. Additionally, a survey of road users was implemented to assess the prevalence and correlates of aggressive driving behavior. A resource guidance document was created to help traffic safety practitioners bolster their current traffic safety efforts to address aggressive driving based on what was learned from the literature review and survey.		

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1 INTRODUCTION

Traffic crashes are a major public health concern in the United States. In 2022, 42,795 people in the U.S. lost their lives in traffic crashes (National Highway Traffic Safety Administration, 2023). While there are many causes that contribute to traffic crashes, aggressive driving is considered a leading cause, with evidence suggesting aggressive driving is a cause in approximately 56% of fatal crashes (AAA, 2013). Aggressive driving is also considered a common behavior among drivers. In a recent self-reported aggressive driving behavior survey, approximately 80% of drivers reported expressing anger, aggression, or road rage while driving at least once in the past 30 days (AAA, 2022). Furthermore, there is evidence to suggest that people's perceptions that others are driving more aggressively has increased in the past five years, especially during the COVID-19 pandemic (Stephens, Trawley, et al., 2022). However, the evidence that aggressive driving frequency is actually increasing is not conclusive (Sullman & Stephens, 2021).

Despite evidence that aggressive driving contributes to negative traffic safety outcomes and is prevalent, definitions of aggressive driving vary, and the lack of a shared and widely used definition contributes to difficulty understanding this behavior as a distinct form of risky driving and challenges in developing effective strategies.

The proposed research project sought to address these gaps with a two-phase project. This report summarizes tasks 1- 3 of Phase 1 of this project. Phase 1 of this project included a literature review to define aggressive driving, a contextual model to explain its occurrence, a survey of road users to further refine the definition and operationalization of aggressive driving behaviors and refine potential points of intervention as presented in the contextual model, and a resource created for traffic safety practitioners about ways to bolster their current traffic safety efforts to address aggressive driving. The information gathered in Phase 1 may be applied in a Phase 2 project where media messages and bystander strategies will be developed and tested to prevent and reduce the incidence of aggressive driving behavior.

2 TASK 1 – LITERATURE REVIEW

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

- compare common definitions of aggressive driving,
- understand factors contributing to aggressive behavior,
- explore models of aggressive behavior, and
- identify ways to reduce aggressive driving to inform the development of an effective intervention.

A summary of the literature review of aggressive driving is provided. In addition to the literature review, Task 1 also includes the development of a definition of aggressive driving and a contextual model to explain aggressive driving.

2.1 Materials and Methods

A keyword search using Google Scholar, TRID database, and Montana State University's Library search engines ("Academic Search Complete," and "EBSCO") was completed. Word search and phrase combinations were used to obtain aggressive driving definitions, factors contributing to aggressive driving behavior, aggressive driving contextual models, and interventions to reduce aggressive driving. The search was limited to articles that were written in English. Once articles were reviewed for relevance, additional key words were used to narrow the search. Additionally, reference lists of relevant articles were also reviewed for articles that may have been missed with the key word searches.

2.2 Defining Aggressive Driving

Aggressive driving is an umbrella term often used to describe a variety of risky driving behaviors (e.g., speeding, tailgating, failing to yield, preventing others from passing, running stop signs and red lights). Aggressive driving is also commonly used to describe a driver's affective motivation (e.g., annoyance, hostility, anger, impatience) to engage in risky driving behaviors.

Various definitions of aggressive driving have been developed, but consensus has not been reached. Some definitions of aggressive driving emphasize a driver's intentions to engage in risky behaviors. For example, according to the AAA Foundation for Traffic Safety (2022), aggressive driving is "any unsafe driving behavior, performed deliberately and with ill intention or disregard for safety" (p.1). However, other definitions have suggested that aggressive driving includes "any dangerous driving behaviors regardless of intent" (Hennessy, 2011, p. 151). The National Highway Traffic Safety Administration (2004) defines aggressive driving as "a combination of moving traffic offenses so as to endanger other persons or property" (p. 1). But this definition conflates "aggressive," "unlawful," and "risky" driving without explaining the etiology of these behavior categories. Shinar (2017) defines aggressive driving behavior as behaviors that are driven by frustration and "behaviors which are manifested in (a) inconsiderateness toward or annoyance of other drivers... and (b) deliberate dangerous driving to save time at the expense of others..." (p. 475). With such varying definitions, a consistent and widely used definition of aggressive driving has not been well established making it difficult to

know what is meant by “aggressive” and whether this label describes the state of the driver or the effect of the behavior.

Further, a wide variety of behaviors have been categorized as “aggressive” including behaviors like purposefully tailgating, failing to yield, preventing others from passing, running stop signs, yelling or honking, pulling into a parking space someone else is waiting for, glaring at other drivers, using profanity or obscene gestures, abruptly braking, and cutting off other drivers in traffic on purpose (AAA Foundation for Traffic Safety, 2016; Soole et al., 2011). Other affective descriptors of aggression have included “pushy, selfish, and inpatient” (Neuman et al., 2003, pp. 1–2). In categorizing aggressive driving behaviors, one attempt has been to distinguish between two forms of aggressive behavior: instrumental and hostile (Shinar, 2017). Instrumental aggression includes behaviors that a person “assumes will help them move ahead and overcome the frustrating obstacle” (Shinar, 2017, p. 476). Typical instrumental aggressive behaviors include behaviors like “honking the horn at other road users blocking the road, weaving in and out of traffic, ‘cutting’ in front of other drivers, and running red lights” (Shinar, 2017, p. 476). Hostile aggression includes “actions that make us feel better without necessarily solving the problem” and include behaviors that are “aimed at hurting the person or thing that is frustrating us” (Shinar, 2017, p. 476).

The types of behaviors that are said to constitute aggressive driving can be placed on a continuum where aggression in driving can range from mild gestures meant to communicate with another driver like swearing, honking the horn, or flashing the lights, to more intense displays of behavior that are meant to cause harm like purposefully slowing down in front of someone or forcing someone off the road (Lennon & Watson, 2011; O’Brien et al., 2004; Soole et al., 2011). Recently, researchers have categorized aggressive behaviors into three classifications reflecting this continuum: minor aggression (e.g., swearing, honking the horn, etc.), aggressive violations (e.g., tailgating, speeding, weaving in and out of traffic, etc.), and road rage (e.g., extreme acts of violence, physical assaults against another road user, etc.) (Sullman & Stephens, 2021).

A review of the literature to identify common definitions of aggressive driving was completed. Table 1 includes definitions of aggressive driving and examples that sought to operationalize the definition when included by the author(s). Aggressive driving has sometimes been used interchangeably with other constructs like road rage and driving anger (Nesbit et al., 2007; Soole et al., 2011). A brief review of definitions and examples for these terms is also included in Table 1. For this review, we distinguish road rage from aggressive driving as other researchers have done by associating road rage with criminal behaviors punishable by law (Alonso et al., 2019). Road rage has been defined as “extreme acts of violence punishable as a criminal offense, which includes physical assault;” thus we do not interchange road rage with aggressive driving and instead treat road rage as a different construct (Sullman & Stephens, 2021, p. 122). Further, driving anger is defined as an emotional arousal of frequent and intense anger in driving-related contexts (Deffenbacher et al., 1994). While the experience of driving anger (the emotional arousal) may be an important predictor of aggressive behaviors on the road, the construct of driving anger does not include the actions of aggressive driving behavior, thus is a distinct construct. Aggressive driving is also distinct from risky driving, which is a broader term used to describe unsafe driving behaviors (Tasca, 2000). Risky driving includes behaviors like not

wearing a seat belt or driving after drinking alcohol but does not include honking the horn or making an angry gesture (Tasca, 2000). While many aggressive driving definitions have been proposed, a uniform and consistently utilized definition has yet to emerge (Wang et al., 2022).

Table 1

Common Definitions of Aggressive Driving and Similar Constructs

Construct	Definition	Examples Provided	Country/Context	Source
Aggressive Driving	"Any unsafe driving behavior, performed deliberately and with ill intention or disregard for safety."	Speeding in heavy traffic; Tailgating; Cutting in front of another driver and then slowing down; Running red lights; Weaving in and out of traffic; Changing lanes without signaling; Blocking cars attempting to pass or change lanes; Using headlights or brakes to "punish" other drivers	United States and Canada/ A not-for-profit organization of motor clubs	(AAA, 2022, p. 1)
Aggressive Driving	"Driving actions that markedly exceed the norms of safe driving behavior and that directly affect other road users by placing them in unnecessary danger."	Aggressive driving may involve driver anger, attempts to gain an advantage over other drivers, and deliberate violations and deviations from normal traffic speeds (Neuman et al., 2003). Not every moving violation is considered to be aggressive driving. However, violations that encroach on others' safe space, such as driving much faster than prevailing speeds, following too closely, making unsafe lane changes, and running red lights, either on one occasion or over a period of time, may indicate a pattern of aggressive driving.	United States/ National Highway Traffic Safety Administration	(Venkatraman et al., 2021, pp. 3–5)
Aggressive Driving	"A behavioral construct that includes behaviors such as tailgating, running a red light, cutting another driver off, etc."		United States/ Research/ Department of Psychological Sciences, Purdue University	(Nesbit et al., 2007, p. 158)
Aggressive Driving	"Operating a motor vehicle in a selfish, pushy, or impatient manner, often unsafely, that directly affects other drivers."	Driving or attempting to drive at a speed different than the prevailing speed and maneuvering so that others are directly affected. Directing verbal or nonverbal expressions of anger toward other drivers designed to encourage retaliation on the part of other drivers.	United States/ Transportation Research Board/ Research Sponsored by the American Association of State Highway and	(Neuman et al., 2003, p. II–1)

	"They also concluded that aggressive driving, in most cases, results from interaction between the driver and the driving environment."	Deliberately ignoring traffic controls, especially by increasing speed or failing to slow for the controls. Driving in a way that attempts to gain an advantage over other drivers (e.g., appearing to be taking an unfair advantage or breaking notions of equity such as violating ramp meters and driving on the shoulder).	Transportation Officials in Cooperation with the Federal Highway Administration	
Aggressive Driving	"Any behavior that interferes with the movement of other drivers or pedestrians."	Honking, cutting across one or more lanes in front of other vehicles, and passing on the shoulders	Israel and United States/ Ben Gurion University of the Negev and National Highway Traffic Safety Administration, US Department of Transportation	(Shinar & Compton, 2004, p. 429)
Aggressive Driving	Posits that aggression at its foundation is a "consequence of frustration" and "...that all aggressive behaviors are instigated by a frustrating situation, behavior, or event" "A syndrome of frustration-driven instrumental behaviors which are manifested in: (a) inconsiderateness towards or annoyance of other drivers (tailgating, flashing lights, and honking at other drivers), and (b) deliberate dangerous driving to save	Instrumental aggressive behaviors include "all of the driving behaviors that the aggressor assumes will help him/her move ahead and overcome the frustrating obstacle. Typical behaviors can be honking the horn at drivers blocking the path, weaving in and out of traffic, cutting in from of other drivers, and running red lights." (p. 139) Hostile behaviors are the kind that make us "feel better" without really solving the problem. They are a means to vent anger... They are actually aimed at hurting the frustrater, and in the context of driving they fall under the category of road rage. (p. 139)	Israel/ Ben Gurion University of the Negev	(Shinar, 1998, pp. 138–139)

	time at the expense of others (running red lights and stop signs, obstructing path of others, weaving)" Distinguishes between two forms of aggressive driving: instrumental or hostile.			
Aggressive Driving	"a syndrome of frustration-driven instrumental behaviors which are manifested in (a) inconsiderateness toward or annoyance of other drivers... and (b) deliberate dangerous driving to save time at the expense of others..."	Examples of inconsiderateness toward or annoyance of other drivers includes – tailgating, flashing lights, and honking at other drivers Examples of deliberate dangerous driving include purposefully running red lights and stop signs, obstructing path of others, weaving Note that definition "does not include speeding, because speeding – by itself – is not a behavior that is either directed at or inconveniences other drivers"	Israel/ Ben Gurion University of the Negev	(Shinar, 2017, p. 475)
Driver Aggression	"any behaviour directed at another road user and intended to cause a negative physical or psychological impact (such as injury, distress or discomfort, even if only mild) in an attempt to achieve a goal and that is accompanied by negative affect such as anger or rage."		Australia and United States/ Research/ Centre for Accident Research and Road Safety – Queensland, Brisbane / University of Michigan Transportation Research Institute, Michigan	(Soole et al., 2011, p. 75)

Aggressive Driving	"a driving behavior is aggressive if it is deliberate, likely to increase the risk of a collision, and is motivated by impatience, annoyance, hostility, and/or an attempt to save time"	Specific behaviors that constitute aggressive driving: "tailgating, weaving in and out of traffic, improve passing, passing on the road shoulder, improper lane changes (failure to signal), failure to yield the right of way to other road users, preventing other drivers from passing, unwillingness to extend cooperation to motorists unable to merge or change lanes due to traffic conditions, driving at speeds far in excess of the norm which results in frequent tailgating, frequent and abrupt lane changes, running stop signs, running red lights" "Displays of annoyance or hostility… likely to intimidate, irritate, anger or provoke… and serve as indicators of the underlying motivation: flashing headlights, sustained horn-honking, glaring at another driver to show disapproval, yelling, gesturing"	Canada/ Research/ Ontario Advisory Group on Safe Driving Secretariat Road User Safety Branch Ontario Ministry of Transportation	(Tasca, 2000, pp. 2–3)
Aggressive Driving	"any behavior emitted by a driver while driving, that is intended to cause physical and/or psychological harm to any sentient being"	Researchers contend that "a definition of aggressive driving that includes intention to harm is essential"	United States/ Research/ Department of Psychology, University of Memphis and Virginia Polytechnic Institute and State University	(Dula & Geller, 2003, p. 565)
Aggressive Driving	"any driving behavior that intentionally (whether fueled by anger or frustration or as a calculated means to an end) endangers others psychologically, physically, or both"	Tailgating, horn honking, traffic weaving, excessive speeding, profanity, obscene gestures, headlight flashing, red-light running, and blocking the passing lane.	United States/ National Highway Traffic Safety Administration and Colorado State University	(Ellison-Potter et al., 2001, p. 432)

Aggressive Driving	"Aggressive driving was defined as comprising three essential qualities: that the behavior is intentional in nature; that it is intended to have an impact on the other driver; and that this impact is intended to be negative." Note: This definition is based on the General Aggression Model	"The intensity of the intended impact can vary from fairly mild, for instance psychological discomfort, to the very severe, which might be potentially life threatening (e.g., forcing someone off the road)."	Australia/ Centre for Accident Research and Road Safety, Queensland, Brisbane	(Lennon & Watson, 2011, p. 2201)
Aggressive Driving	"any form of driving behavior that is intended to injure or harm other road users physically or psychologically"		United Kingdom/ Research/ University of Manchester	(Lajunen et al., 1998, p. 108)
Road Rage	"Hostile (vs instrumental) behaviors that are purposefully directed at other road users. These can be either driving behaviors (e.g., purposefully slowing a following vehicle or colliding with a lead vehicle) or non-driving behaviors (e.g., physically attacking someone)."		Israel/ Ben Gurion University of the Negev	(Shinar, 1998, p. 139)
Road Rage	"Hostile behavior that is purposefully directed at other road users"	"Road rage can manifest itself in either driving behaviors (e.g., purposefully slowing in front of a following vehicle or purposefully hitting another vehicle) or non-driving behaviors (e.g., physically attacking someone, such as a driver of another vehicle)"	Israel/ Ben Gurion University of the Negev	(Shinar, 2017, p. 475)
Road Rage	"Extreme cases of aggressive driving can escalate to road rage."	Cursing and rude or obscene gestures; Throwing objects; Ramming; Sideswiping; Forcing a driver off the road	United States and Canada/ A not-for-profit organization of motor clubs	(AAA, 2022, p. 1)

Driving Anger	“Frequent and intense anger while operating a motor vehicle”		United States/ Research/ Colorado State University	(Deffenbacher et al., 1994, p. 84)
Driving Anger	“A situation-specific emotional construct comprised of anger-related feelings and thoughts that occur while driving”		United States/ Research/ Department of Psychological Sciences, Purdue University	(Nesbit et al., 2007, p. 158)

2.3 Toward a Common Definition of Aggressive Driving

To avoid the pitfalls and previous criticisms of aggressive driving definitions (i.e., that they are generalized and all encompassing), a number of researchers advise having a definition that is specific and that distinguishes aggressive driving behaviors from other risky or dangerous driving behaviors, captures the essence of the driver's intentions, and accounts for the appraisal process motivating the aggressive behavior of the driver (Baron, 1977; Dula & Geller, 2003; Soole et al., 2011; Tasca, 2000). Further, the context in which the behavior occurs is a consideration in defining aggressive driving. Clarifying the following defining elements is important in developing a common definition of aggressive driving: aggression as a behavior not an emotion, the driver's intention, and the context.

Aggression as a Behavior, Not an Emotion

Previous attempts to define aggressive driving have included direct behaviors and affective states to describe aggressive driving. In defining aggression generally, it has been suggested that one's emotions and attitudes may or may not accompany aggressive behaviors, thus "aggression should be viewed as a form of behavior, not as an emotion, a motive, or an attitude" (Baron, 1977, p. 7). "Aggression is an observable behavior" that "requires action;" thinking about making an aggressive move or feeling angry is not aggression (Allen & Anderson, 2017, p. 1). In line with this thinking, we propose limiting aggressive driving to specific forms of behavior, not specific cognitions or feelings.

Driver's Intention

A driver's intention appears to be critical in distinguishing aggressive driving behaviors from other risky or dangerous behaviors (Baron, 1977; Dula & Geller, 2003). Some researchers suggest that malicious intent or intent to harm is a key feature of aggressive driving (Ge et al., 2016; Mohammadpour & Nassiri, 2021) while other researchers have argued that not all aggressive driving behaviors are ill or maliciously intended (Alonso et al., 2019; Lennon & Watson, 2015). For example, Mohammadpour and Nassiri (2021) suggested that malicious intent is of critical importance when defining aggressive driving because without malicious intent, the same behavior could be considered reckless driving behavior. Other researchers have similarly argued that an individual's intent to harm others is a defining feature of aggressive driving behavior and separates this behavior from other risky or dangerous driving behaviors (Ge et al., 2016; Soole et al., 2011). This line of thinking, that aggression includes the intent to cause harm, is common in definitions of aggressive behavior in general (Allen & Anderson, 2017). Researchers have suggested that "aggressive behavior must be intended to harm" and that a behavior, regardless of whatever harm occurs as a result, would not be considered aggressive if there was no intentionality (Allen & Anderson, 2017, p. 1). While negative intentionality is a generally accepted element of aggressive behavior in general, negative intent seems to garner more dialogue and controversy when including it in definitions of aggression that are specific to a context like driving (Soole et al., 2011).

Among those behaviors that might be considered aggressive without negative intent, Lennon and Watson (2015), found that some people who engage in aggressive driving behaviors do so to

instruct or "teach a lesson," without negative intention (Lennon & Watson, 2015). Engaging in aggressive driving behaviors "does not necessarily imply a conscious attempt against the safety of others" (Alonso et al., 2019, p. 416). A driver's intentions are not easily observable but considered an "inner state of the driver" that must be inferred (Xu et al., 2022, p. 5). While driver intention is often identified as an important factor in aggressive driving, intention is often left out of models to predict aggressive driving even though there is some research suggesting that capturing the driver's intention in a model to predict aggressive driving does add to the performance of the model (Xu et al., 2022). We propose that negative intentionality is an important feature to be captured in a definition of aggressive driving. A driver's intentions to engage in aggressive behaviors while driving may provide insight into understanding a driver's motivations and ultimately what interventions may be needed (Lennon & Watson, 2015).

Aggressive Driving Behavior in the Context of Others

Finally, we believe that a definition of aggressive driving must be situated within the context of others. Thus, a behavior is not considered aggressive if it does not occur in the context of another person (e.g., another driver, a pedestrian, etc.). Speeding, for example, may be considered aggressive driving behavior when it impacts other road users (i.e., the other driver must slow down or move over). However, speeding on a highway or isolated road with no other road users would not constitute aggressive driving behavior but instead would be considered risky or careless. This distinction, that aggressive driving behaviors occur within the context of others, may offer additional clarity on what behaviors are considered aggressive and what behaviors are not.

Proposed Definition of Aggressive Driving

In consideration of these elements and toward a common definition of aggressive driving behavior, we propose that the AAA Foundation's definition of aggressive driving as "any unsafe driving behavior, performed deliberately and with ill intention or disregard for safety" (AAA, 2022, p. 1) provides a strong foundation but requires an important addition. We propose that the definition must account for the behavior in the context of others. Without this important contextual addition, a behavior such as not wearing a seat belt would meet the definition of aggressive driving. We acknowledge that the context of others might be assumed in the AAA Foundation definition and argue that explicitly adding the element of others to the definition adds clarity in distinguishing aggressive driving behaviors from those that are risky, but not aggressive.

Thus, we propose the following definition of aggressive driving, building on the AAA Foundation's definition: ***Any unsafe driving behavior that is performed deliberately, with ill intention or disregard for safety, and impacts others.***

Practical Implications

A common definition of aggressive driving may be useful for researchers studying the aggressive driving construct. A clear and well-established definition can make it easier to know exactly what behavior is being studied and can help researchers to distinguish aggressive driving

behavior from other similar behaviors. Further, a common definition can provide a foundation for a growing body of literature that seeks to measure this construct and to develop interventions that may reduce the prevalence of this behavior. Our proposed definition includes elements that cannot be known through observation alone, notably that the behavior is deliberate and performed with ill intention or disregard for safety. We believe these to be critical components of aggressive driving and serve purposes to differentiate aggressive driving from other risky or dangerous driving behaviors. However, since most crash and other traffic safety data do not contain these elements, the definition we propose may not be well-suited for analysis of available crash data. Given the complexity of aggressive driving behavior, a common definition and operationalization offers benefits even if it cannot be universally applied to existent data. One such benefit may be informing new data collection activities or changes to data routinely collected in order to capture elements of aggressive driving.

2.4 Factors Contributing to Aggressive Driving

Aggression has been framed as a personality characteristic of a person, a response to a specific situation, and a combination of both (Shinar, 2017). Further, aggressive driving has been considered a "contextual violation" with two prevailing contexts that influence aggressive driving behavior: "the driver's physical and psychological state (background and current condition) and the roadway environment" (Neuman et al., 2003, p. I–2). In other words, both the characteristics of the driver and the driving situation contribute to aggressive driving behaviors (Allen & Anderson, 2017; Anderson & Bushman, 2002; Sullman & Stephens, 2021). Accordingly, in attempting to understand aggressive driving, researchers have focused on exploring both the individual factors of the driver and the situational factors that may contribute.

2.4.1 Individual Factors Contributing to Aggressive Driving

Many studies have examined characteristics of drivers that may be related to aggressive driving (Dahlen et al., 2005; Dahlen & White, 2006; Kovácsová et al., 2014, 2016; Lin, 2013; Moore & Dahlen, 2008; Nesbit et al., 2007). Individual factors included in this review are personality traits (i.e., propensity for sensation seeking and impulsiveness, one's disposition toward boredom, one's ability to consider future consequences, forgiveness, and trait anger), one's emotions (i.e., affect state/mood, emotional intelligence), and one's cognitions (i.e., cognitive appraisals, perceptions, locus of control, cognitive bias).

2.4.1.1 Personality Traits

2.4.1.1.1 Sensation Seeking, Impulsivity, and Boredom Proneness

Sensation seeking is defined as "a trait characterized by the pursuit of novel, diverse, and extreme experiences" (Hennessy, 2011, p. 150). Sensation seeking in relationship to risky driving behaviors, including aggressive driving, has been studied quite extensively in the literature (Dahlen et al., 2005; Lin, 2013). Similar to sensation seeking, **impulsivity** is defined 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). Like sensation seeking, impulsivity has been associated with a variety of risky driving behaviors including aggressive driving (Dahlen et al., 2005; Lin, 2013). One study suggested that "impulsivity had a moderate capacity to predict the degree of anger expressed by drivers" (Mirón-Juárez et al., 2020, p. 79). Further, both mild and extreme forms of aggressive driving behavior have been found to be positively correlated with impulsivity (Kovácsová et al., 2016).

Another study explored the association between four personality traits (sensation seeking, impulsivity, consideration of future consequences, and anger or temper arousal) and aggressive driving (Lin, 2013). Results showed both sensation seeking and impulsivity influenced aggressive driving (Lin, 2013). Further, sensation seeking, impulsivity, and consideration of consequences were mediated by the trait of anger arousal on aggressive driving (Lin, 2013). Thus, one's ability to manage anger arousal may be an important leverage point in finding ways to reduce aggressive driving (Lin, 2013).

While receiving less attention than sensation seeking and impulsivity, **boredom proneness** (i.e., one's tendency to experience feelings of boredom or disinterest) has also been associated with aggressive driving behaviors (Dahlen et al., 2005). In one study of the relative contributions of driving anger, sensation seeking, impulsiveness, and boredom proneness in the prediction of aggressive and risky driving, results showed that while driving anger explained the most variance in unsafe driving behaviors, all three of the additional personality traits were also important predictors of aggressive and risky driving (Dahlen et al., 2005).

Stephens and Sullman (2015) tested a model of driving behaviors that examined the contributions of sensation seeking, impulsivity, driving anger, and boredom proneness on the prediction of aggressive driving and whether aggressive driving predicted crash-related outcomes. Unlike Lin (2013) and Dahlen and colleagues (2005), results from this study showed that sensation seeking and boredom proneness were not associated with aggressive driving expression; however, anger and impulsivity were significant predictors of aggressive driving expression (Stephens & Sullman, 2015). Then, aggressive driving mediated the relationship between those personality factors and crash-related outcomes (Stephens & Sullman, 2015). "There were no significant direct relationships between driving anger, sensation seeking, boredom proneness, and impulsivity on crash-related behaviors" (Stephens & Sullman, 2015, p. 1741).

2.4.1.1.2 Consideration of Future Consequences and Forgiveness

While much research has focused on the dispositional and personality characteristics likely to increase aggressive driving, there is also research that has focused on identifying characteristics likely to reduce aggressive driving (Moore & Dahlen, 2008). **Consideration of consequences** (i.e., one's ability to consider the future implications of their behavior) (Moore & Dahlen, 2008) and **forgiveness,** "both as a response to a specific transgression and as an individual's tendency to forgive," have received some research attention (Kovácsová et al., 2014, p. 304).

One's tendency to consider the future consequences of their behavior is associated with less aggressive driving and driving anger expression (Moore & Dahlen, 2008). Similarly, the

forward-looking nature of considering future consequences was "positively related to the adaptive/constructive expression of driving anger" (Moore & Dahlen, 2008, p. 1663).

Forgiveness is an "emotion-focused coping strategy," that can counter a stressful emotional reaction to perceived injustice (Worthington & Scherer, 2004, p. 385). Within an aggressive driving context, forgiveness might help a driver overlook the transgressions of another driver or reframe the situation in a more neutral way. The impact of trait forgiveness in aggressive driving was explored, and it was found that trait forgiveness (i.e., one's general willingness to forgive others) contributed to the prediction of aggressive driving and driving anger expression (Moore & Dahlen, 2008). Specifically, researchers found that trait forgiveness was inversely related to driving anger, aggressive driving, risky driving, and maladaptive forms of driving anger expression. Further, trait forgiveness was positively correlated with adaptive/constructive driving anger expression such as thinking the situation through before responding (Moore & Dahlen, 2008).

In another study, the relationships between trait forgiveness and aggressive driving, driving anger, hostility and other negative emotions, and aggression were explored (Kovácsová et al., 2014). Like other research (Moore & Dahlen, 2008), trait forgiveness had a negative relationship to aggressive driving (Kovácsová et al., 2014). However, driving anger was a mediator of the relationship between trait forgiveness and aggressive driving. It was suggested by the researchers that promoting forgiveness may not be the most effective strategy to reduce aggressive driving behavior (Kovácsová et al., 2014).

Bumgarner and colleagues (2016) sought to expand on previous findings (Kovácsová et al., 2014; Moore & Dahlen, 2008) regarding the relationship between forgiveness and aggressive driving behavior by looking at specific dimensions of forgiveness (i.e., forgiveness of self, forgiveness of others, and forgiveness of uncontrollable situations), aggressive driving and driving anger, and adverse driving outcomes. Consistent with previous findings, a significant negative relationship was found between each dimension of forgiveness and driving anger, negative driving anger expression, and aggressive driving behaviors (Bumgarner et al., 2016). "Forgiveness of others and of uncontrollable situations was found to have a significant indirect only effect on traffic violations through the mediators of driving anger and aggressive driving" (Bumgarner et al., 2016, p. 317). None of the dimensions of forgiveness were directly associated with the adverse driving outcomes (motor vehicle crashes or traffic violations) (Bumgarner et al., 2016).

Research shows that both mild and extreme forms of aggressive driving behavior may be negatively correlated with trait forgiveness (Kovácsová et al., 2016). In other words, more forgiving drivers were less likely to engage in aggressive behaviors than drivers whose scores on trait forgiveness were lower (Kovácsová et al., 2016). Further, experiencing negative affect (i.e., anger, hostility, nervousness, upset) in situations that could elicit aggression on the road contributed to aggressive behavior, but this effect was buffered by forgiveness (Kovácsová et al., 2016). The researchers suggested that strategies focused on promoting forgiveness may mitigate negative affect and may, in turn, reduce aggressive behaviors on the road that are motivated by these negative emotions (Kovácsová et al., 2016) .

2.4.1.1.3 Trait Anger

In the context of understanding aggressive driving, negative emotions have been a key focus of research, and many researchers have found a relationship between negative emotions and aggressive driving (Dahlen & Ragan, 2004; Deffenbacher et al., 2001; Kovácsová et al., 2016; Nesbit & Conger, 2012). Anger, for example, has been studied extensively. **Trait anger** is considered a stable personality disposition (Nesbit et al., 2007). In relationship to driving, trait driving anger "refers to the propensity or tendency to become angry while driving" (Deffenbacher et al., 2003, p. 334). Several studies have found that drivers high in trait driving anger engage in more aggressive driving behaviors (Dahlen & Ragan, 2004; Deffenbacher et al., 2001; Nesbit et al., 2007).

One study found that "those reporting higher amounts of aggressive driving were 2.88 times more likely to report a problem with anger than those reporting lower amounts of aggressive driving" (Nesbit & Conger, 2012, p. 713). Another study found that "compared to low anger drivers, high anger drivers reported elevated trait anxiety and anger and were more likely to express their anger generally in outward, negative, less controlled ways." (Deffenbacher et al., 2003, p. 347).

2.4.1.2 Emotions

2.4.1.2.1 Affective State

A person's current mood or **affective state** influences a person's appraisal and decision-making processes (Allen & Anderson, 2017). According to the General Aggression Model, affect is considered one part of a person's internal state along with a person's cognitions and arousal, which can encourage or discourage aggressive behavior (Allen & Anderson, 2017). Anger is a common affect associated with aggression, and while anger can be considered a stable and enduring personality trait, anger is also a transient emotional state (Deffenbacher et al., 2001; Nesbit et al., 2007). State/mood-based anger "refers to angry feelings and physiological arousal in response to a specific driving event" (Deffenbacher et al., 2003, p. 334). Feelings of anger can induce a physiological response like a rapid heart rate or muscle tension (Deffenbacher, 2016). Higher levels of state anger are positively associated with aggressive driving (Deffenbacher et al., 2001; Nesbit et al., 2007). Other transient emotions like hostility, nervousness, and upset may also contribute to a driver's aggressive response on the road (Kovácsová et al., 2016). For example, in one study, researchers found that "negative affect (being angry, hostile, nervous, and upset) was positively associated with aggressive driving, whereas inward emotions (being ashamed and afraid) were not significantly associated with aggressive driving" (Kovácsová et al., 2016, p. 297). One's affective state is considered a key feature of aggressive driving behaviors and can help distinguish aggressive driving behaviors from other risky or dangerous behaviors (Soole et al., 2011). Teaching drivers how to control their negative affect may be an important intervention in reducing aggressive driving (Kovácsová et al., 2016).

2.4.1.2.2 Emotional Intelligence

Evidence exists regarding the relationship between emotional intelligence and risky driving, driving violations, and driving errors (Hayley et al., 2017; Sani et al., 2017; Smorti et al., 2018).

Emotional intelligence refers to a person's abilities and skills that help them recognize emotions in themselves and others, use emotions to guide thinking, understand their own and others' emotions, and manage emotions (Mayer et al., 2004). In a variety of studies measuring emotional intelligence in different ways, there is a consistent pattern associating lower emotional intelligence with greater risky driving and more driving violations and errors. Whether this relationship extends to aggressive driving specifically is less clear considering the variety of definitions used and variation in operationalizing aggressive driving.

A small number of studies have examined emotional intelligence and driving behaviors while differentiating risky from aggressive driving. One such study found emotional intelligence predicts risky driving but not aggressive driving behaviors (Hayley et al., 2017). Another, recent study explored the predictive value of four different subscales of emotional intelligence (i.e., emotionality, self-control, sociability, and well-being) on risky, aggressive, and emotional driving as distinct types of driving behaviors. Results showed the emotionality subscale was the most significant predictor of all three types of driving behaviors, such that better emotional perception and expression ability was associated with less risky, aggressive, and emotional driving. Additionally, aggressive driving was also predicted by the well-being subscale such that drivers with greater well-being engaged in less aggressive driving (Ahmed et al., 2022).

2.4.1.3 Cognitions

2.4.1.3.1 Cognitive Appraisals and Perceptions

One's **cognitive appraisal** of a situation and its influence on behavior plays an important role in understanding aggressive driving (Ge et al., 2016; Lennon & Watson, 2011). It has been suggested that a primary trigger for aggressive driving may be one's cognitive appraisal of a situation (Lennon & Watson, 2011). In other words, how a driver thinks about a road situation can influence their response and the ultimate outcome. Drivers' aggressive or maladaptive cognitions, cognitive motivations, perceptions of the other drivers' behaviors, and cognitive biases may influence their tendencies to engage in aggressive behaviors when driving.

Some common cognitive anger-increasing thoughts include: "(a) catastrophizing (e.g., This is awful!); (b) overgeneralizing (e.g., There's always a billion people on the road.); (c) inflammatory labeling (e.g., Dumb ass!); (d) demanding (e.g., He should get out of my way.); (e) images and thoughts of revenge (e.g., He can't do that to me. I'll do that to him and see how he likes it.); (f) hostile attributional bias (e.g., He did that on purpose.); and (g) anger- and aggression-supportive beliefs (e.g., He deserves to be run off the road.)" (Deffenbacher, 2016, p. 414). Maladaptive or anger-increasing cognitions can influence aggressive driving behavior (Ge et al., 2016; Nesbit & Conger, 2012). For example, Nesbit and Conger (2012) found that maladaptive thinking (angry thoughts) predicted aggressive driving behaviors. Specifically, drivers who reported higher aggressive driving behaviors reported higher levels on various subscales of the Driving Angry Thoughts Questionnaire (DATQ) including pejorative labeling and verbally aggressive thinking, revenge and retaliatory thinking, and physically aggressive thinking (Nesbit & Conger, 2012).

Similarly, in another study, three forms of aggressive thinking were identified (physically aggressive thinking, revenge and retaliatory thinking, and pejorative labeling and verbally aggressive thinking) and found to be positively correlated with dangerous driving behaviors (Ge et al., 2016). Like previous research, "revenge and retaliatory thinking were the most important factors in predicting aggressive driving behavior" (Ge et al., 2016, p. 369). In this study, aggressive thinking mediated the effect of driving anger on dangerous driving behaviors (Ge et al., 2016).

Drivers' maladaptive cognitions influence their behaviors when driving, but there is also research suggesting that **drivers' cognitive motivations and perceptions** of other drivers' behaviors may also influence their tendencies to engage in aggressive behaviors when driving. In a qualitative study to understand the underlying cognitive motivations of drivers engaging in aggressive driving behaviors, one motivation identified was the use of aggressive driving behaviors in attempt to modify the driving of others (Lennon & Watson, 2011). When participants perceived the other drivers' behaviors as likely to be unintentional mistakes or errors, the respondents were more likely to describe their intentions to engage in aggressive behaviors to "inform" the other drivers of their transgressions in hopes that the other drivers would reflect and correct their behavior (Lennon & Watson, 2011). The researchers categorized this motivation as "teaching them a lesson," and while the participants presented their behaviors as benign and not intended to have a negative impact on the other driver, these behaviors did meet the criteria for aggressive driving in the study (Lennon & Watson, 2011).

In addition to being motivated to engage in aggressive driving behaviors to inform other drivers, study participants also described situations that motivated these behaviors as "justified retaliation" (Lennon & Watson, 2011). In these situations, respondents described the other driver's behaviors as intentional and aggressive, thus respondents were motivated to respond or retaliate. Respondents described "choosing actions with the deliberate intention of frustrating, angering, insulting, or denigrating the other driver, or venting their own anger or frustration as a result of another driver's intentional aggression" (Lennon & Watson, 2011, p. 2205).

Driver motivation has been a key construct in developing a typology of an aggressive driver and may be an important leverage point in developing tailored interventions for addressing aggressive driving behavior (Berdoulat et al., 2021). One study developed four different profiles describing drivers' aggression: respectful, aggressive-avenger, aggressive-situational, and aggressive-dominant (Berdoulat et al., 2021). The respectful drivers included those with low levels of aggressive driving. They were highly motivated to respect established traffic rules and did not seem to have anger predispositions. This profile was also associated with the highest average age of participants (Berdoulat et al., 2021). Conversely, the aggressive-avenger profile included drivers characterized by high levels of anger. It was suggested that this cluster of drivers may have a tendency toward high anger arousal, and their aggression may be seen as "an immediate response to interpersonal interactions between drivers that are perceived as incorrect or unfair by the other drivers" (Berdoulat et al., 2021, p. 6).

The aggressive-situational drivers included those with high levels of aggressive driving. It was found that this group of drivers "displays driving aggression underpinned by emotional motives,

in response to the hostile gestures of other drivers." (Berdoulat et al., 2021, p. 7). It was also suggested that the aggressive driving of this group may be closely tied to their "low frustration tolerance. This frustration depends on the way injustice is perceived, and therefore implies moral judgment" (Berdoulat et al., 2021, p. 7). The aggressive-dominant profile of drivers was characterized by high levels of aggressive driving and high levels of anger. Displays of aggression among those in this profile were motivated by "ways to master others or the situation, to have the upper hand" (Berdoulat et al., 2021, p. 7). This profile included the lowest average age and was comprised mostly of men (80%) (Berdoulat et al., 2021).

As identified in this study to develop typologies of aggressive drivers, drivers' perceptions of other drivers' behaviors seem to be an important motivator of aggressive behavior (Berdoulat et al., 2021). Other studies have also looked at the influence of drivers' perceptions of other drivers' behaviors and their influence on aggressive driving behaviors (Deffenbacher, 2016; Lennon & Watson, 2015). Drivers who perceived that other drivers were intentionally driving aggressively or that other drivers were incompetent or dangerous were more likely to have higher driving anger scores and engage in more aggressive driving responses (Lennon & Watson, 2015). In contrast, drivers who had an attributional style that gave others the benefit of the doubt and attributed other drivers' behaviors as "mistakes" had lower driving anger scores and were less likely to respond with aggressive driving behaviors (Lennon & Watson, 2015). Similarly, perceived discourtesy of other drivers was consistently found as eliciting the most anger in studies over the past twenty years of research using the Driving Anger Scale (Deffenbacher, 2016). In other words, what we tell ourselves about the driving behaviors and intentions of others is likely to influence how we think, feel, and respond in the driving situation.

2.4.1.3.2 Locus of Control

Locus of control generally refers to how an individual thinks about how much personal control or lack of control they have over the outcomes of events in their lives (Detert et al., 2008; Özkan & Lajunen, 2005). A person who believes that they have a lot of control over the outcomes of events in their lives is thought to have an orientation toward an internal locus of control whereas a person who believes they have little control over events in their lives and attributes outcomes to chance, fate, outside forces, or powerful others has an orientation toward an external locus of control. The influence of locus of control in relationship to aggressive driving has been explored with results suggesting that a tendency toward external locus of control predicts aggressive driving behaviors (Balogun et al., 2012; Özkan & Lajunen, 2005; Zeyin et al., 2022).

A recent study applied locus of control to driving by using traffic locus of control, which is conceptualized as individuals' perceptions of how much influence they have over driving outcomes (Zeyin et al., 2022). Drivers with greater internal traffic locus of control attribute traffic outcomes to internal attributes such as their driving skills and abilities whereas drivers with greater external locus of control attribute traffic outcomes to external forces such as the weather (Özkan & Lajunen, 2005; Zeyin et al., 2022). The results of the study showed that greater external locus of control was a significant predictor of aggressive driving. Further, traffic locus of control had a moderating effect on the relationships between safe driving climate and driving behaviors (Zeyin et al., 2022). Another study found "drivers who are ascribed whatever

happens to them to external forces beyond their reach or control [external locus of control] are significantly higher in aggressive driving behavior; compared to those who take responsibilities for their actions and accept that they are responsible for whatever happens to them [internal locus of control]" (Balogun et al., 2012, p. 87).

2.4.1.3.3 Cognitive Bias

Finally, in more recent research, the role of **cognitive bias** and its influence on aggressive driving has been a focus. In a recent study, the role of overconfidence as a cognitive bias was studied, and it was found that overconfidence was associated with aggressive driving through aggressive thoughts while driving (Mohammadpour & Nassiri, 2021). Results showed that overconfidence "predicted aggressive thoughts, the number of active MVCs (motor vehicle crashes), the frequency of phone use and traffic violation while driving (driving performance), and driver's risk perception" (Mohammadpour & Nassiri, 2021, p. 182). These results suggest that cognitive biases, like that of overconfidence, may play an important role in driver aggression (Mohammadpour & Nassiri, 2021).

2.4.2 Situational Factors Contributing to Aggressive Driving

Several studies have examined the influence of situational factors on aggressive driving. Galovski and Blanchard (2004) called these "aggressive cues," which accumulate or combine with other ingredients to produce an aggressive response (p. 112). Things that impede driving like traffic congestion, road construction, and red lights are examples of aggressive cues that can contribute to aggressive driving. Included in this review are situational factors that have been found to contribute to aggressive driving including travel impedance, time pressures, and daily stressors.

2.4.2.1 Travel Impedance

Travel impedance is commonly referenced as a primary factor contributing to aggressive driving (Deffenbacher et al., 2016; Shinar, 2017). Travel impedance is defined as "behavioral constraints on movement and goal-directed activity, which is an aversive and frustrating condition" (Galovski & Blanchard, 2004, p. 112). Examples of travel impedance include traffic congestion, red lights, road construction, lower speed limits, roundabouts, etc. Travel impedance can foster frustration and aggression because it blocks the driver from achieving their intended goals (i.e., getting to their destination); travel impedance can also be linked to the pressure of time and generate anger (Deffenbacher et al., 2016).

2.4.2.2 Time Pressure

Time pressure is also a common factor contributing to aggressive driving. Time pressure is defined as a "sense of urgency related to a specific road journey, such as running late for an important meeting" (O'Brien et al., 2004, p. 102). Shinar (2017) found that running red lights was more common in a city perceived to be fast paced than in a city perceived to be slow paced. Further, aggressive driving behaviors like honking were seen more during workdays and work hours than during weekends, and running red lights was more common during the daytime hours than at night (Shinar, 2017). In another study, it was found that the amount of anger experienced

by a frustrating driving situation was affected by having a sense of time pressure (O'Brien et al., 2004). Time pressure can foster angry feelings at oneself for not allowing enough time or choosing a slowed route or can generate angry feelings at others if they are perceived as the source of the time pressure (Deffenbacher et al., 2016).

2.4.2.3 Extraneous Stressors

Everyday stressors including job-related stress and general life stressors can result in aggressive behaviors when driving (Rowden et al., 2011; Turgeman-Lupo & Biron, 2017). For example, in one study, the relationship between different extraneous sources of stress (e.g., work-related stress, stressful life events, daily hassles, etc.), driving behavior, and road safety was investigated (Rowden et al., 2011). In this study, there were positive associations between extraneous stress measures (work-related stress, hassles, and poor general mental health) and several of the Driver Stress Inventory scales, including aggression. These findings highlight the impact that various daily life stressors can have on driving outcomes (Rowden et al., 2011). Looking specifically at workplace stressors and driving behavior, another study found that psychological workplace stressors were significantly associated with riskier commuting safety behaviors (conceptualized as violations, such as speeding and running through an intersection on a yellow or red light) (Turgeman-Lupo & Biron, 2017). While this research did not specifically identify the commuting behaviors (speeding and running through red lights) as aggressive driving behaviors, these behaviors have been operationalized as aggressive behaviors by others (AAA, 2022).

2.5 Aggressive Driving Models

A variety of models have been developed to explain aggressive driving. Included in this review are Shinar's Model of Aggressive Behavior, the General Aggressive Model, a Comprehensive Model of Aggressive Driving, and a model that applied the General Aggressive Model in the context of aggressive driving.

2.5.1 Shinar's Model of Aggressive Behavior

Shinar's Model of Aggressive Behavior, shown in Figure **1**, is based on the frustration-aggression model, originally developed by Dollard and colleagues (1939), which suggests that "aggression is the consequence of frustration" (p. 27) (i.e., a frustration situation or event) and aligns with Ajzen's (2011) theory of planned behavior (Shinar, 1998, 2017). This model accounts for the interacting relationship between the personality characteristics of the driver, the driving situation, and the expression of aggressive driving (Neuman et al., 2003; Shinar, 1998, 2017).

This model has been criticized for relying heavily on the emotion of frustration to evoke aggression and not accounting for other emotions like fear or anxiety that could be triggered by on-road events (Soole et al., 2011). Further, it has been suggested that this model doesn't adequately account for the importance of the cognitive and emotional appraisal process that ensues from a potentially aggressive provoking encounter (Soole et al., 2011). Shinar's Model of Aggressive Behavior has also been criticized as not providing enough latitude in the variation of responses that may be evoked from a frustrating situation; essentially, not all frustrating

situations results in aggressive behavior and there are a variety of factors that may lessen the likelihood that a person will act out aggressively (Soole et al., 2011).

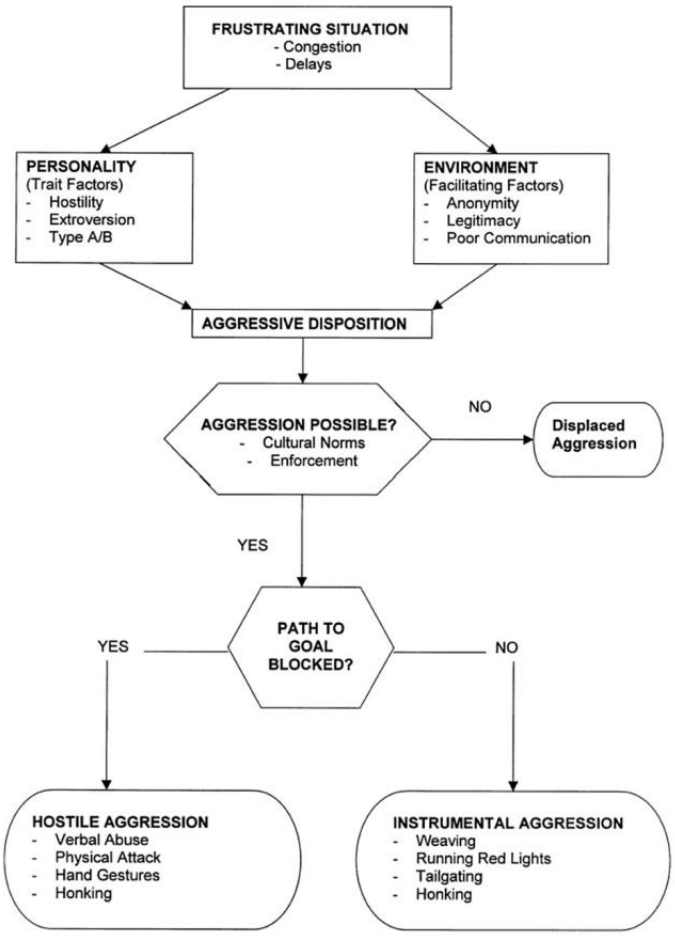

Figure 1. Shinar's Model of Aggressive Behavior (Shinar, 1998, p. 140)

2.5.2 General Aggression Model (GAM)

The General Aggression Model (GAM) has been used as a framework for understanding aggression broadly and in a way that can be applied to a variety of contexts (Allen et al., 2018; Allen & Anderson, 2017; Anderson & Bushman, 2002; Kovácsová et al., 2016; Lin, 2013; Soole et al., 2011). The original GAM developed by Anderson and Bushman (2002) is shown in Figure **2**. Figure **3** shows an updated and expanded version of the GAM developed by Allen and Anderson (2017).

The GAM focuses on a "person in a situation" and includes the interactions of distal causes and processes (biological modifiers, environmental modifiers, and personality) and proximate causes and processes including individual and situational factors (inputs), an individual's current state (thoughts, feelings, current state of arousal) (routes), and their influence on the outcomes or resulting behavioral responses based on the person's appraisal processes (outcomes) (Allen & Anderson, 2017; Anderson & Bushman, 2002). According to this model, the behavioral response

generated may be aggressive or not aggressive depending on the person's appraisal of the situation, their current internal state, what a person brings with them to the current situation, and what their future plans, goals, and expectations are (Anderson & Bushman, 2002).

The GAM integrates five theories of aggression (cognitive neoassociation theory, social learning theory, script theory, excitation transfer theory, and social interaction theory) (Allen et al., 2018; Anderson & Bushman, 2002). It has been suggested that these theories are very good at explaining aggression in specific domains but lack a general and integrative framework for human aggression, thus the GAM seeks to build upon these theoretical foundations and adopt a knowledge structure approach to understanding aggression (Allen & Anderson, 2017). "Knowledge structures: develop from experience; influence perceptions…; can become automatized with practice…; can be linked to or contain affect, behaviors, and beliefs; and can influence interpretations and guide behavior" (Allen & Anderson, 2017, p. 7). Because of the substantial influence that knowledge structures have on our beliefs, decision making processes, and our actions, adopting such an approach can provide insight into understanding the complexities of aggressive behavior and can be used to guide us to potential points of intervention (Allen & Anderson, 2017).

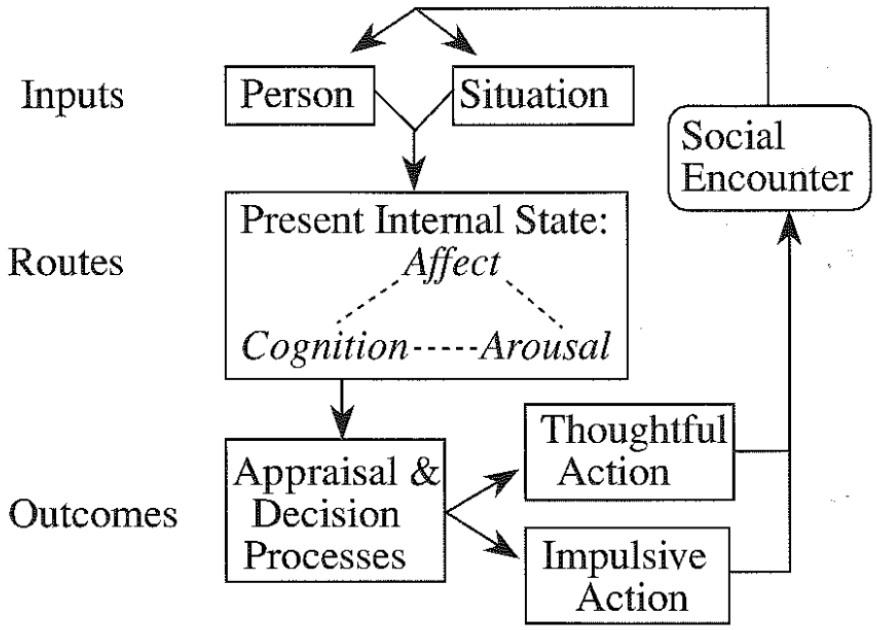

Figure 2. General Aggression Model (Anderson & Bushman, 2002, p. 34)

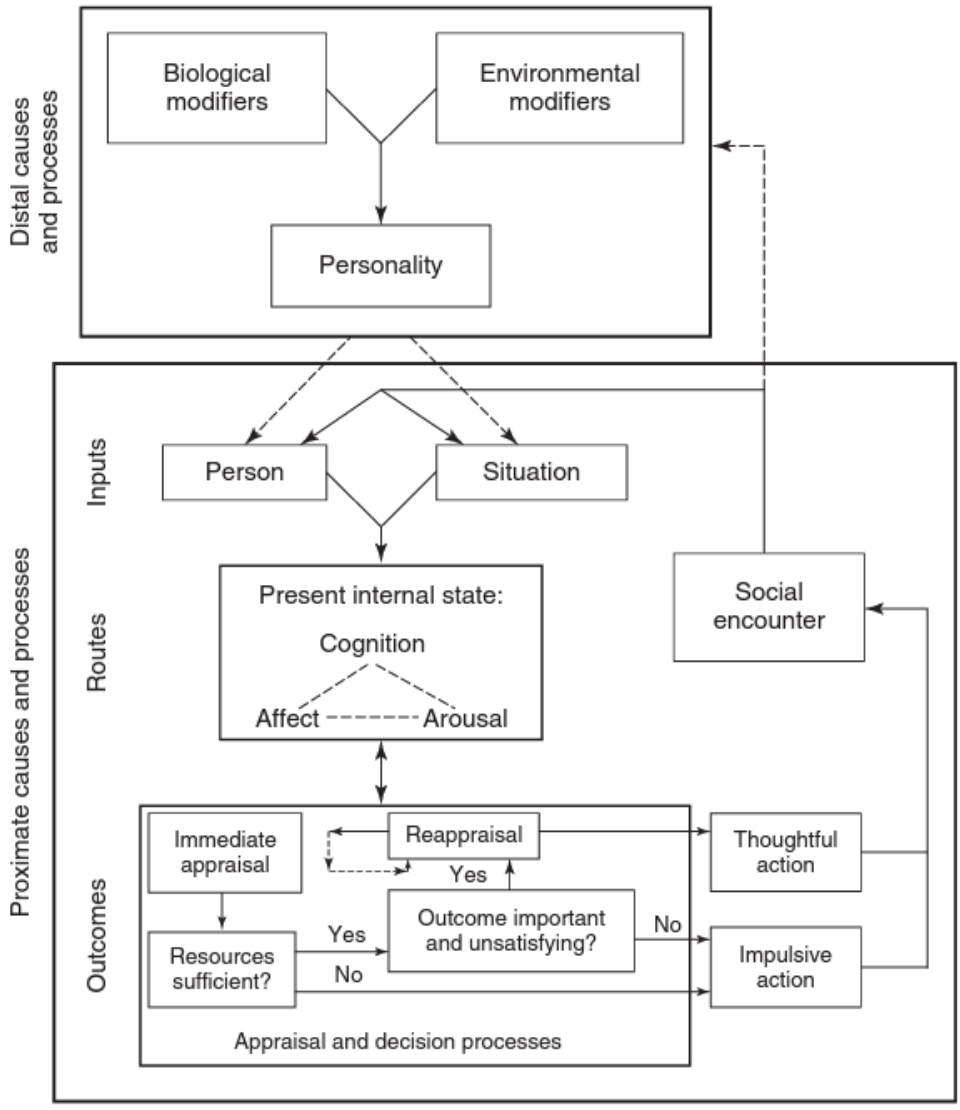

Figure 3. General Aggressive Model (Allen & Anderson, 2017, p. 8)

2.5.3 Applying the GAM to Understand Aggressive Driving

The GAM has been applied as a comprehensive framework for understanding aggression in general and in a driving context to highlight the importance of personal factors, situational factors, and a person's current internal state (cognitions, emotions, and arousal) (Kovácsová et al., 2016). Lin (2013) suggested that the GAM is a helpful framework to explain how personality traits including sensation seeking, impulsivity, and consideration of consequences (traits related to low-self-control) influence aggressive driving. A few studies have looked at the GAM in its entirety in relationship to aggressive driving, but there is extensive literature that extracts components of this model examining them in relationship to aggressive driving (Sullman & Stephens, 2021).

Soole and colleagues (2011) proposed a Comprehensive Model of Aggressive Driving (Figure **4**), which includes elements of Shinar's (1998) driver aggression model and the General Aggression Model (GAM) (Anderson & Bushman, 2002). The process of aggressive driving behavior captured in their Comprehensive Model of Aggressive Driving was discussed:

> Our conceptual model proposes a process beginning with an initial on-road event (e.g., a driver's progress being blocked by a slower vehicle; being cut off). The driver's perceptions of this event are influenced by both person related factors, including traits (e.g. age, gender, long-term goals, trait hostility, beliefs, attitudes) and their internal state (e.g. mood, level of arousal, etc.), as well as situational factors (such as the level of congestion, degree of anonymity, etc.). These perceptions in turn are appraised by the driver in both cognitive and emotional terms, as reflected in the attributions they make about the cause of the initial event and their state emotions (such as anger, anxiety, stress etc.). This appraisal process, along with the ongoing influence of the personal and situation-related factors (e.g., previous individual experience of the outcome of different behavioural responses; presence of barriers such as police), determines the range of behavioural responses considered and the specific behaviour(s) adopted by the driver. In some cases, a driver may adopt a non-aggressive response, which may or may not lead to a displaced aggressive response in a non-driving context. Drawing on the work of Shinar, aggressive responses may be instrumental in nature (e.g., behaviour directly intended to remove an impediment, such as flashing lights or weaving in and out of traffic lanes) or serve a non-instrumental function (e.g., retaliatory action).
>
> Irrespective of the nature of the aggressive response, its immediate outcome depends on the behaviour of the other road user(s) at which it is directed. If the other road user(s) respond in a manner which effectively removes the impediment (e.g., move out of the way), the aggressive driving cycle is unlikely to continue. However, if the other road user doesn't respond in a 'compliant' manner, this can lead to the cycle repeating itself and a different, and possibly more aggressive, response being adopted by the driver (e.g., deciding to tailgate the slower vehicle). (Soole et al., 2011, pp. 87–88)

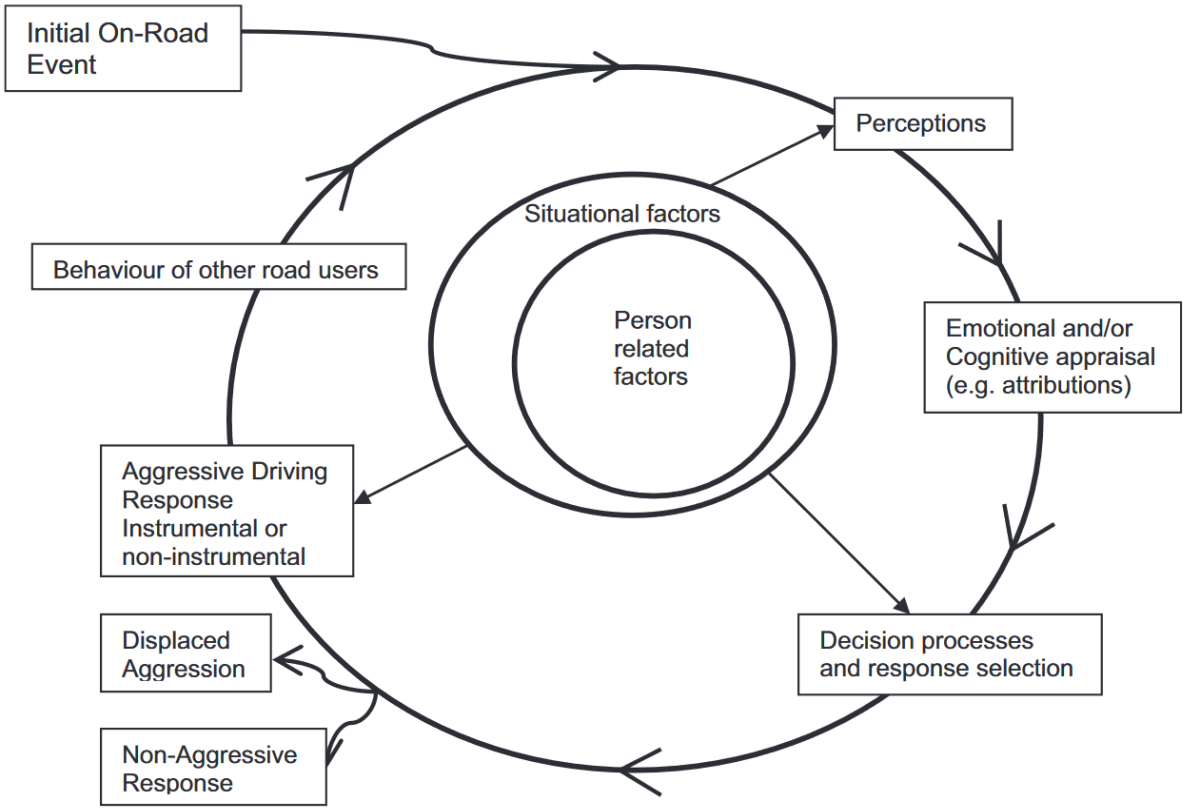

Figure 4. Comprehensive Model of Aggressive Driving (Soole et al., 2011, p. 87)

Soole and colleagues (2011) identified unique components of the Comprehensive Model of Aggressive Driving: -- it brings together elements of previous context-specific and general aggression models, captures the role of behavioral intention, and includes the cognitive and emotional appraisal process of the driver.

While Soole and colleagues (2011) combined elements from different models to create an aggressive driving model, Sullman and Stephens (2021) specifically adapted the GAM to aggressive driving. Figure **5**. GAM applied to aggressive driving (Sullman & Stephens, 2021, p. 125) shows Sullman and Stephens' (2021) adaptation of the GAM to aggressive driving. It is noted that Sullman and Stephens' (2021) adaptation of the GAM does not specifically call out the distal processes like the original GAM, which is said to be operating in the background of an aggressive driving event. Distal processes in the original GAM included biological and persistent environmental factors that influence individual driver characteristics and situational factors.

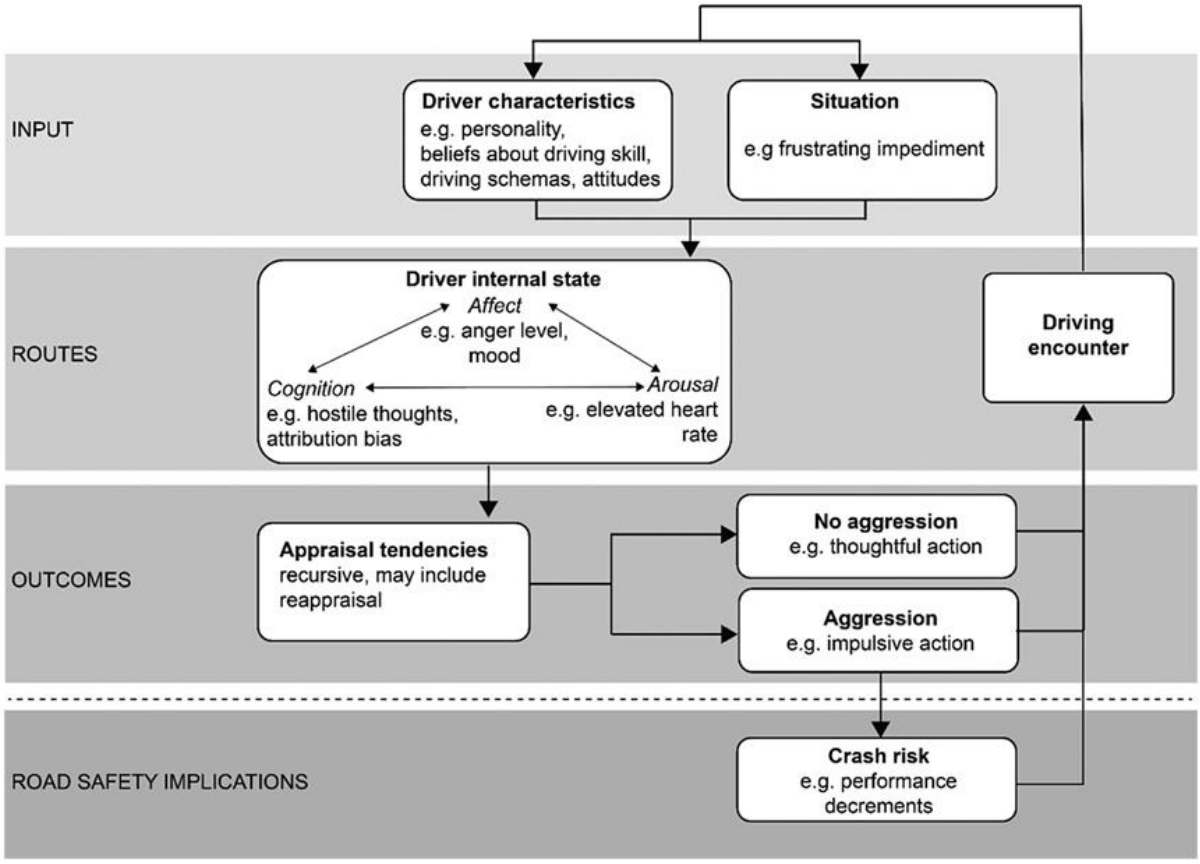

Figure 5. GAM applied to aggressive driving (Sullman & Stephens, 2021, p. 125)

2.6 Contextual Model Adapted for This Project

One objective of this project in Task 1 was to develop a contextual model of aggressive driving. Based on what was learned from the literature and the review of existing models, instead of creating a new contextual model, we decided to use the contextual model developed by Sullman and Stephens (2021), which applied the GAM to aggressive driving. However, we specifically added traffic safety culture to illustrate the influence of traffic safety culture on aggressive driving (Figure **6**).

Sullman and Stephens' (2021) model was selected because it was based on a widely utilized general model of aggression and applied to a driving context. We additionally sought to illustrate the influence of traffic safety culture in the model. Traffic safety culture is defined as "the shared belief system of a group of people, which influences road user behaviors and stakeholder actions that impact traffic safety" (Ward et al., 2019). Traffic safety culture includes multiple shared beliefs including "values, assumptions, expectations, perceptions of what is common or typical (i.e., perceived norms), and our sense of control" (Ward et al., 2019, pp. 12–13).

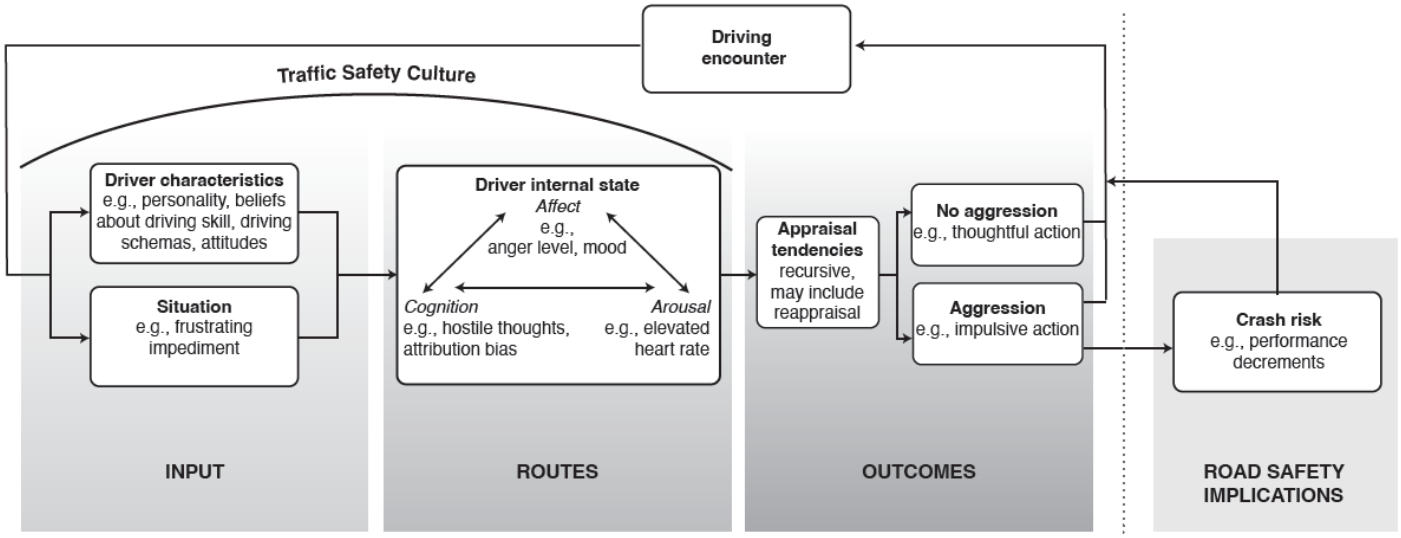

Figure 6. The influence of traffic safety culture included in the GAM applied to aggressive driving

The GAM applied to aggressive driving illustrates how a driving encounter may result in aggressive driving. The model describes the process in three phases: inputs, routes, and outcomes, at which different points of intervention could be implemented. The model suggests that "aggression relies on the emotional response a driver has to a situation (routes). This response will differ according to who the driver is and the circumstances of the situation (inputs). The resulting behavior (outcomes) will also depend upon the emotion-based appraisals made by the driver, who will evaluate what response is appropriate and the risk involved" (Sullman & Stephens, 2021, p. 124).

Below is a detailed explanation and illustrative example of each phase of the model in the context of aggressive driving.

Phase One: Inputs

The first phase of the GAM applied to aggressive driving includes individual and situational factors, also called input variables, that serve to increase or decrease the likelihood of aggressive driving through their influence on a driver's present internal state (Allen et al., 2018; Allen & Anderson, 2017; Sullman & Stephens, 2021). Factors that increase the likelihood of aggressive driving are known as risk factors, and factors that decrease the likelihood of aggressive driving are known as protective factors (Allen et al., 2018).

From the review of literature, some of the risk factors associated with aggressive driving include individual factors like one's propensity toward higher sensation seeking and impulsivity, increased levels of trait anger, and situational factors that impede one's travel experience like traffic congestion, red lights, lower speed limits, roundabouts, and time pressure like running late for an important engagement. Other situational factors include extraneous stressors such as work-related stressors or daily hassles.

Individual protective factors include things like one's ability to consider the future implications of their behavior, a positive affective state/mood, and a higher internal locus of control. Situational factors can also be protective, such as perceptions of a safe driving climate and not having a sense of urgency or time pressure to get to one's destination.

These risk and protective factors are impacted by traffic safety culture, as the shared values and beliefs influence the driver's characteristics (such as their individual beliefs and attitudes). Traffic safety culture may also influence the situation, as shared expectations influence the behavior of others. For example, a traffic safety culture that supports giving others plenty of space may reduce feelings of pressure even in congested driving situations.

Here is an example to illustrate various inputs that are influencing this driving encounter in phase one of this model.

Individual Factors: Meet Dan. Dan is a person who likes adventures and challenges that push his comfort level and are considered a little dangerous. He enjoys the thrill of those adventures in his personal life (increased sensation seeking). Further, Dan's friends describe him as one who is quick to anger (trait anger) and a person who does not stop to think about the consequences of his actions before making big decisions in his life (higher impulsivity). He lives by the mantra that the outcomes of his choices are left to fate (higher external locus of control).

Situational Factors: Dan commutes a short distance to and from work every day. His commute takes 10 minutes, and tonight Dan has planned a social gathering with friends at their favorite restaurant. Dan leaves work at his normal time, expecting a quick commute home. However, during the commute, Dan encounters a significant amount of traffic congestion, which results in a long delay (situation). Because of the delay, Dan is going to be late for the social gathering with his friends.

Phase Two: Routes

Individual and situational factors (input variables) influence aggressive driving behavior (outcomes) through three routes that make up a driver's present internal state: affect, cognition, and arousal (Allen & Anderson, 2017). Affect includes a driver's current mood or emotional state, for example, whether the driver feels angry, happy, nervous, upset, or content. Cognition includes a driver's thoughts, perceptions, and cognitive biases, for example, how a driver thinks about a situation or event on the road. Arousal includes a driver's physiological state like a rapid heart rate or sweating. For example, if the outside temperature is hot and the vehicle does not have air conditioning, the driver may start sweating.

It is important to note that these three routes: affect, cognition, and arousal, influence each other and interact (Allen & Anderson, 2017). For example, a driver's angry mood (affect) may contribute to having an elevated heart rate or muscle tension (arousal). A driver's negative thoughts (cognition) may impact their mood (affect). A driver who feels hot and is sweating (arousal) might start to have negative thoughts (cognition) and/or negative mood (affect).

Driver's Internal State: Continuing with the example of Dan, Dan is frustrated and feeling angry (affect) because he will not make his social gathering on time. He feels muscle tension in his

neck and shoulders (arousal), and his thoughts about this traffic congestion are hostile. He thinks, "If other drivers would do what they are supposed to do, we wouldn't be in this mess" (cognition).

Dan's present internal state is influenced by both individual and situational factors (inputs). Further, individual inputs and his present internal state are influenced by the traffic safety culture as represented by the arc moving across inputs and routes in Figure **6**.

Phase Three: Outcomes

The driver's present internal state influences the driver's appraisal and decision-making processes, which lead to the aggressive or non-aggressive action selected by the driver (outcomes) (Allen & Anderson, 2017). In the third phase, the driver appraises the situation and decides on an action or response they will take. The first appraisal of the situation is immediate, occurs automatically with little effort, and is influenced by the driver's present internal state (Allen et al., 2018). After this immediate appraisal, the action the driver decides to take is based upon the available resources the driver perceives to have (i.e., time and cognitive capacity) and the event. Based on this initial appraisal, the driver may engage in a reappraisal process to consider different interpretations of the event, sometimes several times, before deciding on a specific action (whether aggressive or non-aggressive) (Sullman & Stephens, 2021, p. 126).

The action (aggressive or non-aggressive) that is selected by the driver will influence the driving encounter, the individual and situational factors, and the driver's present internal state in a fluid and cyclical process (Allen & Anderson, 2017). Further, through this cyclical process, a feedback loop is created for the driver. For example, if the driver decides to engage in an aggressive action and that aggressive action results in what the driver believes to be a successful outcome, it will likely reinforce future aggressive driving (Sullman & Stephens, 2021, p. 124).

Appraisal: Dan assesses the traffic congestion situation and decides how to respond. His immediate appraisal of the traffic congestion is influenced by his negative internal state. Based on his appraisal, Dan decides to push the limits. Instead of going with the traffic flow, he decides to purposefully tailgate the vehicle in front of him, who he thinks is going too slow. In this case, the other driver does not speed up or move over. The driving encounter continues, and Dan cycles through the model again. Now Dan is still in traffic and is continually getting later for his dinner with friends (inputs). The other driver's behavior, not speeding up or moving over, increases Dan's frustration, and he thinks: "Why won't that car get out of my way? They can tell I need to get by! They must be stupid" (cognitive and affective routes). These inputs and routes will influence Dan's continuing appraisal and decision-making processes. Based on his latest appraisal, Dan may engage in another aggressive behavior. In this scenario, perhaps Dan decides to honk his horn at the driver (aggressive behavior), attempting to "get his point across" and hoping for a different outcome.

Or as an alternative in this story, maybe because of Dan's aggressive behavior, tailgating, the other driver quickly moves over and speeds up resulting in the outcome Dan was hoping for. In this scenario, it is likely that Dan's perceptions of the outcomes of his aggressive driving are different than in the scenario where the other driver continues their behavior unaltered. Thus,

Dan's inputs and routes may be altered and his appraisal and decision-making processes change, resulting in next action that is not aggressive. In this example, Dan chooses not to honk (non-aggressive action).

The example of Dan illustrates an aggressive cycle showing how aggressive driving may flow within the GAM applied to aggressive driving model. This model provides a feedback loop within a specific driving encounter but suggests that the encounter also serves to more globally influence a person's future behaviors (Allen & Anderson, 2017).

This model can help us understand the complexities of aggressive driving, recognizing there are different phases and varying factors influencing a driver's appraisal and ultimately their behavior. Further, in attempting to reduce aggressive driving, this model can be used to identify points of intervention. For example, focusing on inputs and routes within the model may illustrate important leverage points that could be impacted through growing a shared traffic safety culture.

2.7 Interventions to Reduce Aggressive Driving

Twenty years ago, a small body of research explored the effect of various behavioral, cognitive, and relaxation interventions on drivers' feelings of anger and occasionally also assessed the behavioral or physiological reactions that accompanied that driving anger (for a review, see Deffenbacher et al., 2016). Since then, much research has explored aggressive driving as behaviors that go beyond feelings of driving anger, but there is a lack of research testing interventions. Instead, interventions to reduce aggressive driving behavior are frequently mentioned as potential implications of studies that explore individual and situational factors as predictors or correlates of aggressive driving behavior (Mohammadpour & Nassiri, 2021; Roseborough et al., 2021). For example, cognitive-behavioral interventions are suggested to address attributions for others' driving behaviors that might be interpreted aggressively or lead to aggressive driving (Lennon & Watson, 2015).

Similarly, research on interventions to change cognitions or reactions often describes aggressive driving as one of several potential behaviors that could be changed. For example, there is a wide body of research on interventions for aggression focused on various populations across the lifespan (for a review, see Lee & DiGiuseppe, 2018). But rarely do these interventions include aggressive driving behaviors as an outcome of interest. Often, general interventions for aggression are suggested as applicable to aggressive driving.

While much published research about aggressive driving includes implications for interventions to reduce aggressive driving behavior and some interventions include the potential for impact on aggressive driving behaviors, less research is available that describes development or testing of interventions specific to aggressive driving.

In one of the few examples available, Stephens and colleagues (2022) tested the Reducing Aggressive Driving (RAD) program – an intervention to address the complexity of aggressive driving and the multiple potential influences identified when applying the GAM to aggressive driving. Delivered via Zoom to Australian participants, the intervention included components to

aid participants in understanding aggressive driving, identifying triggers for aggressive driving behavior, and developing strategies to avoid aggressive driving behaviors. In this preliminary evaluation study, participants reported that they were able to develop strategies to avoid aggressive driving, and they reported fewer instances of driving anger and aggressive driving one month after the program. These reductions were sustained four months after the RAD program. While the study lacked a control or comparison treatment group, the authors suggest that the results provide evidence for the effectiveness of the RAD program.

In other recent work, researchers in Denmark tested a cognitive-behavioral intervention designed to address aggressive driving by changing patterns of cognitions, which resulted in less aggressive behavioral reactions (Haustein et al., 2021). Delivered to participants in groups, the intervention delivered content to increase participants' knowledge about driving anger and traffic safety as well as information about conflict management strategies. The intervention also included discussions and practice exercises with driving situations. Intervention effectiveness was assessed with both observations in a driving simulator and self-report surveys. Participants who received the intervention exhibited fewer expressions of anger in the driving simulator after the intervention compared to before the intervention; however, this change was not statistically significant. Participants who received the intervention did report less driving anger following the intervention and reductions for mild forms of anger (i.e., yelling and gesturing) were statistically significant. Intervention participants also demonstrated increases in constructive expressions of driving anger following the intervention, while control participants showed no change. Finally, the study included a focus group where participants generally reported that the intervention was interesting, useful, and good. Nearly half reported that their thinking while driving in traffic had changed. While the study did include a control group, participants were not truly randomized to the condition, and the sample was relatively small. Despite these limitations, based on the results, the authors posit that the intervention was successful in mitigating driving anger and supporting more constructive driving behavior.

Additional research on feasibility or effectiveness for interventions addressing aggressive driving behaviors is needed. Growth in this area of research will be supported by clarity around what specific behaviors constitute aggressive driving, which will be supported by use of a clear definition and a comprehensive contextual model.

3 TASK 2 – AGGRESSIVE DRIVING SURVEY

3.1 Methodology

The Center for Health and Safety Culture developed a survey to assess the prevalence and correlates of aggressive driving behavior. Development of the survey was informed by the literature review completed in Task 1 and included validated scales such as the Prosocial and Aggressive Driving Inventory (PADI) (Harris et al., 2014) and the Driving Anger Expression Inventory (DAX) (Deffenbacher et al., 2002). On the PADI, participants reported how often they engaged in prosocial (e.g., "yield when the right of way belongs to other drivers") and aggressive (e.g., "speed up when another vehicle tries to overtake me") driving behaviors. The DAX items asked participants about their responses when they experience anger while driving with options that are positive/adaptive (e.g., "think of positive solutions to deal with the situation") and negative/aggressive (e.g., "drive right up on the other driver's bumper").

Additional questions were asked to gather perceived norms and additional experiences with aggressive driving. For these questions, we described aggressive driving behaviors without using the word "aggressive" and instead provided the following examples of driving actions: "cutting off another vehicle and braking hard, tailgating a slower vehicle, ignoring the right-of-way to 'beat' another vehicle, and responding to other drivers with rude gestures or excessive honking." We also gathered information about driving history and participant demographics. (See Appendix A for a copy of the full survey. PADI and DAX items were presented to participants in random order.)

We obtained approval from the Montana State University Institutional Review Board (IRB) and administered the survey via Qualtrics, an online survey platform. Participants were obtained through a Qualtrics purchased panel. Individuals were eligible to participate if they were age 18 and older, resided in the U.S., currently held a valid driver's license, and drove at least a few times per week in the past month. Further, the sample was recruited to approximate the U.S. population with regard to distribution by age, gender, race, ethnicity, and state of residence.

Data collection occurred between June 26, 2023 and July 4, 2023 and yielded 841 complete and valid responses.

3.1.1 Demographics of Participants

Participants were recruited with quotas to achieve distributions in demographics similar to those of the United States population as described in census data. Geographic distribution was by state; participants were from 49 states (all except Vermont) and the District of Columbia. Sample distribution was within 0.5% of the census population distribution. For example, 12.0% of the sample was from California compared to 11.8% of the population according to the U.S. census.

Other participant demographics are presented in Table 2. All categories closely approximate the U.S. population.

Table 2

Participant Demographics

Demographic	*n*	%
Age		
18 – 25 years	103	12.2
26 – 34 years	120	14.3
35 – 54 years	279	33.2
55 years or older	338	40.2
Gender		
Man	394	46.8
Woman	437	52.0
Transgender man	2	.2
Transgender woman	2	.2
Non-binary	3	.4
Another description (genderfluid, questioning)	3	.4
Race		
White or Caucasian	625	74.3
Black or African American	108	12.8
American Indian/Native American or Alaska Native	23	2.7
Asian	41	4.9
Native Hawaiian or Other Pacific Islander	11	1.3
Other	53	6.3
Ethnicity		
Spanish, Hispanic or Latino origin	152	18.1
Driving (Past Month)		
A few days a week	204	24.3
Most days each week	220	26.2
Every day	417	49.6
Ridden in Vehicle Driven by Someone Else (Past Month)		
Never	86	10.4
Less than once a week	247	30.0
Once a week or a few days a week	331	40.2
Most days each week or every day	160	19.4
Citation History (Speeding Ticket)		
Never	355	42.2
Within the last year	53	6.3
1-3 years ago	71	8.4
More than 3 years ago	349	41.5

3.2 Results

3.2.1 Analyses

In this section, we summarize how often participants reported engaging in prosocial and aggressive driving behaviors (from the PADI) and how often participants reported positive/adaptive and negative/aggressive when they experienced anger while driving (from the DAX). We then report how often the participants perceived that others engaged in aggressive driving behaviors and how much they perceived others would approve or disapprove of driving aggressively. Finally, we describe participants' reports of witnessing and experiencing aggressive driving by others.

In each section, we report descriptive statistics and other statistics when they are useful for interpretation. We use t-tests and correlations to compare variables. T-tests are used to determine if participants' responses on two variables are significantly different from one another. The correlation coefficient is a statistical measure that can vary from -1 to 1 and indicates the relationship or association between two variables. A value of 0 is no association between the variables whereas -1 or 1 is a perfect association. For t-tests and correlations, we set alpha at .05, reflecting 95% certainty in the result; accordingly, we report *p* values to reflect significance.

3.2.2 Self-Reported Behaviors

First, we examine participants' PADI responses to identify how many participants report *any* aggressive driving. The vast majority of participants (90.2%) report engaging in at least one aggressive driving behavior "sometimes" or more frequently.

The PADI is useful to explore driving behaviors in general and so to further explore how many participants engaged in prosocial and aggressive driving behaviors, we grouped participants' PADI responses into three groups for their average prosocial and aggressive responses, respectively. Specifically, groups were created to represent rarely (based on average responses of never or almost never), sometimes (based on average responses of sometimes or fairly often), and often (based on average responses of very often or always). The overwhelming majority of participants (91.1%) reported engaging in prosocial driving behaviors often while driving. Most participants (63.5%) also reported rarely engaging in aggressive driving behaviors. See Figure **7**.

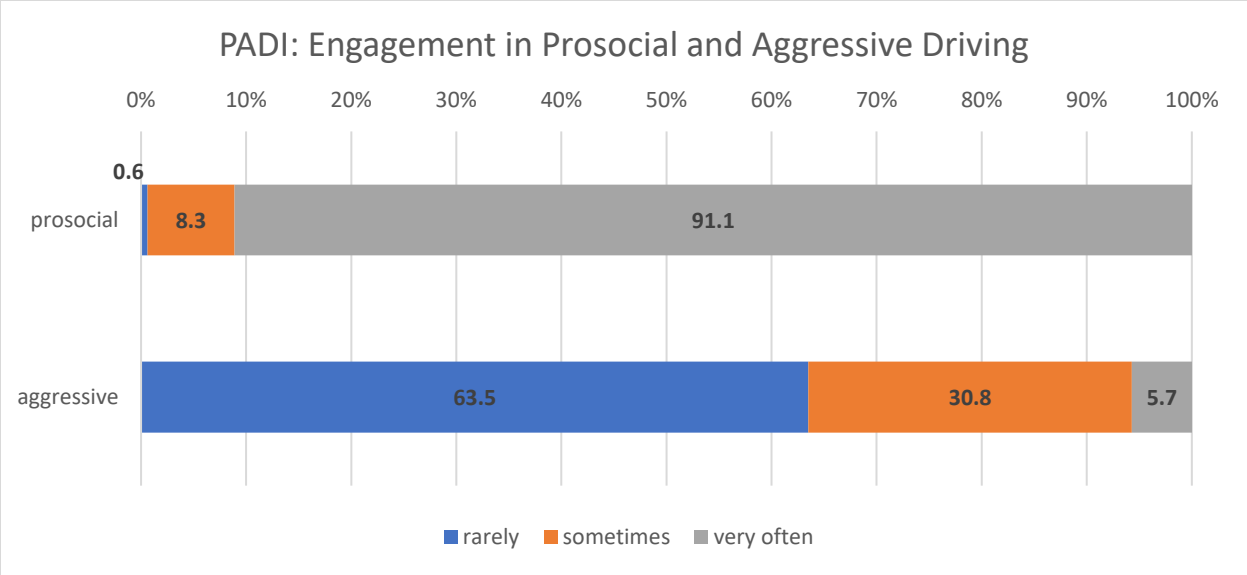

Figure 7. How often participants reported engaging in prosocial and aggressive driving.

Comparing average responses of each behavior on the PADI allows us to understand which specific behaviors survey participants reported engaging in most often. The table below shows the most frequent prosocial and aggressive driving behaviors. For each behavior, we provide the mean (from 1 – never to 6 – always) and standard deviation as well as the percentage of respondents indicating often (scale responses of very often or always). (See Table 3.)

Table 3

Most Frequent Prosocial and Aggressive Driving Behaviors

Driving Behaviors	*M*	*SD*	% often
Prosocial			
Use mirrors and check blind spots when changing lanes	5.58	.87	90.2
Use turn signals (blinkers) to notify other drivers of my intention to turn	5.58	.91	91.3
Pay attention to traffic and my surroundings while driving	5.55	.89	90.7
Drive with extra care around pedestrians	5.53	.92	88.5
Aggressive			
Honk when another driver does something inappropriate	2.97	1.54	20.3
Accelerate into an intersection when the traffic light is changing from yellow to red	2.79	1.42	15.1
Pass other vehicles using the right lane	2.77	1.58	17.9
Follow a slower vehicle at less than a car length	2.66	1.60	17.4

The DAX assesses how participants respond when they feel anger while driving, with responses grouped as positive/adaptive or negative/aggressive. To explore how many participants engaged in adaptive and aggressive responses, we grouped participants' DAX responses into three groups based on their average response. Specifically, groupings were created to represent almost never, sometimes, and almost always. Participants often utilized adaptive responses to feeling anger

while driving, with 55.3% sometimes and 43.1% almost always utilizing adaptive responses. Most participants (59.4%) reported that they had aggressive responses almost never, and 39.4% reported sometimes responding aggressively. See Figure **8**.

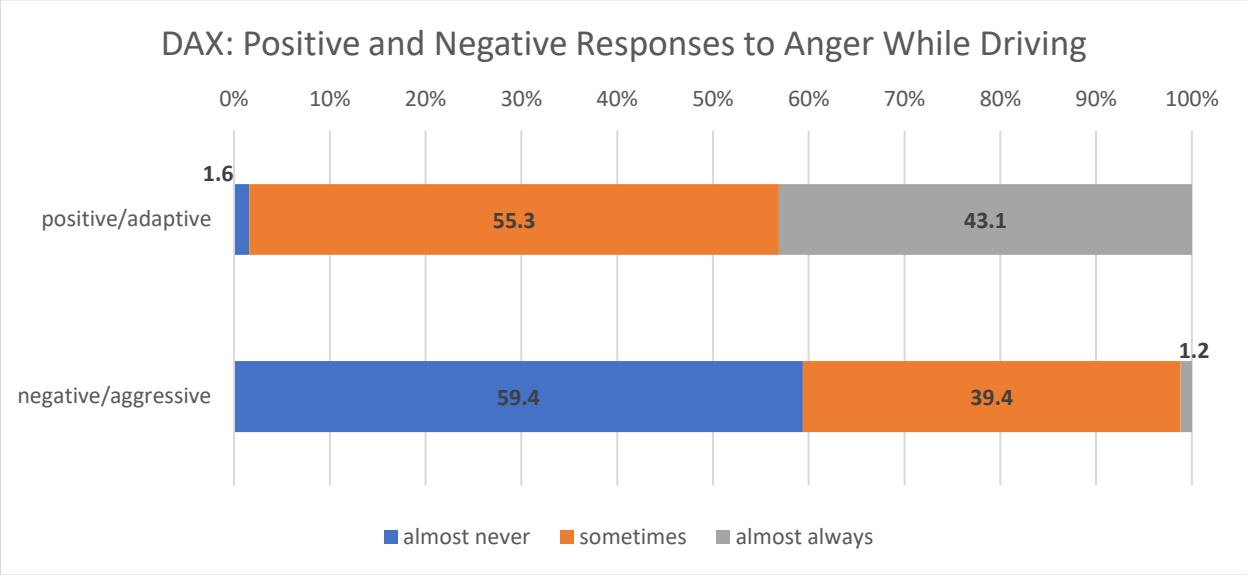

Figure 8. How often participants reported adaptive and aggressive responses to anger while driving.

Comparing average responses of each response on the DAX allows us to understand which specific adaptive strategies and aggressive responses survey participants reported engaging in most often. The table below shows the most frequent responses. For each, we provide the mean (from 1 – almost never to 4 – almost always) and standard deviation as well as the percentage of respondents indicating almost always. (See Table 4.)

Table 4

Most Frequent Adaptive and Aggressive Responses to Anger While Driving

Driving Behaviors	*M*	*SD*	% almost always
Positive/Adaptive			
Tell myself it's not worth getting involved	3.29	.94	55.6
Accept there are frustrating situations	3.28	.87	50.4
Tell myself it's not worth getting mad at	3.27	.93	53.6
Negative/Aggressive			
Make negative comments about the other driver aloud	1.94	1.01	9.1
Swear at the other driver aloud	1.80	.97	7.7
Drive a lot faster	1.74	.89	4.9

Comparing participants' average engagement in prosocial and aggressive driving behaviors shows the same pattern and allows for significance testing. On the PADI, participants reported engaging in prosocial driving behavior significantly more frequently than aggressive driving behavior, $t(832) = 61.94$, $p<.001$. (See Figure **9**.) Similarly, on the DAX, participants reported

adaptive responses to feelings of anger while driving significantly more often than aggressive responses, $t(835) = 50.48$, $p<.001$. (See Figure **10**.)

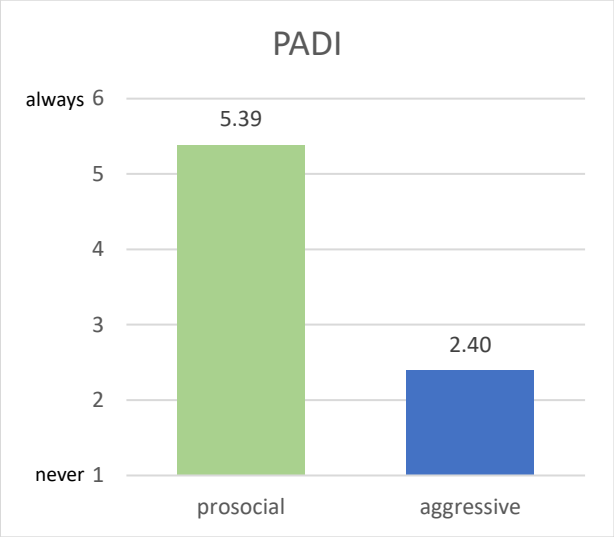

Figure 9. Average engagement in prosocial and aggressive driving behaviors.

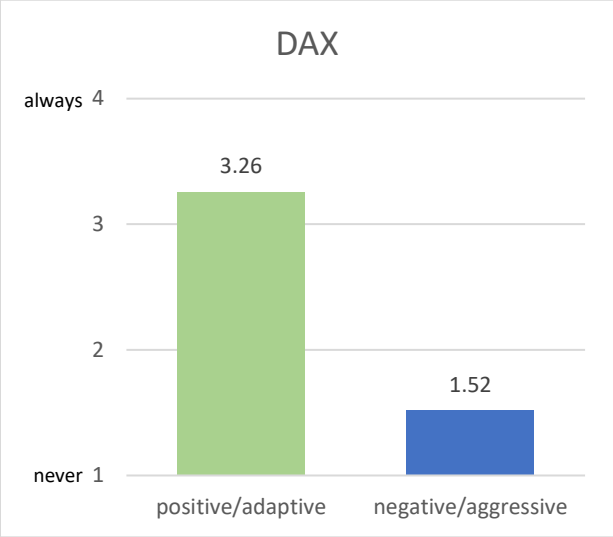

Figure 10. Average utilization of adaptive and aggressive responses.

We explored correlations between PADI and DAX responses to further understand their relationships. On the PADI, as expected, prosocial and aggressive driving behaviors were significantly inversely correlated, $r = -.27$, $p<.001$. That is, engaging in prosocial driving behaviors more frequently was associated with less frequent aggressive driving behaviors. The same relation existed for the DAX where more frequent engagement in adaptive responses to feeling anger was associated with less frequent aggressive responses, $r = -.25$, $p<.001$.

Further, there were significant correlations between adaptive responses on the DAX and aggressive driving on the PADI as well. More frequent utilization of adaptive responses was associated with less frequent aggressive driving, $r = -.16$, $p < .001$. Likewise, utilization of a greater number of adaptive responses was also associated with less frequent aggressive driving, $r = -.12$, $p < .001$.

3.2.3 Perceptions of Behaviors and Approval by Others

In response to examples of aggressive driving actions, participants reporting engaging in these driving actions significantly less frequently than others. Specifically, we asked how often they thought the following groups drove in the way described: most drivers they ride with, most drivers like them, most drivers in their community, and most drivers in the U.S. Each of the paired t-tests comparing frequency between themselves and the other group was significant, $p<.001$ for all. As shown in Figure 11, participants perceived increasing frequency of aggressive driving with increasing social distance from themselves. That is, participants perceived more frequent aggressive driving for most drivers in their community than most drivers like themselves and the most frequent aggressive driving for most drivers in the U.S. (See Figure **11**.)

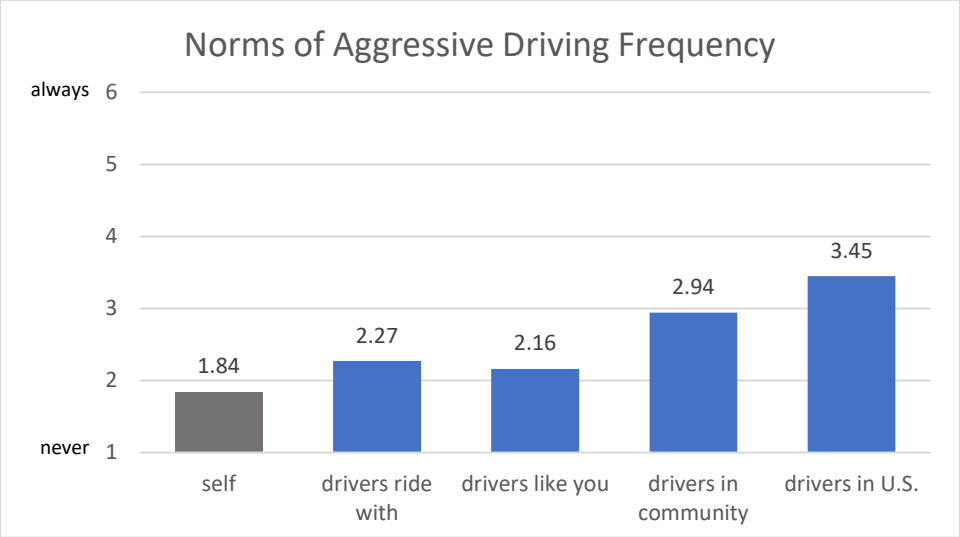

Figure 11. Frequency of aggressive driving by self and perceived frequency of aggressive driving by others.

Participants' own frequency of aggressive driving was positively correlated with perceived norms regarding the aggressive driving of others. That is, participants who engaged in aggressive driving actions more frequently perceived that others also engaged in that behavior more often. Correlations were stronger for those groups closer to the individual (e.g., r = .62 for drivers they ride with and drivers like them) and weakened with increasing social distance (e.g., r = .43 for most drivers in their community and r = .31 for most drivers in the U.S.); p<.001 for all bivariate correlations.

Participants described how much other people in their lives would approve or disapprove if they were to engage in aggressive driving actions. Overall, participants described that other people would disapprove of them engaging in aggressive driving actions. Participants believed their partner, significant other, or closest friend would disapprove the most. (See Figure **12**.)

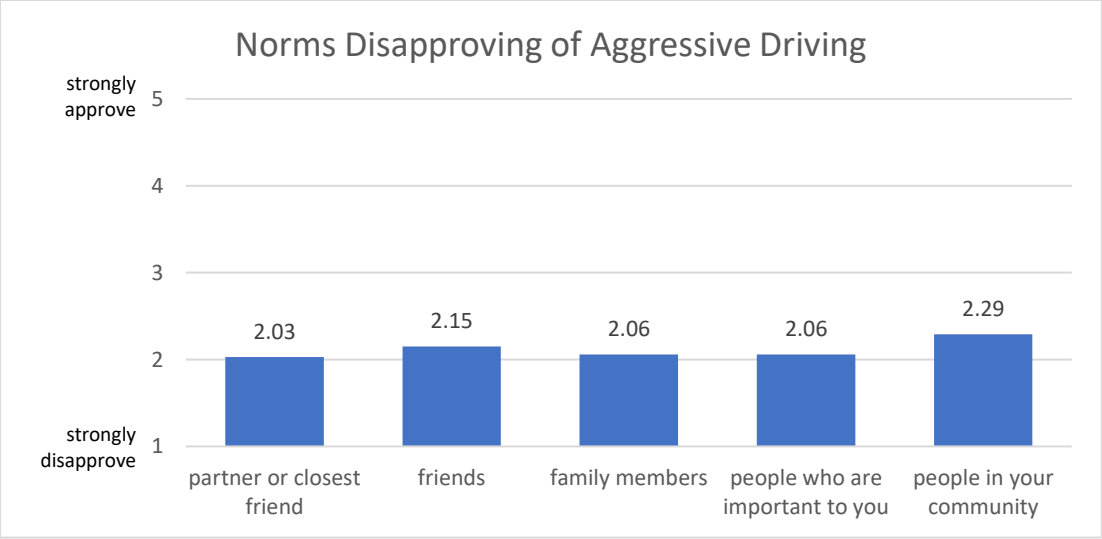

Figure 12. Perceived approval/disapproval of aggressive driving actions by various groups.

Participants' own frequency of aggressive driving was positively correlated with perceived approval by other groups. That is, participants who engaged in aggressive driving actions more frequently perceived greater approval of such behavior by all groups, r from .41 to .45, $p<.001$ for all bivariate correlations.

3.2.4 Experiences With Aggressive Driving

With aggressive driving, there are at least two parties and vehicles involved. We wanted to understand not just the frequency of engaging in aggressive driving actions but also how often participants were experiencing others driving aggressively. We provided example actions that represent aggressive driving behaviors and asked how often participants experienced aggressive driving by asking how often they "had this happen" to them. We assessed witnessing aggressive driving by asking how often they had "seen this happen to someone else." Using a six-point scale from 1 (never) to 6 (always), participants reported witnessing aggressive driving "happen to someone else" ($M = 3.21$) significantly more often than they experienced aggressive driving happen to them while driving ($M = 2.79$), $t(835) = 11.56$, $p<.001$.

Additionally, witnessing and experiencing aggressive driving was correlated with perceived norms regarding aggressive driving. Witnessing aggressive driving happen to someone else was correlated with perceived frequency of aggressive driving by others, with increasing correlation by social distance and r ranging from .31 for most similar drivers to .48 for most drivers in the U.S. ($p<.001$ for all groups). Correlations between experiencing aggressive driving and perceived norms were also significant for all groups ($p < .001$) and ranged from .35 for most similar drivers to .48 for most drivers in their community. In other words, those who witnessed or experienced aggressive driving more often believed that others drove aggressively more frequently. Interestingly, the correlations between participants' own self-reported aggressive driving behavior were not consistent for witnessing and experiencing aggressive driving. While both correlations were significant ($p<.001$), the correlation between driving behavior and witnessing aggressive driving was much lower ($r = .28$) than between driving behavior and experiencing aggressive driving ($r = .70$). That is, participants' experience of having "had this happen" to them was strongly associated with their engagement in the same types of driving behaviors.

4 TASK 3 – GUIDANCE DOCUMENTS

The purpose of Task 3 was to create a guidance document for traffic safety practitioners about ways to bolster their current traffic safety efforts to address aggressive driving. Specifically, the guidance document included information about what was learned from the survey on aggressive driving among adults in the U.S., guiding questions to identify opportunities to enhance existing traffic safety efforts to reduce aggressive driving, and ideas and specific actions that could be integrated into existing traffic safety efforts. (See Appendix B for the content of the Guidance Document.) Further, a PowerPoint presentation was created for traffic safety professionals to use to disseminate information learned in this project. (See Appendix C for the PowerPoint slides.)

5 CONCLUSIONS

Task 1 of this project included a review of literature that sought to identify common definitions of aggressive driving, identify factors that precipitate such behavior, understand previously developed contextual models that explain its occurrence, and identify ways to reduce aggressive driving. Further, a proposed definition of aggressive driving and a contextual model that could be used to represent factors and context that influence aggressive driving behavior was included.

Many definitions of aggressive driving have been developed, but a consistent and widely used definition of aggressive driving has not been well established making it difficult to know what is meant by "aggressive" and whether this label describes the state of the driver or the effect of the behavior. Adding to this complexity, a wide variety of behaviors have been categorized as "aggressive," but there is ambiguity among researchers about which behaviors are considered aggressive driving behaviors or would more appropriately be labeled as risky or dangerous.

Based on a review of the literature of common definitions of aggressive driving, the need to reduce ambiguity became clear. As called out by various researchers, a definition of aggressive driving must be specific and distinguished from other risky or dangerous driving behaviors, capture intentions, and account for the context in which the behavior occurs. Thus, we built upon the aggressive driving definition first proposed by the AAA Foundation (2022) and added the impact on others as an important defining feature. We proposed aggressive driving is ***a****ny unsafe driving behavior that is performed deliberately, with ill intention or disregard for safety, and impacts others*.

To better understand aggressive driving, researchers have investigated both individual and situational factors associated with aggressive driving. Individual factors associated with aggressive driving such as personality traits (propensity for sensation seeking and impulsiveness, one's disposition toward boredom, one's ability to consider future consequences, forgiveness, and trait anger), emotions (emotional state/mood, emotional intelligence), and cognitions (cognitive appraisals, perceptions, locus of control, cognitive bias) were reviewed. Situational factors that have been found to contribute to aggressive driving including travel impedance, time pressures, and daily stressors were also reviewed. Understanding these individual and situational factors that precipitate aggressive driving behaviors can help us better understand this complex driving behavior and provide insight into potential points of intervention.

In addition to understanding factors associated with aggressive driving, a contextual model is important to develop strategies to effectively prevent and reduce the incidence of aggressive behaviors. Previous models of aggressive driving were reviewed including Shinar's Model of Aggressive Behavior (Shinar, 1998), the General Aggressive Model (Allen & Anderson, 2017), and a Comprehensive Model of Aggressive Driving (Soole et al., 2011). Based on this review, we selected the contextual model developed by Sullman and Stephens (2021), which applied the GAM to aggressive driving; to that model, we added traffic safety culture and then explored the model with a detailed example of aggressive driving.

A primary utility of the contextual model for aggressive driving is to support identification of points of intervention for aggressive driving. Much of the published research on aggressive

driving suggests potential interventions, but research testing interventions for feasibility or effectiveness is lacking. Using the contextual model as a guide, interventions can be directed at inputs, such as driver attitudes and beliefs about driving. Adding traffic safety culture, we also consider the role of shared values and beliefs and understand that shared values and beliefs of a group have an influence on those of each individual. Interventions can also be applied to routes, with the goal of impacting the driver's internal state during the driving encounter, such as through improved emotion regulation or more adaptive cognitive biases and processes. The depth of the literature and the thoroughness of the contextual model allows for consideration of many factors that have a role in aggressive driving behavior. While limited, the existent research on interventions has similarly identified weakness in single-factor interventions. Instead, interventions are best when they are designed to address multiple influential factors. Such interventions can support a variety of drivers, with different combinations of individual and situational factors, in avoiding aggressive driving.

The literature review, definition of aggressive driving, and contextual model were used to support the development of a survey in Task 2. In Task 2, we conducted a large survey of U.S. drivers to better understand aggressive driving behaviors and the relationship with adaptive behaviors and perceived norms. Consistent with prior research, aggressive driving was relatively common among our sample though few participants reported consistently engaging in aggressive behaviors with high frequency. It is noteworthy, though, that prosocial driving behaviors were much more common and that the vast majority of participants reported consistent and high frequency engagement in prosocial driving behaviors. As more frequent engagement in prosocial driving behaviors was associated with less frequent aggressive driving behaviors, promotion of prosocial driving may be a potential avenue to reduce aggressive driving.

Aggressive driving behavior can sometimes be driven by feelings of anger. As strong irritation or anger is normal to experience, including while driving, how people respond to those feelings can impact their driving behavior. Most participants reported utilizing adaptive responses sometimes or always, and approximately 40% of participants also reported aggressive responses at least sometimes. Greater utilization of adaptive responses, both in how often they were utilized and in the number of different adaptive responses endorsed, was associated with less aggressive driving. While this relationship was weaker than some other correlations observed, the similarity to the prosocial finding supports application of both findings for interventions. Therefore, promotion of prosocial and adaptive responses in situations of high emotional response such as anger could reduce aggressive driving. Promoting prosocial driving and adaptive responses could include activities such as awareness and communication campaigns as well as targeted approaches to build drivers' skills in those specific areas.

Overall, participants reported that they occasionally drive aggressively and believed that others drove aggressively more frequently. Believing others drive aggressively more frequently was associated with more frequent engagement in aggressive driving actions. In other words, those who believe everyone else is driving that way are more likely to also drive that way. This discrepancy presents an important opportunity to correct misperceptions regarding the actual

frequency of aggressive driving and present actual norms that most people do not regularly drive aggressively.

Like beliefs regarding what others typically do, our belief that others would approve or disapprove of certain behaviors also impact our likelihood of engaging in those behaviors. Participants in this survey believed that others would not approve of them engaging in aggressive driving behaviors, with the greatest disapproval from partner, significant other, or closest friend. Participants also believed that other family members and people who are important to them would similarly disapprove. Perceived disapproval was associated with less frequent engagement in aggressive driving behaviors, highlighting a unique opportunity for intervention to reduce aggressive driving. Bystanders, especially partners, family, and close friends, can be influential in encouraging others to not drive aggressively. Whether riding along in the vehicle or not, we can make clear to people who are important to us that we do not support them driving aggressively and instead support prosocial driving behavior. Broadly, interventions to reduce aggressive driving can focus on not just drivers who engage in aggressive driving but also friends, family, and important others. These important others can ask people in their lives not to drive aggressively.

Finally, participants reported engaging in aggressive driving more frequently if they also experienced others driving aggressively more often. This finding is consistent with models of aggressive driving as cycles as well as with our earlier finding that people who believe others drive aggressively more often also engage in aggressive driving more often themselves. Based on this finding, cognitive reappraisal interventions may reduce aggressive driving. If people can reconceptualize the behavior of other drivers as neutral or an innocent mistake rather than malicious or aggressive driving, they may be less likely to engage in aggressive driving actions. This type of cognitive reappraisal is similar to adaptive behaviors participants frequently reported utilizing when they experience driving anger, indicating that they are feasible. Interventions could target these skills to further enhance individuals' ability to utilize those skills as well as broaden the types of situations in which people apply this cognitive skill.

Findings from this survey must be interpreted in light of limitations. While the sample of participants who completed the survey was large and care was taken to recruit a sample with demographics that approximated the U.S. population, participants were volunteers. It is possible that people who were willing to participate in the survey are different in important ways related to aggressive driving than people who were unwilling to participate or who were not afforded the opportunity to participate. Therefore, findings must be interpreted with understanding of this potential bias. Results may not generalize to all individuals or communities. However, findings are strengthened by the similarity in prevalence estimates to other recent, high-quality research studies that use probability-based sampling (AAA Foundation for Traffic Safety, 2022).

In the survey study, almost all drivers reported that they have driven aggressively (even if rarely), and many drivers drive aggressively sometimes. Despite how common aggressive driving is, people perceive aggressive driving as occurring even more frequently. Findings from the survey provide insights for multiple kinds of interventions, including encouraging prosocial driving, addressing inaccurate normative beliefs, developing skills for cognitive reappraisal

among drivers, and supporting bystanders to encourage others to not drive aggressively. The survey in Task 2 was used to develop guidance for traffic safety stakeholders in Task 3. In Task 3, we created a resource providing guidance for traffic safety practitioners about ways to bolster their current traffic safety efforts to address aggressive driving and created a PowerPoint presentation for professionals to use to disseminate information learned in this project. Efforts to address aggressive driving utilizing these kinds of interventions should test their effectiveness to understand which are most successful.

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7 APPENDICES

7.1 Appendix A. Survey Questions

The following is the text of the survey. The survey was implemented online; therefore, this does not represent how the questions appeared to the respondent.

Introduction.
The Center for Health and Safety Culture at Montana State University is asking for your input. We are learning about ways to improve traffic safety. Your voice matters. Each and every survey is very important to us.

This survey will take about 8 minutes and asks questions about driving and other common life experiences. Your participation is voluntary and you can stop at any time. You can choose to not answer any question you do not want to answer. Your responses are confidential. We will not share individual responses; only summary results will be shared in reports or publications.

This study has been approved by the Montana State University (MSU) Institutional Review Board (IRB). If you have questions or comments about the survey, please contact Bridget Hanson with the Center for Health and Safety Culture at bridget.hanson@montana.edu. If you have questions about your rights as a participant, you may contact the MSU IRB at irb@montana.edu.

Proceeding with the survey indicates your consent to participate. Thank you for taking this survey!

Demographics. (Quotas to match population distribution.)

1. How old are you?
    a. Under 18 years *(exclude)*
    b. 18-25 years
    c. 26-34 years
    d. 35-54 years
    e. 55 years or older
2. How do you describe your gender?
    a. Man
    b. Woman
    c. Transgender man
    d. Transgender woman
    e. Non-binary
    f. Prefer to self-describe: _____
3. Choose one or more races that you consider yourself to be
    a. White or Caucasian
    b. Black or African American
    c. American Indian/Native American or Alaska Native
    d. Asian
    e. Native Hawaiian or Other Pacific Islander
    f. Other
    g. Prefer not to say
4. Are you of Spanish, Hispanic, or Latino origin?
    a. Yes
    b. No

5. In what state do you currently reside?
    a. List of 50 states, D.C., and Puerto Rico

Drive.

1. Do you currently have a driver's license?
    a. Yes, I have a standard driver's license (non-commercial, Class D).
    b. Yes, I have a commercial driver's license (CDL).
    c. No *(exclude)*
2. On average over the past month, how often have you...

	Never	Less than once a week	About once a week	A few days a week	Most days each week	Every day
Driven a vehicle?	*exclude*	*exclude*	*exclude*			
Ridden in a vehicle driven by someone else? (Not including public transportation)						

UCLA Loneliness Scale. (Russell et al., 1996; NORC General Social Survey, 2018)

	Never	Rarely	Sometimes	Often
How often do you feel that you lack companionship?				
How often do you feel left out?				
How often do you feel isolated from others?				

Social Trust Index (Trust). (NORC General Social Survey, 2016, 2018, 2021, 2022)
Please choose one response from each pair of statements.

1. Generally speaking, would you say that most people can be trusted or that you can't be too careful in dealing with people?
    a. Most people can be trusted
    b. You can't be too careful in dealing with people.
2. Do you think most people would try to take advantage of you if they got the chance, or would they try to be fair?
    a. Most people would try to take advantage of you if they got the chance
    b. They try to be fair
3. Would you say that most of the time people try to be helpful, or that they are mostly just looking out for themselves?
    a. Most of the time people try to be helpful
    b. They are mostly just looking out for themselves

PADI. (Harris et al., 2014)

Using the response scale provided, indicate how often you engage in each of these driving behaviors.

Response scale (6 points): *never, almost never, sometimes, fairly often, very often, always*

Item	Statement
1	Drive with extra care around pedestrians
2	Pay special attention when approaching intersections
3	Drive with extra care around bicyclists
4	Pay special attention when making turns
5	Pay attention to traffic and my surroundings while driving
6	Brake slowly enough to alert drivers behind me
7	Decrease speed to accommodate poor road conditions
8	Use mirrors and check blind spots when changing lanes
9	Drive more cautiously to accommodate people or vehicles on the side of the road (e.g., slow down, move over)
10	Maintain a safe distance when following other vehicles
11	Slow down in a construction zone
12	Come to a complete stop at a stop sign
13	Decrease speed to accommodate poor weather conditions
14	Yield when the right of way belongs to other drivers
15	Obey traffic signs
16	Obey posted speed limits in a school zone
17	Use turn signals (blinkers) to notify other drivers of my intention to turn
18	Weave in and out of lanes to overtake traffic
19	Speed up when another vehicle tries to overtake me
20	Follow the vehicle in front of me closely to prevent another vehicle from merging in front of me
21	Pass in front of a vehicle at less than a car length
22	Merge into traffic even when another driver tries to close the gap between vehicles
23	Accelerate into an intersection when the traffic light is changing from yellow to red
24	Drive 15 miles per hour faster than the posted speed limit
25	Flash my high beams at a slower vehicle so that it will get out of my way
26	Make rude gestures at other drivers when they do something I do not like
27	Honk when another driver does something inappropriate
28	Pass other vehicles using the right lane
29	Follow a slower vehicle at less than a car length

DAX. (Deffenbacher et al., 2002)
Everyone feels angry or furious from time to time when driving, but people differ in the ways that they react when they are angry while driving. A number of statements are listed below which people have used to describe their reactions when they feel angry or furious. Read each statement and then fill in the bubble to the right of the statement indicating how often you generally react or behave in the manner described when you are angry or furious while driving. There are no right or wrong answers. Do not spend too much time on any one statement.

Response scale: 1 = *almost never*; 4 = *almost always*

Item	Statement
1	Drive right up on the other driver's bumper
2	Make negative comments about the driver aloud
3	Try to get out of the car and tell the other driver off
4	Roll down the window to communicate my anger
5	Try to scare the driver
6	Do to drivers what they did to me
7	Think of positive solutions to deal with the situation
8	Drive a lot faster
9	Swear at the other driver aloud
10	Tell myself it's not worth getting mad at
11	Tell myself it's not worth getting involved
12	Yell at the other driver
13	Try to get out and have a physical fight
14	Accept there are frustrating situations
15	Tell myself to ignore it

Perceived Norms (Norms).
Next are some questions about driving actions that could increase the likelihood of a crash.

Actions like:

- cutting off another vehicle and braking hard
- tailgating a slower vehicle
- ignoring the right-of-way to "beat" another vehicle
- responding to other drivers with rude gestures or excessive honking.

Thinking about driving actions like these, how often do the following people drive that way? (If you're unsure, please give your best guess.)

	Never	Occasionally	Sometimes	Regularly	Often	Always
You						
Most drivers you ride with						
Most drivers like you						
Most drivers in your community						
Most drivers in the U.S.						

Actions like:

- cutting off another vehicle and braking hard
- tailgating a slower vehicle
- ignoring the right-of-way to "beat" another vehicle
- responding to other drivers with rude gestures or excessive honking.

Still thinking about these same kinds of driving actions, how often in the past month have you… ?

	Never	Occasionally	Sometimes	Regularly	Often	Always
Seen this happen to someone else						
Had this happen to you while driving						

Actions like:

- cutting off another vehicle and braking hard
- tailgating a slower vehicle
- ignoring the right-of-way to "beat" another vehicle
- responding to other drivers with rude gestures or excessive honking.

Still thinking about these kinds of driving actions, how much would the following people disapprove or approve of YOU driving this way?

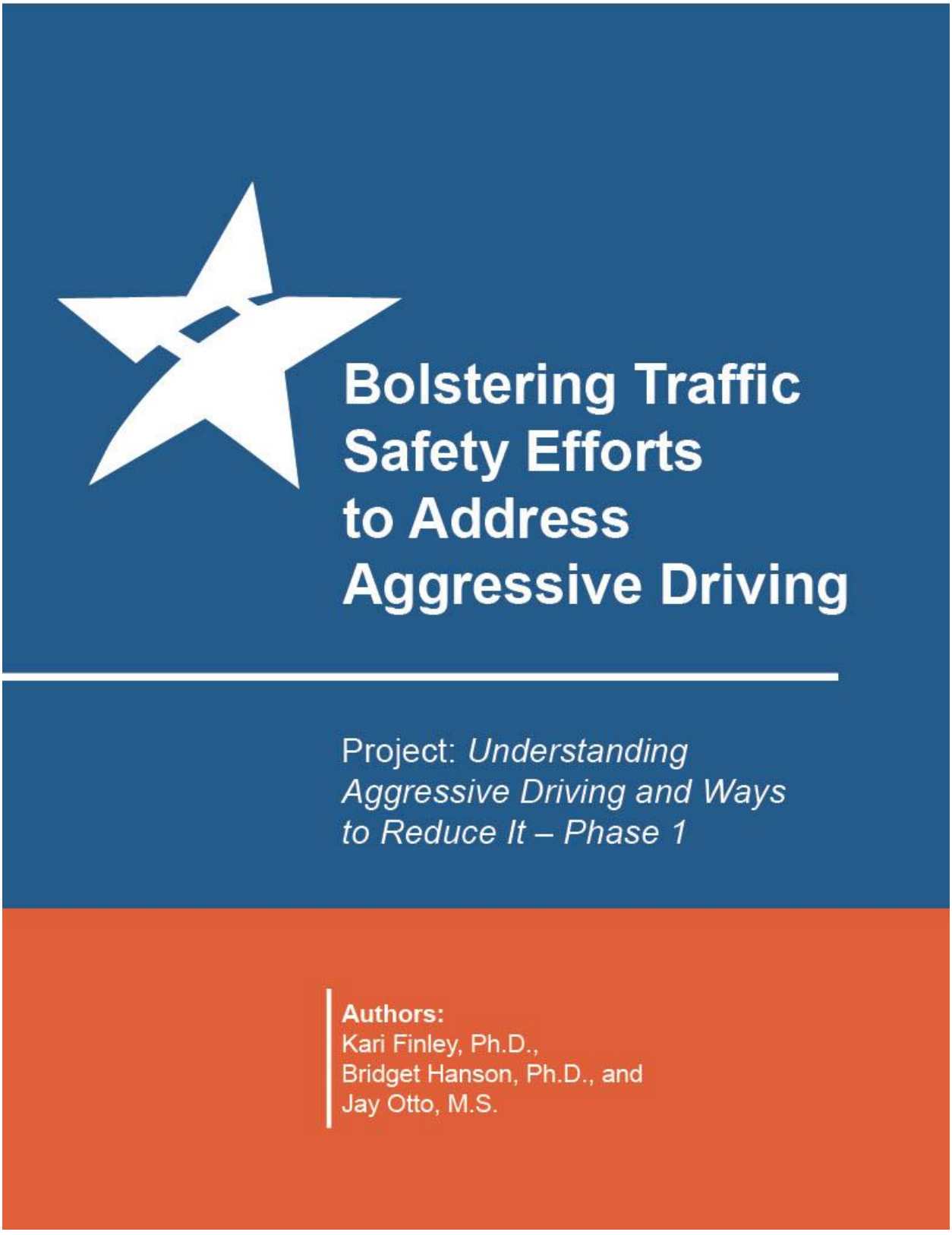
	1 - Strongly disapprove	2	3	4	5 - Strongly approve
Partner, significant other, or closest friend					
Most of your friends					
Most of your family members					
Most people who are important to you					
Most people in your community					

Driving History.

Have you ever….

	No, never	Yes, within the last year	Yes, 1-3 years ago	Yes, more than 3 years ago
Gotten a ticket or citation for speeding?				
Gotten a ticket or citation for a moving violation other than speeding?				
Gotten into a car accident or crash (when driving)?				
Had your license suspended or revoked?				

7.2 Appendix B. Guidance Document



Alternative Format Statement

MDT attempts to provide accommodations for any known disability that may interfere with a person participating in any service, program, or activity of the Department. Alternative accessible formats of this information will be provided upon request. For further information, call 406/444.7693, TTY 800/335.7592, or Montana Relay at 711.

Bolstering Traffic Safety Efforts to Address Aggressive Driving

Montana Department of Transportation
in cooperation with the U.S. Department of
Transportation Federal Highway Administration

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Table of Contents

Introduction

This document provides guidance for traffic safety practitioners about ways to bolster their current traffic safety efforts to address aggressive driving.

Aggressive driving is a complex behavior that requires multiple strategies and involves many diverse stakeholder groups to work together. Bolstering current traffic safety efforts to address aggressive driving can foster collaboration and promote engagement on this important issue.

Aggressive driving is defined as "any unsafe driving behavior that is performed deliberately, with ill intention or disregard for safety, and impacts others."[1]

There are many reasons to be concerned about aggressive driving. Aggressive driving is a leading contributing cause in traffic crashes, with evidence suggesting aggressive driving is a cause in approximately 56% of fatal crashes in the United States (U.S.).[2] Further, aggressive driving is considered a common behavior among drivers. In a recent self-reported aggressive driving behavior survey, approximately 80% of drivers reported expressing anger, aggression, or road rage while driving at least once in the past 30 days.[3]

What is aggressive driving?

Aggressive driving includes "ANY unsafe driving behavior that is performed deliberately, with ill intention or disregard for safety, and impacts others."[1]

Aggressive driving behaviors include actions like:

- cutting off another vehicle and braking hard,
- tailgating a slower vehicle,
- ignoring the right-of-way to "beat" another vehicle,
- responding to other drivers with rude gestures or excessive honking.

This document includes:

information about what was learned from a survey on aggressive driving among adults in the U.S.;

guiding questions to identify opportunities to enhance existing traffic safety efforts to reduce aggressive driving; and

ideas and specific actions that could be integrated into existing traffic safety efforts.

Is aggressive driving the same as road rage?

Aggressive driving and road rage are different. Road rage can be defined as "extreme acts of violence punishable as a criminal offense, which includes physical assault."[4] Road rage is often more extreme than aggressive driving.[5]

Is speeding considered aggressive driving?

It depends. Aggressive driving must be situated within the context of others. Thus, behavior is not considered aggressive if it does not occur in the context of another person (e.g., another driver, a pedestrian, etc.).

Speeding, for example, may be considered aggressive driving behavior when it impacts other road users (e.g., the other driver must slow down or move over). However, speeding on a highway or isolated road with no other road users would not constitute aggressive driving behavior and instead would be considered risky or careless.[1]

Bolstering Existing Traffic Safety Efforts to Reduce Aggressive Driving

Bolstering Existing Traffic Safety Efforts to Reduce Aggressive Driving

Bolstering current traffic safety efforts with strategies that address aggressive driving can occur in many ways, including:


growing prosocial driving


using strategies that support cognitive reappraisal and adaptive responses


challenging misperceptions


increasing perceived disapproval through bystander engagement

This document uses information learned from a survey about aggressive driving.

About the Survey

Throughout this document, we share results from a survey of adult U.S. drivers conducted in the summer of 2023. The survey was completed by 841 drivers; demographics of the sample approximated the U.S. population in age, gender, race, ethnicity, and state of residence. More detailed information about the survey methodology and results can be found in the *Understanding Aggressive Driving and Ways to Reduce It – Final Report.*[1]

Bolstering Existing Traffic Safety Efforts to Reduce Aggressive Driving

Growing Prosocial Driving

Prosocial driving is "**a pattern of safe driving behaviors** that potentially protect the well-being of passengers, other drivers, and pedestrians, and that promotes effective cooperation with others in the driving environment."[6]

Prosocial driving includes a wide range of behaviors[6] like:

- Using mirrors and checking blind spots when changing lanes
- Using turn signals (blinkers) to notify other drivers of an intention to turn
- Braking slowly enough to alert drivers behind you
- Decreasing speed to accommodate poor road conditions
- Yielding when the right of way belongs to other drivers
- Maintaining a safe distance when following other vehicles
- Paying attention to traffic and surroundings while driving
- Driving with extra care around pedestrians

Promoting prosocial driving may be a potential avenue to reduce aggressive driving as engaging in prosocial driving makes aggressive driving less likely.[1]

Survey Data

The majority of participants (91.1%) reported engaging in prosocial driving behaviors often while driving.

More frequent engagement in prosocial driving behaviors was associated with less frequent aggressive driving behaviors.

The most frequent prosocial behaviors endorsed by participants included using mirrors and checking blind spots when changing lanes, using turn signals, paying attention to traffic and surroundings, and driving with extra care around pedestrians.

Guiding Questions

- What current strategies/ countermeasures/campaigns promote prosocial driving behaviors?
- How can your current strategies be bolstered to increase prosocial driving?
- In what ways can prosocial driving behaviors be promoted?

Growing Prosocial Driving 10

Ideas

Infuse communication strategies and traffic safety campaigns with the promotion of prosocial driving behaviors that align with the strategy or campaign being implemented.

For example, if the current traffic safety campaign focuses on occupant protection, consider ways to promote prosocial driving behaviors that align with occupant protection.

- Partner with public health car seat inspection events and promote prosocial driving behaviors among parents. Focus on connecting a child's safety to engaging in prosocial behaviors like paying extra attention while driving around pedestrians and bicyclists or slowing down when road conditions are less than ideal.
- Partner with local emergency medical service events that focus on occupant protection and consider ways to promote prosocial behaviors that align with the wellbeing of everyone. For example, asking others to wear a seat belt in the vehicle, not using a cellphone while driving, or maintaining a safe distance between vehicles.

Provide education about prosocial driving behaviors in driver education programs, driver training programs, and workplace driving safety meetings.

Connect prosocial driving to shared values and beliefs people have about safety on roadways and caring about others.

Communication messages could be used in a variety of media (social media, campaigns, etc.). Some examples:

- Most people engage in prosocial driving behaviors often while driving.
- Most people engage in prosocial behaviors like using mirrors and checking blind spots when changing lanes, using turn signals, paying attention to traffic and surroundings, and driving with extra care around pedestrians.
- Most drivers in our community look out for one another on the roads.
- Other fellow drivers sometimes make mistakes, but drivers around here are usually courteous and careful.

Bolstering Existing Traffic Safety Efforts to Reduce Aggressive Driving

Using Strategies that Support Cognitive Reappraisal and Adaptive Responses

How a driver thinks about a situation they encounter while driving can influence their response and the ultimate outcome. A driver's cognitive appraisal of a situation is likely to influence their behavior.[7,8]

Thinking about a situation encountered while driving in a negative way can lead to feelings of anger or frustration. For example, negative thoughts that might increase anger include 'He did that on purpose,' 'He can't do that to me. I'll do that to him and see how he likes it,' 'There's always a billion people on the road.'[9] In contrast, thinking about a situation in a neutral or positive way may lead to less anger or frustration about the situation. Neutral or positive thoughts might include 'He didn't mean to do that,' 'They must not have seen me waiting to merge into traffic,' 'I don't blame them; it is hard to navigate this busy traffic.'

Similarly, when drivers perceive that other drivers' behaviors are unintentional mistakes or errors, they may respond differently and with less aggression than if they think other drivers' behaviors are deliberate or malicious.[8] Perceptions of other drivers' intentions may influence a driver's tendencies to engage in aggressive behaviors when driving.[10,11]

Cognitive reappraisal is about changing the way we think about a driving situation to change our response to the situation.

If people can reconceptualize the behavior of other drivers as neutral or an innocent mistake rather than malicious or intentionally hostile, **they may be less likely to engage in aggressive driving actions.**[1]

Survey Data

Participants reported engaging in aggressive driving more frequently if they experienced others driving aggressively more often.

Similarly, participants who perceived that others frequently drive aggressively engaged in aggressive driving more often themselves.

It is normal for drivers to sometimes feel angry. When feeling angry, drivers can choose an aggressive response or an adaptive response. Examples of aggressive responses include making negative comments about the other driver aloud, swearing at the other driver aloud, or driving faster.

Adaptive responses are constructive ways people respond to feelings of anger that focus on safe driving and coping. These responses include problem-solving, changing perspective, reframing the situation, acceptance, and using coping strategies that reduce anger.[12]

Examples of adaptive responses include:

Promoting adaptive responses to anger while driving **could reduce aggressive driving.**[1]

Survey Data

Most participants often used adaptive responses to feeling angry while driving.

Greater use of adaptive responses, both in how often and in the number of different adaptive responses reported, was associated with less aggressive driving.

Most participants rarely responded aggressively to feeling angry while driving.

The most frequent positive/adaptive responses used by participants when angry included: telling yourself it's not worth getting involved, accepting there are frustrating situations, telling yourself it's not worth getting mad at.

Guiding Questions

- What activities can grow drivers' skills to engage in cognitive reappraisal and adaptive responses when feeling angry?
- How do current traffic safety efforts promote the use of cognitive reappraisal skills and adaptive responses?
- What strategies are currently being implemented to increase traffic safety and how could those strategies be augmented to include strategies to grow drivers' skills to use cognitive reappraisal and adaptive responses?
- Who in the community has shared interest in growing reappraisal and adaptive skills?

Using Strategies that Support Cognitive Reappraisal and Adaptive Responses 14

Ideas

Understand existing strategies and consider ways to integrate cognitive reappraisal and adaptive response skill building into those strategies.

- For example, a common resource document for traffic safety practitioners is *Countermeasures that Work: A Highway Safety Countermeasure Guide for State Highway Safety Offices Tenth Edition, 2020*.[13] This resource is used to assist in identifying and selecting effective traffic safety strategies for various risky behaviors. The risky behavior of aggressive driving is discussed alongside strategies to reduce speed. Deterrence through traffic law enforcement is a strategy highlighted in this resource to reduce aggressive driving behaviors. Thus, traffic safety practitioners may want to consider ways to grow cognitive reappraisal and adaptive responses skills alongside enforcement efforts.

Provide education in driver education programs, driver training programs, and workplace driving safety meetings.

- Teach how cognitive reappraisal works and why it is important. Give examples of what it looks like in driving situations.
- Teach what adaptive response skills are and help participants identify a variety of adaptive responses they could use.

Show examples of cognitive reappraisal skills and adaptive responses in media communications.

- For example, if a current traffic safety campaign focuses on distracted driving, consider ways to show the use of cognitive reappraisal skills to lessen the frustration of encountering someone who is on their phone and driving.
- Provide examples of how to challenge negative thoughts and reframe them in a more neutral way. For example, promote that other drivers might make mistakes but that most drivers are not intentionally rude to other drivers or driving aggressively.

Partner with local events to grow cognitive reappraisal skills and adaptive response skills.

- Partner with a local traffic safety event and provide education about how cognitive reappraisal works, why it is important, and give examples of situations where cognitive reappraisal could lead to a different emotional reaction.

Bolstering Existing Traffic Safety Efforts to Reduce Aggressive Driving

Challenging Misperceptions

Beliefs influence behavior, and misperceptions may make it more likely people will engage in behaviors that are risky.[14]

Thus, **to change behavior, we need to focus on changing beliefs.** Correcting misperceptions regarding the actual frequency of aggressive driving and presenting factual norms that most people do not regularly drive aggressively may reduce aggressive driving.

Challenging misperceptions could present an important opportunity to **reduce aggressive driving.**[1]

Survey Data

Drivers believe other people in their community drive aggressively more frequently than the drivers themselves report. Drivers also perceive that other drivers in their state and across the country drive aggressively even more often than other drivers in their community.

Those that believe others drive aggressively more frequently also drive aggressively more often themselves.

Guiding Questions

- What are opportunities to correct misperceptions about aggressive driving?
- Who are stakeholders that could support efforts to challenge misperceptions about aggressive driving?
- What information may directly or indirectly contribute to misperceptions about aggressive driving?

Challenging Misperceptions 17

Ideas

Challenge misperceptions by presenting accurate norms through messaging. Use current and accurate data to support these claims.

Messages could include:

- Most drivers in our community do not often drive aggressively.
- Most adults engage in prosocial driving behaviors often while driving.
- It might seem like everyone around here drives aggressively, but most drivers in our community are respectful and considerate of other drivers.

Engage with the public in a variety of ways to promote accurate data about aggressive driving.

- Attend local events (health fairs, community hall meetings, community events, etc.) to promote conversation and accurate data about aggressive driving. These community engagement events are opportunities to engage on the topic of aggressive driving and to encourage conversation.

Find trusted sources to deliver information.

- Carefully consider the source being used to deliver information and select sources the audience for the messages finds trustworthy.
- Consider:
  - Who can add credibility?
  - Who are the trusted sources for the intended audience?

Bolstering Existing Traffic Safety Efforts to Reduce Aggressive Driving

Increasing Perceived Disapproval Through Bystander Engagement

Bystanders, especially partners, family, and close friends, can be influential in encouraging others to not drive aggressively.

Whether riding along in the vehicle or not, we can make it clear to people who are important to us that we do not support them driving aggressively and instead support prosocial driving behavior.

Perceived disapproval is a unique opportunity for **intervention to reduce aggressive driving.**[1]

Survey Data

Greater perceived disapproval was associated with less frequent engagement in aggressive driving behaviors.

Participants believed their partner, significant other, or closest friend would disapprove the most of them engaging in aggressive driving actions.

Guiding Questions

- What are opportunities to grow perceptions of disapproval about aggressive driving?
- In what ways can we bolster bystander engagement skills to speak up about aggressive driving?
- How can bystanders be directly engaged in promoting traffic safety, including reducing aggressive driving?

Increasing Perceived Disapproval Through Bystander Engagement 20

Ideas

Promote bystander engagement as an overarching strategy to address a variety of risky driving behaviors (i.e., distraction, not wearing a seat belt, driving under the influence of substances, aggressive driving, etc.).

- Include specific examples of what bystander engagement could look like in situations for each risky driving behavior.

Show examples of bystander engagement in media communications.

- Illustrate bystanders both in and out of the vehicle asking their loved ones to not drive aggressively.
- Provide language that passengers of all ages can use, such as asking drivers to not drive aggressively or to offer cognitive reappraisals during an encounter with another driver.

Incorporate the role of bystanders in drivers' education and prevention strategies for young people.

Empower passengers to play an active role in traffic safety and increase awareness among drivers and passengers alike that traffic safety and reducing aggressive driving is a shared responsibility.

Conclusion

Bolstering current traffic safety efforts to address aggressive driving can help traffic safety practitioners maximize resources and foster engagement.

Growing prosocial driving, using strategies that support cognitive reappraisal and adaptive responses, challenging misperceptions, and increasing perceived disapproval through bystander engagement can be incorporated into existing efforts to address aggressive driving.

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1. Finley, K., Hanson, B., Otto, J., & Green, K. (2024). *Understanding Aggressive Driving and Ways to Reduce It—Phase 1 | Montana Department of Transportation (MDT)*. https://www.mdt.mt.gov/research/projects/trafficsafety-ad.aspx

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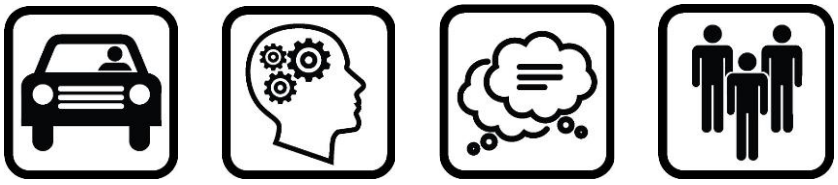
7.3 Appendix C. PowerPoint Presentation Slides

Bolstering Traffic Safety Efforts to Address Aggressive Driving

Agenda

- An overview of aggressive driving
- Ways to bolster existing traffic safety efforts to reduce aggressive driving



What is aggressive driving?

"Any unsafe driving behavior that is performed deliberately, with ill intention or disregard for safety, and impacts others."[1]

1. Finley, K., Hanson, B., Otto, J., & Green, K. (2024). Understanding Aggressive Driving and Ways to Reduce It —Phase 1 | Montana Department of Transportation (MDT). https://www.mdt.mt.gov/research/projects/trafficsafety -ad.aspx

Aggressive driving behaviors include actions like:

- cutting off another vehicle and braking hard
- tailgating a slower vehicle
- ignoring the right -of-way to "beat" another vehicle
- responding to other drivers with rude gestures or excessive honking

Why is addressing aggressive driving important?

Traffic crashes are a major public health concern in the U.S.

- In 2022, 42,795 people in the U.S. lost their lives in traffic crashes. [1]
- While there are many causes that contribute to traffic crashes, aggressive driving is considered a leading cause, with evidence suggesting aggressive driving is a cause in approximately 56% of fatal crashes. [2]
- Aggressive driving is considered a common behavior among drivers.
- In a recent self -reported aggressive driving behavior survey, approximately 80% of drivers reported expressing anger, aggression, or road rage while driving at least once in the past 30 days. [3]

1. AAA Foundation for Traffic Safety. (2022). *2021 Traffic Safety Culture Index*. https://aaafoundation.org/wp -content/uploads/2022/11/2021 -TSCI-Full-Report.pdf
2. AAA. (2013). *Road Rage: How to Avoid Aggressive Driving*. https://exchange.aaa.com/wp -content/uploads/2013/06/Road -Rage-Brochure.pdf
3. AAA. (2022). *Aggressive Driving – AAA Exchange*. Aggressive Driving. https://exchange.aaa.com/safety/driving -advice/aggressive -driving/

Aggressive Driving Survey

- 841 adult drivers completed the survey
- Participants were from 49 states (all except Vermont and the District of Columbia)
- Demographics of the sample approximate the U.S. population by age, gender, race, ethnicity, and state of residence

About the Survey

A survey of adult U.S. drivers was conducted in the summer of 2023. More detailed information about the survey methodology and results can be found in the *Understanding Aggressive Driving and Ways to Reduce It – Final Report.* The report can be found at: https://www.mdt.mt.gov/research/projects/trafficsafety.shtml

Ways to Bolster Existing Traffic Safety Efforts to Reduce Aggressive Driving

- Growing Prosocial Driving

- Using Strategies that Support Cognitive Reappraisal and Adaptive Responses

- Challenging Misperceptions

- Increasing Perceived Disapproval through Bystander Engagement

Growing Prosocial Driving

Prosocial driving is *"a pattern of safe driving behaviors that potentially protect the well-being of passengers, other drivers, and pedestrians, and that promotes effective cooperation with others in the driving environment."*[1]

1. Harris, P. B., Houston, J. M., Vazquez, J. A., Smither, J. A., Harms, A., Dahlke, J. A., & Sachau, D. A. (2014). The Prosocial and Aggressive Driving Inventory (PADI): A self -report measure of safe and unsafe driving behaviors. *Accident Analysis & Prevention* , *72*(Supplement C), 1 –8. https://doi.org/10.1016/j.aap.2014.05.023

Prosocial driving includes a wide range of behaviors [1] like:

- Using mirrors and checking blind spots when changing lanes
- Using turn signals (blinkers) to notify other drivers of an intention to turn
- Braking slowly enough to alert drivers behind you
- Decreasing speed to accommodate poor road conditions
- Yielding when the right of way belongs to other drivers
- Maintaining a safe distance when following other vehicles
- Paying attention to traffic and surroundings while driving
- Driving with extra care around pedestrians

1. Harris, P. B., Houston, J. M., Vazquez, J. A., Smither, J. A., Harms, A., Dahlke, J. A., & Sachau, D. A. (2014). The Prosocial and Aggressive Driving Inventory (PADI): A self -report measure of safe and unsafe driving behaviors. *Accident Analysis & Prevention* , *72*(Supplement C), 1 –8. https://doi.org/10.1016/j.aap.2014.05.023

Aggressive Driving Survey Data

The majority of participants (91.1%) reported engaging in prosocial driving behaviors often while driving.

More frequent engagement in prosocial driving behaviors was associated with less frequent aggressive driving behaviors.

The most frequent prosocial behaviors endorsed by participants included using mirrors and checking blind spots when changing lanes, using turn signals, paying attention to traffic and surroundings, and driving with extra care around pedestrians.

Promoting prosocial driving may be a potential avenue to reduce aggressive driving as engaging in prosocial driving makes aggressive driving less likely.

Guiding Questions

- What current strategies/ countermeasures/campaigns promote prosocial driving behaviors?
- How can your current strategies be bolstered to increase prosocial driving?
- In what ways can prosocial driving behaviors be promoted?

Ideas - Growing Prosocial Driving

Infuse communication strategies and traffic safety campaigns with the promotion of prosocial driving behaviors that align with the strategy or campaign being implemented.

Provide education about prosocial driving behaviors in driver education programs, driver training programs, and workplace driving safety meetings.

Connect prosocial driving to shared values and beliefs people have about safety on roadways and caring about others.

Using Strategies that Support Cognitive Reappraisal and Adaptive Responses

How a driver thinks about a situation they encounter while driving can influence their response and the ultimate outcome. A driver's cognitive appraisal of a situation is likely to influence their behavior.[1] [2]

1. Ge Y, Zhang Q, Zhang J, et al. Validation of the Driver's Angry Thoughts Questionnaire (DATQ) in a Chinese sample. *Accident Analysis & Prevention*. 2016;95:362 -372. doi:10.1016/j.aap.2016.04.025

2. Lennon AJ, Watson B. "Teaching them a lesson?" A qualitative exploration of underlying motivations for driver aggression. *Accident Analysis & Prevention*. 2011;43(6):2200 -2208. doi:10.1016/j.aap.2011.06.015

Cognitive Reappraisal

- Thinking about a situation encountered while driving in a negative way can lead to feelings of anger or frustration. In contrast, thinking about a situation in a neutral or positive way may lead to less anger or frustration about the situation.
- When drivers perceive that other drivers' behaviors are unintentional mistakes or errors, they may respond differently and with less aggression than if they think other drivers' behaviors are deliberate or malicious. [1]
- Perceptions of other drivers' intentions may influence a driver's tendencies to engage in aggressive behaviors when driving. [2 3]
- Cognitive reappraisal is about changing the way we think about a driving situation to change our response to the situation.

1. Lennon AJ, Watson B. "Teaching them a lesson?" A qualitative exploration of underlying motivations for driver aggression. *Accident Analysis & Prevention* . 2011;43(6):2200 -2208. doi:10.1016/j.aap.2011.06.015

2. Berdoulat, E., Deninotti, J., & Vavassori, D. (2021). Typology of aggressive and transgressive drivers. *Accident Analysis & Prevention* , *162*, 106404. https://doi.org/10.1016/j.aap.2021.106404

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Aggressive Driving Survey Data

If people can reconceptualize the behavior of other drivers as neutral or an innocent mistake rather than malicious or intentionally hostile, **they may be less likely to engage in aggressive driving actions.**

Participants reported engaging in aggressive driving more frequently if they experienced others driving aggressively more often.

Similarly, participants who perceived that others frequently drive aggressively engaged in aggressive driving more often themselves.

Adaptive Responses

Adaptive responses are constructive ways people respond to feelings of anger that focus on safe driving and coping. These responses include problem-solving, changing perspective, reframing the situation, acceptance, and using coping strategies that reduce anger.[1]

1. Deffenbacher JL, Lynch RS, Oetting ER, Swaim RC. The driving anger expression inventory: a measure of how people express their anger on the road. *Behaviour Research and Therapy* . 2002;40(6):717 -737. doi:10.1016/s0005 -7967(01)00063 -8

Examples of adaptive responses[1] include:

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Aggressive Driving Survey Data

Promoting adaptive responses to anger while driving **could reduce aggressive driving.**

Most participants often used adaptive responses to feeli
angry while driving.

Greater use of adaptive responses, both in how often and in the number of different adaptive responses reported, was associated with less aggressive driving.

Most participants rarely responded aggressively to feeling angry while driving.

The most frequent positive/adaptive responses used by participants when angry included: telling yourself it's not worth getting involved, accepting there are frustrating situations, telling yourself it's not worth getting mad at.

Guiding Questions

- What activities can grow drivers' skills to engage in cognitive reappraisal and adaptive responses when feeling angry?
- How do current traffic safety efforts promote the use of cognitive reappraisal skills and adaptive responses?
- What strategies are currently being implemented to increase traffic safety and how could those strategies be augmented to include strategies to grow drivers' skills to use cognitive reappraisal and adaptive responses?
- Who in the community has shared interest in growing reappraisal and adaptive skills?

Ideas – Using Strategies that Support Cognitive Reappraisal and Adaptive Responses

Understand existing strategies and consider ways to integrate cognitive reappraisal and adaptive response skill building into those strategies.

Provide education in driver education programs, driver training programs, and workplace driving safety meetings.

Show examples of cognitive reappraisal skills and adaptive responses in media communications.

Partner with local events to grow cognitive reappraisal skills and adaptive response skills.

Challenging Misperceptions

Beliefs influence behavior, and misperceptions may make it more likely people will engage in behaviors that are risky.[1]

Thus, **to change behavior, we need to focus on changing beliefs.** Correcting misperceptions regarding the actual frequency of aggressive driving and presenting factual norms that most people do not regularly drive aggressively may reduce aggressive driving.

1. Amialchuk A, Ajilore O, Egan K. The influence of misperceptions about social norms on substance use among school -aged adolescents. *Health Economics*. 2019;28(6):736 -747. doi:10.1002/hec.3878

Aggressive Driving Survey Data

Drivers believe other people in their community drive aggressively more frequently than the drivers themselves report. Drivers also perceive that other drivers in their state and across the country drive aggressively even more often than other drivers in their community.

Those that believe others drive aggressively more frequently also drive aggressively more often themselves.

Challenging misperceptions could present an important opportunity to **reduce aggressive driving**.

Guiding Questions

- What are opportunities to correct misperceptions about aggressive driving?
- Who are stakeholders that could support efforts to challenge misperceptions about aggressive driving?
- What information may directly or indirectly contribute to misperceptions about aggressive driving?

Ideas – Challenging Misperceptions

Challenge misperceptions by presenting accurate norms through messaging. Use current and accurate data to support these claims.

Engage with the public in a variety of ways to promote accurate data about aggressive driving.

Find trusted sources to deliver information.

Increasing Perceived Disapproval Through Bystander Engagement

Bystanders, especially partners, family, and close friends, can be influential in encouraging others to not drive aggressively.

Whether riding along in the vehicle or not, we can make it clear to people who are important to us that we do not support them driving aggressively and instead support prosocial driving behavior.

Aggressive Driving Survey Data

Greater perceived disapproval was associated with less frequent engagement in aggressive driving behaviors.

Participants believed their partner, significant other, or closest friend would disapprove the most of them engaging in aggressive driving actions.

Perceived disapproval is a unique opportunity for **intervention to reduce aggressive driving.**

Guiding Questions

- What are opportunities to grow perceptions of disapproval about aggressive driving?
- In what ways can we bolster bystander engagement skills to speak up about aggressive driving?
- How can bystanders be directly engaged in promoting traffic safety, including reducing aggressive driving?

Ideas – Increasing Perceived Disapproval Through Bystander Engagement

Promote bystander engagement as an overarching strategy to address a variety of risky driving behaviors (i.e., distraction, not wearing a seat belt, driving under the influence of substances, aggressive driving, etc.).

Show examples of bystander engagement in media communications.

Incorporate the role of bystanders in drivers' education and prevention strategies for young people.

Empower passengers to play an active role in traffic safety and increase awareness among drivers and passengers alike that traffic safety and reducing aggressive driving is a shared responsibility.

Conclusion

- **Bolstering current traffic safety efforts to address aggressive driving can help traffic safety practitioners maximize resources and foster engagement.**

- Growing prosocial driving, using strategies that support cognitive reappraisal and adaptive responses, challenging misperceptions, and increasing perceived disapproval through bystander engagement can be incorporated into existing efforts to address aggressive driving.

Bolstering Traffic Safety Efforts to Address Aggressive Driving

Project: *Understanding Aggressive Driving and Ways to Reduce It– Phase 1*

Montana Department of Transportation
in cooperation with the U.S. Department of
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