EMOTIONAL INTELLIGENCE AND DANGEROUS DRIVING BEHAVIORS

by

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DEDICATION

This dissertation is dedicated to my mother Jahera Begum, my best friend in this world, for her endless love, support, and encouragement.

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ABSTRACT

Dangerous driving behaviors are the leading cause of road crashes and fatalities. Many factors contribute to dangerous driving behaviors including drivers' beliefs, attitudes, personalities, and emotions. Of these, the role of emotions has received less attention. Emotional Intelligence theory provides a framework for understanding how individuals' emotional factors influence their behaviors and interactions with others. Therefore, this research aims to understand how emotional intelligence can be used to investigate and alleviate dangerous driving behaviors. The research aims of this dissertation include 1. Identify the most appropriate measure of emotional intelligence that is currently available for the driving context; 2. Examine the correlations between emotional intelligence and dangerous driving behaviors in different risk exposure groups (commercial and non-commercial drivers); 3. Develop an emotional intelligence measure specific to the context of driving. This research dissertation comprised four survey studies conducted between November 2019 to July 2021 among commercial and non-commercial drivers across the United States. The results further revealed higher emotional intelligence scores related to less dangerous driving behaviors for both commercial and non-commercial drivers. However, the relationship between emotional intelligence and dangerous driving was significantly stronger among commercial drivers than their non-commercial counterparts. In the final study, this research developed a new Drivers' Emotional Intelligence Scale (DEIS) specific to driving. Factor analysis revealed a three-factor structure for DEIS labeled as emotionality, self-control, and anxiety. The results showed that the DEIS subscales were stronger predictors of dangerous driving behaviors compared to the previously used emotional intelligence scales. This research concludes that improving emotional intelligence will be useful to reduce dangerous driving behaviors and suggests incorporating emotional intelligence to design interventions to reduce fatal road crashes. This research acknowledges some limitations such as the use of self-reported surveys and convenience quota samples, which may have limited the generalizability of these results. Future research should continue to gather evidence about the association between emotional intelligence and traffic safety through different experimental designs and longitudinal studies.

CHAPTER ONE

INTRODUCTION

Motor vehicle crashes lead to a significant loss of life and many injuries worldwide every year. Motor vehicle crashes are also a significant public health concern as one of the leading causes of fatalities and injuries in the United States. In 2019, there were a total of 36,096 deaths, and more than 2.7 million injuries in vehicle crashes in the United States (NHTSA, 2020). Many factors are associated with vehicle crashes, including vehicle condition (e.g., flat tire, brakes), road infrastructure (e.g., traffic signal placement), driving environment (e.g., slick roads, glare, and weather), and human factors (e.g., risky behaviors, driving errors) (Scott-Parker et al., 2012; Weng & Meng, 2012). Surprisingly, 94% of crashes are due to the drivers behind the wheel, while other factors contribute insignificantly (NHTSA, 2020; Sabey & Taylor, 1980). While governments and policymakers primarily focus on infrastructure development and law enforcement in order to improve road safety, it is the responsibility of the drivers to pay attention and undergo appropriate road safety training to reduce driving crashes. This dissertation aims to examine drivers' dangerous behaviors and associated contributing factors to increase traffic safety.

Dangerous driving behaviors can be defined as any driving behavior that increases the likelihood of a driver being involved in a vehicle crash or traffic law violation that may harm the driver, the passengers, or other road users (Dula & Geller, 2003; Scott-Parker et al., 2012). These behaviors can be intentional or unintentional; either way, such behaviors can increase the probability of a crash or violation. The colloquial terms for dangerous driving behaviors are aggressive driving, traffic violations, and road rage. In addition, the National Highway Traffic Safety Administration (NHTSA) also identified drunk driving, drug impaired driving, speeding,

lack of seat belt use, and drowsy driving as dangerous driving behaviors on their website. Traffic safety literature classifies dangerous driving behaviors differently based on human factors.

Reason et al. (1990) were traffic safety research pioneers, who considered the human factors aspect to classify and understand dangerous driving behaviors and have been cited in over 2000 scientific articles. They took into consideration drivers' intentions, mistakes, and slips that can contribute to dangerous driving behaviors and classified them into violations and errors. Driving violations were defined as an intentional breach of traffic laws and social norms (e.g., driving over the posted speed limit), while driving errors were defined as drivers' unintentional faults of judgment or decision making when driving a vehicle (e.g., failure to yield) (Reason et al., 1990). Many of the common forms of dangerous driving, such as speeding and drunk driving, are considered under the violations measure, and other unintentional forms of dangerous driving, such as forgetting a turn signal, were measured through the error scale. After a decade, Dula and Ballard (2003) proposed a new classification of dangerous driving behaviors and suggested three categories: risky driving, aggressive driving, and negative emotional driving. They defined risky driving as a driver's intentional risk-taking behaviors (e.g., drinking and driving); aggressive driving as a driver's intentional actions to annoy, irritate, or punish other drivers (e.g., tailgating); and finally, negative emotional driving as a driver's irritability and anger that influences them to want to cause harm to others on the road. The consequences of dangerous driving behaviors are severe regardless of how researchers have named or classified them. For example, speeding accounted for 25% of fatalities, drug or alcohol-impaired driving accounted for 28%, driving without a seat belt accounted for 40%, and distracted driving accounted for 9% (NHTSA, 2020). In order to reduce fatalities and crashes in the United States or worldwide, there is a need to understand why a driver engages in dangerous driving behaviors (intentionally or

unintentionally) and the associated factors that also contribute to those behaviors. Exploring the connection between emotions and driving behavior can lead to a more robust picture of what leads to or causes dangerous behaviors on the road.

Emotions and Dangerous Driving Behaviors

Emotions and personality traits are significant human factors that influence dangerous driving behaviors (Lucidi et al., 2019; Smorti et al., 2018; Ulleberg & Rundmo, 2003). Personality traits have been widely investigated in traffic safety research; however, the influence of emotions remains less explored. We experience different emotions in our everyday life, and emotions influence and motivate everyday behaviors (Detweiler-Bedell & Salovey, 2002). Moreover, emotions and affective components greatly influence decision-making and the perception of risk, which are potentially linked with engaging in dangerous behaviors (Markič, 2009). Many studies identified that reduced abilities in emotional regulation contribute to different risky behaviors, including substance abuse (Bonn-Miller et al., 2008; Rivers et al., 2013; Vilhena-Churchill & Goldstein, 2014), delinquency (Rivers et al., 2013), risky sexual behavior (Messman-Moore et al., 2010; Tull et al., 2012), self-harm (Gratz & Roemer, 2008; Gratz & Tull, 2010) and aggressive behaviors (Cohn et al., 2010; Gratz et al., 2009; Rivers et al., 2013). While it is clear that emotions play a large role in decision making and behaviors in the day-to-day lives of people, it is important to apply this knowledge to the driving context.

Considerable research has substantiated that a driver's emotions have a significant effect on dangerous driving behaviors (Arnau-Sabates et al., 2012; Dula & Ballard, 2003; Hayley et al., 2017; James & Nahl, 2000; Rivers et al., 2013). For instance, studies have found a strong correlation between negative emotions (e.g., frustration, anger, and sadness) and dangerous driving behaviors (Dula & Ballard, 2003; James & Nahl, 2000). Furthermore, multiple studies

have found that anger predicts drivers' impatience with traffic, rage towards other drivers, aggressive driving, and traffic violations (Dahlen & White, 2006; Deffenbacher et al., 2003; Lajunen & Parker, 2001). Drivers' emotions on the road can be stimulated by different factors, such as slow or heavy traffic, other drivers' risky activities (e.g., lane change without proper signal), and personal or work-related factors (Deffenbacher et al., 2003; Underwood et al., 1999). Though researchers separately studied different emotional components and the influence of emotional regulation on driving behaviors, a comprehensive investigation is required to understand how different aspects of emotions combined together related with those behaviors. The comprehensive picture of emotions can be understood precisely by learning an individual's emotional intelligence.

Emotional Intelligence

Drivers' emotions can be better understood by assessing emotional intelligence (EI). Emotional intelligence was introduced in the early 90s that has been defined as the ability to recognize emotions (of themselves and others), control emotions, and to use emotions appropriately to guide one's thinking and behaviors (Mayer et al., 1990). EI became popular over the last decade to measure individuals' emotion-related intelligence and how that impacts human life. o It is important to note that EI is not any specific emotions, rather emotions are the result of EI. EI scales except the ability measure MSCEIT, do not measure any specific emotions (e.g., sadness, frustration), instead access individuals' ability to understand or express overall emotions and emotional control. EI provides an applicable framework to grow individuals' emotional competencies through training and education. EI is associated with various types of outcomes across multiple dimensions, including cognitive and social functioning, psychological well-being, psychopathology, academic performance, leadership, and behavior (Brackett et al., 2004;

Brackett et al., 2011; Caruso et al., 2002; Durlak et al., 2011; Parker et al., 2004). Mayer, Roberts, et al. (2008) found that EI predicts social relations, workplace performance, and mental and physical well-being. Similarly, Charbonneau and Nicol (2002) found that adolescents with higher EI are more altruistic, courteous, and conscientious and have more civic virtue. EI has also been found to be negatively associated with different risky behaviors, including substance abuse, aggressive behaviors, social deviance, and risky sexual behaviors (Brackett et al., 2004; Rivers et al., 2013; Trinidad & Johnson, 2002). Though researchers have studied emotional intelligence in the context of other dangerous behaviors, it has not been widely explored in the context of driving.

While the first introduction of EI was based on cognitive abilities, others likened the concept with a list of social skills and personality traits (Goleman, 1995; Petrides & Furnham, 2000). Though different models of EI have emerged since its beginning, they have many conceptual similarities, including the hierarchical approach to measure total EI and some common facets such as emotion perception, emotion regulation, and emotion use. At present, there are three broadly recognized EI models available in research known as ability, mixed, and trait EI. However, most researchers consider that trait and mixed EI are similar in terms of construct and measurement (O'Connor et al., 2019; Pérez et al., 2005). The ability EI measures claimed to be better than the mixed or trait models because they do not rely on participants' self-reporting (Mayer et al., 2000). However, others argued that self-report measures of EI have better utility as these scales were designed to assess ‘typical performance’ instead of ‘maximal performance’ (Gignac, 2010). In view of the complexity of the EI models, it is difficult to select one specific measure in the context of driving behavior.

The ability EI models assess individuals' theoretical ability to understand emotions and emotional function through a test that uses questions comparable to an intelligence (IQ) test (O'Connor et al., 2019). Ability measures require participants to solve emotion-related problems which have pre-determined correct or incorrect answers (e.g., what mood might be helpful to feel when creating new, exciting decorations for a birthday party? (a) annoyance (b) boredom (c) joy), instead of self-reporting an answer to a statement (Mayer et al., 2003). One main advantage of ability EI is that the test cannot be biased due to the participants attempting to give correct answers to obtain a high score (O'Connor et al., 2019). However, there are many disadvantages to the ability measures. The test is only good at determining emotional competencies, and there is a chance for unaccounted emotional confounding factors (e.g., anxiety-related disorders, emotional trauma, tiredness) (O'Connor et al., 2017). Many researchers argue that the ability test is nothing but an intelligence test, given its similarities to and high correlation with IQ and SAT tests (O'Connor et al., 2019; Pérez et al., 2005). Moreover, ability EI showed poor psychometric properties regarding reliability and validity, as well as the test's weak predictability of behaviors (Miao et al., 2017; O'Boyle et al., 2011). In addition, the administration of the ability EI test is not easily accessible or convenient, and the language of the questions is difficult for participants with limited education. For these reasons, the ability EI model may not be the best fitting measure for the driving context.

In contrast, trait and mixed EI models assess different self-rated emotional abilities as well as emotion-related behaviors (Brackett et al., 2011; Mayer, Roberts, et al., 2008; Petrides & Furnham, 2001). Several researchers in the field of EI have argued that mixed EI measures have limitations in terms of theoretical construct because they use ability EI theory while not using the correct test format (e.g., maximal emotional test) (O'Connor et al., 2017). Additionally, there are

several mixed EI measures that focus on workplace and leadership development (e.g., GENOS, WLEIS), limiting its use in generalized contexts such as driving. A detailed review of the mixed EI model can be found in Pérez et al., 2005 which explains its downfalls and strengths. Due to the inconsistent format, scale structure, and ungeneralizability, the mixed EI model has been excluded from further consideration.

Trait EI measures have a strong theoretical background that assess emotional intelligence in the general population and have become popular in various research domains considering their validity and reliability. Trait EI measures incorporate many confounding factors highly influential in emotion-related decisions. Moreover, trait EI was found to be strongly associated with a broader range of emotional and social related outcomes including goal-orientation, coping, work and marital satisfaction, job stress, job performance, and deviant behavior at school (Pérez et al., 2005). However, many researchers criticized trait EI due to the self-reported measure, as people are not always accurate about their emotion-related abilities and tendencies (Boyatzis, 2018; Brackett et al., 2006). Moreover, there is always a high probability that participants can choose to answer in a socially desirable way (O'Connor et al., 2019). However, others argued that when participants do not have access to the results, such as research survey questionnaires, individuals are more likely to respond accurately to trait EI (Tett et al., 2012). For these reasons, trait EI is being regularly used in the research context.

After a review of each EI model, it is clear that ability EI should be chosen when research aims to measure only emotional abilities in a situation where a strong understanding of emotion is required, while trait EI should be selected when research aims to measure behavioral tendencies as well as emotional self-efficacy (O'Connor et al., 2019). Additionally, researchers suggest using trait EI for research where the situation can be characterized by ongoing stressors

such as the educational, employment, or driving contexts (O'Connor et al., 2017; O'Connor et al., 2019). Trait EI shows stronger psychometric properties over the ability EI model, as well as a stronger theoretical basis, and it was correlated with a larger set of outcome variables (O'Connor et al., 2019). Of the scales within the trait model, the Trait Emotional Intelligence Questionnaire (TEIQue) is recommended by multiple researchers based on its comprehensive measurement ability of emotions and associated factors, strong predictability of behaviors, and evidence of its reliability and validity, which has been used in over 2000 academic studies (Andrei et al., 2016). Therefore, the best measure for all traffic safety research concerning emotions in the driving context may be the TEIQue scale.

Emotional Intelligence and Driving Behaviors Research

To date, there has been limited research investigating the relationship between emotional intelligence and dangerous driving behaviors (Arnau-Sabates et al., 2012; Falahi & Goudarzi, 2015; Hayley et al., 2017). Smorti et al. (2018) found that total EI (measured by TEIQue) was correlated to risky and aggressive driving, but they did not explore other EI subscales. Moreover, Arnau-Sabates et al. (2012) found that EI components of emotional regulation, empathy, and impulse control were negatively correlated to dangerous driving behaviors. Similarly, Hayley et al. (2017) found that lower emotional recognition and expression scores predicted aggressive driving and negative emotional driving. Furthermore, Falahi and Goudarzi (2015) stated that drivers with higher social awareness and relationship management scores had significantly fewer driving violations and errors.

Though these studies found relationships between EI and various dangerous driving behaviors, their results varied. Confounding factors including cultural driving norms, sample demographics, and the EI measures used could all be contributing factors to the variability found

in these studies. These studies investigated different driving behavior measures, such as aggressive and negative emotional driving (Hayley et al., 2017; Smorti et al., 2018), driving violations and errors (Falahi & Goudarzi, 2015), number of citations (Smorti et al., 2018), and driving attitudes (Arnau-Sabates et al., 2012). Moreover, these studies used different EI measures such as the TEIQue (Smorti et al., 2018), GENOS (Hayley et al., 2017), and EQ-*i* (Arnau-Sabates et al., 2012) without giving any explanation to why those scales were selected or their appropriateness in the driving context. The varying results of these studies may not only be from the measurement differences, but also from sampling-related issues such as being limited by age groups, gender, geography, or population (e.g., not including the commercial driving population of road users) (Arnau-Sabates et al., 2012; Falahi & Goudarzi, 2015; Hayley et al., 2017; Smorti et al., 2018). Considering the findings and shortcomings of these studies, further investigation is required in the North American context, with a more representative sample of the driving population.

Goal and Objectives

Emotional Intelligence (EI) has become popular in understanding individuals' emotional ability and has been applied in many social and psychological fields. However, its application is limited in the field of road and traffic safety. This research identified the following gaps that need to be addressed in order to understand the scope:

First, the literature review has revealed that a broad range of measures are available in terms of dangerous driving behaviors and emotional intelligence. However, no consistent guidelines are available to select the best measurement in the context of traffic safety. Therefore, a study to determine the best measure is necessary based off of the literature review.

Second, the correlations between EI and dangerous driving needed to be further validated, given the shortcomings of existing research. Moreover, the nature of driving for different populations (e.g., commercial drivers) may contribute to different driving behaviors on the road. Therefore, drivers' related factors for various populations (e.g., commercial and non-commercial) need to be addressed and compared to determine if there are differences in EI and behaviors that impact road crashes.

Finally, there is no emotional intelligence measure available specific to driving. Using an EI scale not specific to the driving context could produce less accurate results in predicting behaviors or developing interventions for road safety. Developing an EI scale in the driving context may help inform new methods of traffic safety intervention intended to reduce dangerous driving related to extreme emotions.

The main goal of the research is to investigate dangerous driving behaviors, with a focus on emotional intelligence. Three objectives have been taken into consideration to address these research gaps:

1. Identify the most appropriate measure of emotional intelligence for driving context.
2. Examine the correlations between emotional intelligence and dangerous driving behaviors in different risk exposure groups (commercial and non-commercial drivers).
3. Develop an emotional intelligence measure specific to the context of driving.

Structure of the Dissertation

This dissertation is conducted in several separate studies to address the aforementioned objectives. The outline of this dissertation will be as below:

Objective One: Chapter One outlines the current states of EI and dangerous driving behaviors and provides a rationale for this research. Chapter Two provides the results and

findings from the pilot study regarding finalized measures, population and sample size, and guidelines for analysis.

Objective Two: Chapter Three provides the relationship between EI and dangerous driving behaviors among non-commercial drivers. Chapter Four reports the relationship between EI and dangerous driving behaviors among commercial drivers as well as compares that relationship between commercial and non-commercial drivers.

Objective Three: Chapter Five reports the pilot study findings in order to develop a driving-specific EI scale. Chapter Six develops a new EI scale in the context of driving and provides the validity and reliability of that scale.

Finally, Chapter Seven is a general discussion of the research findings of five main chapters, the practical and methodological implications, the strengths and limitations of this research, and future research directions.

Table 1.1. List of Chapters and Manuscript

Chapter 1	Introduction
Chapter 2	An Exploratory Study of Emotional Intelligence and Dangerous Driving
Chapter 3	How Does Emotional Intelligence Predict Driving Behaviors Among Non-Commercial Drivers?
Chapter 4	The Influence of Emotional Intelligence on Dangerous Driving: A Comparison between Commercial and Non-commercial Drivers.
Chapter 5	A Pilot Study of Developing a Scale to Assess Emotional Intelligence in the Context of Driving
Chapter 6	Developing a Scale to Assess Emotional Intelligence in the Context of Driving
Chapter 7	Discussion and Conclusions

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CHAPTER TWO

AN EXPLORATORY STUDY OF EMOTIONAL INTELLIGENCE AND DANGEROUS DRIVING

Introduction

The World Health Organization (WHO) reports that 1.35 million people die worldwide every year because of traffic crashes. In addition, the National Highway and Traffic Safety Administration (NHTSA) in the US reported that in 2019 more than 2.7 million people were injured in vehicle crashes, with a total of 36,560 deaths. As a result, medical and property damage costs are over $230 billion every year (NHTSA, 2015). Therefore, motor vehicle crashes are a significant area of public health concern in the US and finding ways to mitigate and lower crash rates will be an important area of traffic safety. When considering reducing crash rates, it is important to look at the factors that typically cause vehicular crashes. Many factors have been associated with crashes, including road design, vehicle errors, environment, and driver behaviors (Scott-Parker et al., 2012; Weng & Meng, 2012). However, more than 90% of crashes occurred due to drivers' dangerous behaviors or wrong decisions (Singh, 2015).

Dangerous driving behaviors have been defined as drivers' inappropriate or unsafe activity that increases road hazards and increases the likelihood of a vehicle crash. While most traffic safety research recognized aggressive driving or road rage as dangerous driving behaviors, some argued the classification was inaccurate to explain different dimensions. For example, Dula and Ballard (2003) classified dangerous driving behaviors into aggressive, risky, and emotional driving. They defined aggressive driving as intentional acts of bodily and/or psychological aggression toward other road users (e.g., cursing and rude or obscene gestures, throwing objects), while risky driving is risk-taking behaviors without intent to harm themselves or others (e.g.,

running red lights, weaving through traffic). Furthermore, the researchers classified emotional driving as another category of dangerous driving that considered drivers' harmful emotions, which have deleterious effects on safe vehicle operations (see detailed review by Dula and Geller (2003)). On the other hand, Reason et al. (1990) classified dangerous driving behaviors into violations and errors. Though their definition and measures of violations have vast similarities to what is now considered aggressive driving or risky driving, the errors were significant measures that considered drivers' slips, lapses, or mistakes on the road and significantly affected road safety. Given the difference in definitions, previous research has confirmed that these dangerous driving behaviors are significantly correlated to crashes and citations (de Winter et al., 2018; Dula & Ballard, 2003; Iversen & Rundmo, 2004; Mizell et al., 1997; Sümer, 2003). This indicates that research focusing on road user behavior could significantly reduce motor vehicle crashes.

In order to reduce dangerous driving behaviors, it is important to understand the factors that cause them. Various factors have been discussed in the traffic safety literature (see Fernandes et al. (2007) for a detailed review), including demographics (e.g., age, gender, geography), attitude, belief, perception, personality traits (e.g., sensation seeking), and emotions (e.g., anger, frustration). This article focuses on dangerous driving behaviors influenced by emotions and will not discuss other factors already discussed elsewhere (Jonah, 1997; Oltedal & Rundmo, 2006; Rhodes & Pivik, 2011; Scott-Parker et al., 2013). Considerable research has confirmed that emotions significantly affect dangerous driving behaviors (Arnau-Sabates et al., 2012; Dula & Ballard, 2003; Hayley et al., 2017). Notably, drivers' anger has been widely identified in the prediction of risky and aggressive driving as well as adverse outcomes such as crashes and citations (Deffenbacher et al., 2002; James & Nahl, 2000; Lajunen & Parker, 2001;

Underwood et al., 1999). Dula and Ballard (2003) identified other negative emotions while driving such as frustration, sadness, dejection, jealousy also associated with aggressive driving as well as adverse outcomes. In addition, drivers who reported positive emotions like happiness also reported having higher crash rates overall (Mesken et al., 2007).

While different emotions have been found to uniquely contribute to dangerous driving behaviors, other research also identified regulating emotions as more effective at reducing the behaviors. Emotional regulation involves the skills to manage individual emotions and their expression in a socially acceptable way (Gratz & Roemer, 2004). Individuals who find it difficult to regulate emotions are more likely to behave aggressively and show impulsivity, which can lead to risky behaviors on the road (Gratz & Roemer, 2004; Roberton et al., 2012). Research has shown that lack of emotional regulation significantly predicts driving violations as well as risky and aggressive driving (Denson et al., 2012; Magar et al., 2008; Roberton et al., 2012). Therefore, understanding and managing emotions can improve drivers' ability for safe vehicle operation.

Emotional intelligence (EI) theory aims to discover an individual's ability to understand and regulate emotions and use emotional information to guide behaviors. A few studies have investigated dangerous driving behaviors in the context of emotional intelligence (Arnau-Sabates et al., 2012; Falahi & Goudarzi, 2015; Hayley et al., 2017; Smorti et al., 2018). Those studies found that different forms of dangerous driving behaviors (e.g., risky, aggressive, emotional driving, violations, and errors) were correlated with different components of EI (e.g., emotion recognition and expression, emotion regulation, empathy, relationship). However, these studies do not consistently explain the relationship between EI and dangerous driving behaviors. For example, Hayley et al. (2017) reported that less emotion recognition and expression predicted

risky and emotional driving, and no EI component predicted aggressive driving. In contrast, Smorti et al. (2018) reported that EI failed to predict risky and aggressive driving. Furthermore, Arnau-Sabates et al. (2012) found all EI components had negative correlations with risky driving attitude, speeding, risk-taking tendency, and distracted driving but did not consider important measures to explain drivers' behaviors (e.g., aggressive driving). While these studies used different EI scales (e.g., GENOS, TEIQue, EQ i, and Brad Berry-Greaves EI) to understand dangerous driving behaviors, none explained why they chose one over the others. The measurement differences may not only cause the inconsistent results of these studies, but also sampling related issues, such as using populations limited by age groups, gender, or the study location (Arnau-Sabates et al., 2012; Falahi & Goudarzi, 2015; Hayley et al., 2017).

Thus, further investigation is required to understand the relationship between EI and driving behaviors using appropriate scales and measures, particularly in the North American context. This study analyzes the relationship between dangerous driving behaviors, behavior-related adverse outcomes, and emotional intelligence. After exploring this relationship, this pilot study aims to identify the best EI measures to predict different dimensions of dangerous driving behaviors. In addition, appropriate sample size will be identified to achieve desired statistical power for future research within this topic. Most importantly, after examining different scales, this study identifies the most appropriate EI and driving behavior measures to guide future research in this avenue. Understanding this relationship might help develop strategies to improve traffic safety by showing the significance of EI in reducing dangerous driving behaviors.

Methods and Materials

Design and Procedure

This study conducted a rigorous literature review on different measures of EI and dangerous driving behaviors. Based on the suggestions from different highly cited articles, this study selected three emotional intelligence measures based on their scale reliability and association with behaviors (O'Connor et al., 2017; O'Connor et al., 2019). The selected scales are Trait Emotional Intelligence Questionnaire-Short Form (TEIQue-SF), GENOS EI (formerly known as Swinburne University Emotional Intelligence Test), and Wong and Law Emotional Intelligence Scale (WLEIS) (Palmer et al., 2009; Pérez et al., 2005; Wong & Law, 2002). However, the first scale (TEIQue) is solely explored trait based EI, while GENOS EI aimed to measure people's emotionally intelligent workplace behaviors. In contrast, WLEIS also a self-report EI measures based on ability model of EI. Including three different types of EI measures will be useful to identify one most suitable in the driving context. Next, this study included the Driving Behavior Questionnaire (DBQ) and Dula Dangerous Driving Index (DDDI) as the most reliable and appropriate measures for different dimensions of dangerous driving (Dula & Ballard, 2003; Reason et al., 1990). Furthermore, this study considered the Driving Behavior Inventory (DBI) questionnaire to further explore aggressive driving and driving stress (Gulian et al., 1990). The web-based final survey included the demographic information (age, gender, geographical location, education, marital status, language), general driving history (e.g., miles driven, crashes, and citations), driving behaviors scales (DDDI, DBQ, DBI), and EI scales (TEIQue, GENOS, WEIS). This study's data were collected from a paid panel of respondents from Qualtrics, an American software company that provides survey services.

Driving Behaviors Measures

Dula Dangerous Driving Index (DDDI)

The Dula Dangerous Driving Index (DDDI) was used to measure self-reported (intentional) risky, aggressive and emotional behaviors (Dula & Ballard, 2003). The DDDI consists of 28 questions, rated on a 5-point Likert scale (1=almost never, 5=almost always). Alpha reliability for risky, aggressive, and negative emotional driving was 0.99, 0.94, and 0.91, respectively. Three subscales were generated from the questionnaire:

1. Risky driving (12 questions, score 12–60): This measured the willingness to engage in unsafe driving behavior (e.g., "I will race a slow-moving train to a railroad crossing").
2. Negative emotional driving (9 questions, score 9–45): This determined drivers' irritability and anger when driving and their tendency to become annoyed with other drivers (e.g., "Passengers in my car/truck tell me to calm down").
3. Aggressive driving (7 questions, score 7–35): This assessed behaviors that were intentionally meant to annoy, irritate, or punish other drivers (e.g., "I would tailgate a driver who annoys me").

Driving Behavior Questionnaire (DBQ)

The Driver Behavior Questionnaire (DBQ) was used to measure self-reported intentional violations and unintentional driving errors (Reason et al., 1990). The DBQ consisted of 36 questions, rated on a 6-point Likert scale (1=almost never, 6=almost always). The two subscales were as follows:

1. Violations (13 questions, score 13–78): This assessed drivers' intentional deviations from safe driving practices (e.g., "Disregard the speed limits late at night or early in the morning").
2. Errors (23 questions, score 23–138): This measured drivers' faults in judgment or decision making (e.g., "Misjudge your gap in a car park and nearly or actually hit an adjoining vehicle").

The two-factor structure that was used in this study had been validated (Cordazzo et al., 2014). A low score meant safe driving behaviors, and a high score represented dangerous driving behaviors. Alpha reliabilities for the violations and errors were 0.97 and 0.98, respectively.

Driving Behavior Inventory (DBI)

The 30 questions on the DBI (Gulian et al., 1989) was used to measure driver stress as a combination of driving aggression, irritation when overtaken, driving alertness, driving dislike, and frustration when failing to overtake. The participants were asked to respond to the frequency of behavior on a 5-point Likert scale from almost never (1) to almost always (5). For the whole sample, internal consistency coefficients were good, and alpha reliabilities were 0.93, 0.89, 0.81, and 0.95 for driving aggression, dislike driving, irritation at being overtaken, overtaking tension, and driving stress, respectively. The factors descriptions are as below:

1. Driving stress (average score of 16 questions): This scale measured drivers' perceived stress in the context of driving (e.g., "I am annoyed to drive behind slow-moving vehicles").
2. Driving aggression (average score of 6 questions): This item measured drivers' aggressive tendencies (e.g., "Driving usually makes me feel aggressive").
3. Irritation when overtaken (average score of 3 questions): This item referred to drivers' frustration provoked by other drivers in relation to overtaking (e.g., "I feel angry when overtaken at a junction").
4. Overtaking tension (average score of 3 questions): This item referred to drivers' tension and frustration in terms of successful or unsuccessful overtaking (e.g., "I feel tense when overtaking another vehicle").
5. Dislike of driving (average score of 9 questions): This item measured drivers' dislike of driving and related anxiety (e.g., "I am worried to drive in bad weather").

6. Driving alertness (average score of 5 questions): This item assessed drivers increased alertness on the road regarding safe driving (e.g., “I increase concentration on a difficult road”).

Number of Crashes and citations

Participants were asked to self-report the number of active crashes (i.e., you hit another road user or an obstacle) and passive crashes (i.e., you were hit by another road user) in which they were involved in the last 12 months. Additionally, they also reported the number of citations they received for violations in the last 12 months. The responses to these three questions were highly skewed. Three measures were dichotomized so that 0 indicated no active or passive crashes and no citations, while 1 indicated some crashes or citations.

Emotional Intelligence Measures

The Trait Emotional Intelligence Short Form (TEIQue-SF)

TEIQue-SF was used, which consists of 30 items developed from the original version of 151 items (Petrides & Furnham, 2001). This scale considers a wide range of emotional and social attributes, which is applicable to a variety of research and applied contexts (e.g., educational, clinical, occupational, and organizational). Participants were asked to select an answer on a 7-point Likert scale ranging from completely disagree (1) to completely agree (7). The scale provided a total EI score along with four factors. Alpha reliabilities for the total EI, well-being, self-control, emotionality, and sociability were 0.91, 0.70, 0.70, 0.80, and 0.65, respectively. The subscales details are given below:

1. Emotionality (average score of 8 questions): Reflected an individual’s ability to recognize and process emotions (e.g., “Many times, I cannot figure out what emotion I am feeling”).
2. Self-control (average score of 6 questions): Assessed an individual’s ability to regulate their emotions and impulses (e.g., “I usually find it difficult to regulate my emotions”).

3. Sociability (average score of 6 questions): Evaluated an individual's social interactions and impact on the community (e.g., "I can deal effectively with people").
4. Well-being (average score of 6 questions): Measured an individual's satisfaction with life (e.g., "I generally do not find life enjoyable").

GENOS EI Scale

The GENOS EI 70-item questionnaire (Palmer et al., 2009) was developed for use in the workplace to measure three broader aspects of EI (emotion recognition, reasoning with emotions, and management of emotions) through seven factors (10 items for each factor). This study omitted all work-related wordings from the questions to better fit general populations. Items were scored on a 5-point Likert scale from almost never (1) to almost always (5). Each scale score was calculated by adding items together for each participant, ranging from 10-70. Alpha reliabilities for the total EI and the seven factors including emotional self-awareness, emotional expression, emotional awareness of others, emotional reasoning, emotional self-management, emotional management of others, and emotional self-control were 0.96, 0.84, 0.69, 0.76, 0.85, 0.69, 0.75, and 0.66, respectively.-The description of all subscales is given below.

1. Emotional self-awareness: Measured individuals' ability to identify their emotions (e.g., "I fail to recognize how my feelings drive my behavior").
2. Emotional expression: Assessed individuals' ability to express their emotions ("When I get frustrated with something at work, I discuss my frustration appropriately").
3. Emotional awareness of others: Assessed individuals' ability to identify emotions expressed by others ("I find it difficult to identify the things that motivate").

4. Emotional reasoning: Measured individuals' ability to use emotionally relevant information in decision-making or problem-solving ("I consider the way others may react to decisions when communicating").
5. Emotional self-management: Measured individuals' ability to manage their own emotions ("I engage in activities that make me feel positive").
6. Emotional management of others: Assessed participants ability to manage others' emotions ("I am effective in helping others feel positive").
7. Emotional self-control: Measured individuals' ability to control their strong emotions appropriately ("I fail to control my temper").

Wong's Emotional Intelligence Scale

The 16-item WLEIS EI scale (Wong & Law, 2002) was designed to assess EI for leadership and management. However, it has never been used before in the context of traffic safety. Therefore, this scale was used to investigate driving behaviors to determine if it could be used in other research fields other than leadership and management. Participants answered each item on a 5-point Likert scale that ranges from strongly disagree (1) to strongly agree (5). Alpha reliabilities for the regulation of emotion, self-emotion appraisal, appraisal of others' emotion, and use of emotion were 0.87, 0.91, 0.89, and 0.89, respectively.

1. Self-Emotion appraisal (Average items 1-4): This explains a person's ability to understand and express their emotions ("I always know whether or not I am happy").
2. Regulation of emotion (Average items 5-8): This scale assesses individuals' ability to regulate their emotions ("I am quite capable of controlling my own emotions").

3. Use of emotion (Average items 9-12): This scale describes individuals' ability to use their emotions to constructive activities and performance ("I always tell myself I am a competent person").
4. Appraisal of others' emotions (Average items 13-16): This scale explains individuals' ability to perceive and understand the emotions of others around them ("I am sensitive to the feelings and emotions of others").

Internal Reliability of Measures

The means and standard deviations along with alpha reliability of all measures are provided in Table 2.1 All driving behaviors and EI scales showed strong reliability except TEIQue subscales of sociability (0.39) and self-control (0.45).

Table 2.1. Summary of Scales and Internal Reliability.

Scale	Number of Items	Measures	Mean	SD	Cronbach's Alpha
DDDI	28	1. Risky driving	22.36	12.45	0.966
		2. Aggressive driving	13.59	7.37	0.936
		3. Emotional driving	21.99	8.38	0.907
DBQ	36	4. Violations	27.99	16.76	0.966
		5. Mistakes	14.66	8.80	0.948
		6. Slips	35.88	19.99	0.974
DBI	30	7. Driving aggression	12.09	6.40	0.932
		8. Irritation at being overtaken	6.54	3.32	0.895
		9. Overtaking tension	7.15	3.20	0.814
		10. Driving stress	34.60	13.80	0.945
TEIQue-SF	30	11. Total EI	4.46	0.79	0.880
		12. Well-being	4.69	1.03	0.670
		13. Self-control	4.40	0.85	0.450
		14. Emotionality	4.37	0.96	0.650
		15. Sociability	4.36	0.80	0.390
GENOS	70	16. Total GENOS EI	233.17	42.51	0.959
		17. Emotional self-awareness	34.52	7.72	0.839
		18. Emotional expression	32.87	6.17	0.688

Table 2.1 Continued

		19. Emotional awareness of others	44.29	6.48	0.758
		20. Emotional reasoning	31.81	7.79	0.849
		21. Emotional self-management	33.19	6.15	0.696
		22. Emotional management of others	33.39	6.64	0.753
		23. Emotional self-control	34.09	6.12	0.659
WLEIS	16	24. Regulation of emotion	20.26	5.08	0.872
		25. Self-emotion appraisal	20.41	5.64	0.908
		26. Appraisal of others' emotion	20.08	5.54	0.889
		27. Use of emotion	20.63	5.04	0.890

Participants

A total of 155 US drivers ages 18-65 (M = 35.76 years, SD = 15.992 years) participated in the study between October 15 and November 10, 2019. A quota was placed on the sample, requiring 50% of the sample to be young adults between 18-26 years and equal distribution of males and females. The participants were recruited from all 50 states and currently held valid US driver's licenses and drove their vehicles in the last thirty days. Two participants were removed due to incomplete responses. Table 2.2 summarizes the respondents' demographics.

Table 2.2. Demographics of Respondents.

Sex		Age		Geography	
Male	49.7%	18-26	49.7%	Urban	80.5%
Female	50.3%	26-65	50.3%	Rural	19.5%

Statistical Analysis

A correlation analysis was conducted between all driving behaviors, behavior-related outcomes, and different emotional intelligence scales. Then multiple statistical regression analyses were conducted to develop predictive models of all driving behaviors and behavior-related outcomes based on the emotional intelligence scale (TEIQue). However, due to

insignificant correlations between the GENOS, WLEIS, and driving behaviors, both of these EI scales were excluded from the regression analyses. Finally, a power analysis was conducted to identify the effect size and required sample size for future studies. All analyses were conducted using the IBM SPSS statistics software package v.25, and all tests were two-tailed with conventional 95% confidence ($p < 0.05$) as the significance threshold.

Results

Correlation Analysis

Table 2.3 and 2.4 lists correlations between dangerous driving behaviors (DDDI, DBQ, and DBI), safety-related outcomes (crashes and citations), and EI (TEIQue, GENOS, and WLEIS). The TEIQue appeared as the most significant EI scale to be correlated with dangerous driving behaviors (DDDI and DBQ), driving stress (DBI), and safety-related outcomes (crashes and citations). In particular, the TEIQue total EI score and emotionality subscale score were the strongest when considering all driving behaviors. Besides the TEIQue, the emotional self-control subscale of GENOS EI was also significantly correlated with driving behaviors. Other subscales of GENOS, and all subscales of WLEIS, were not correlated with driving behaviors. The TEIQue scale was further validated through regression analysis in predicting driving behaviors and behavior-related outcomes and identifying future study pathways by conducting a power analysis. GENOS and WLEIS were excluded due to their insignificant correlations to dangerous driving behaviors.

Table 2.3. Pearson's Correlations Between Dangerous Driving and Emotional Intelligence.

	Total EI	EMT	SC	WB	SOC	GENOS Total	ESA	EE	EAO	ER	ESM	EMO	ESC	SEA	OEA	UE	RE
1. Risky driving	**-40****	**-.42****	**-.28****	**-.26****	**-.34****	**-.18***	-.10	**-.18***	-.13	.08	-.12	**-.17***	**-.46****	-.03	-.04	-.04	-.10
2. Aggressive driving	**-.42****	**-.47****	**-.31****	**-.28****	**-.31****	**-.20***	-.11	**-.20***	-.14	.10	**-.18***	**-.16***	**-.48****	-.04	.01	-.06	-.10
3. Emotional driving	**-.32****	**-.36****	**-.24****	-.15	**-.29****	-.11	-.02	-.10	-.09	.12	-.11	-.06	**-.40****	-.04	-.03	-.05	-.15
4. Violation	**-.40****	**-.44****	**-.27****	**-.27****	**-.32****	**-.16***	-.10	**-.16***	-.13	.14	-.11	-.14	**-.45****	-.04	.00	-.05	-.09
5. Errors	**-.39****	**-.43****	**-.25****	**-.25****	**-.32****	-.14	-.08	-.14	-.10	**.16***	-.10	-.12	**-.43****	-.02	.03	-.03	-.06
6. Driving aggression	**-.40****	**-.43****	**-.28****	**-.29****	**-.31****	-.13	-.06	**-.17***	-.10	.12	-.13	-.10	**-.45****	-.07	-.05	-.10	-.15
7. Dislike of driving	.04	.03	.03	.11	-.02	**.31****	**.32****	**.26****	**.31****	**.45****	**.26****	**.29****	-.01	**.24****	**.21***	**.17***	.11
8. Driving alertness	**.41****	**.36****	**.35****	**.40****	**.31****	**.58****	**.59****	**.52****	**.55****	**.55****	**.52****	**.54****	**.32****	**.41****	**.37****	**.33****	**.24****
9. Irritation overtaken	**-.30****	**-.32****	**-.23****	**-.24****	**-.18***	-.09	-.02	-.13	-.07	**.16***	-.09	-.08	**-.35****	-.08	-.02	-.11	-.14
10. Overtaking tension	**-.24****	**-.27****	-.15	-.14	**-.20***	.05	.07	.03	.07	**.30****	.05	.04	**-.28****	.01	.08	-.03	-.03
11. Driving stress	**-.27****	**-.28****	**-.18***	-.16	**-.22****	.01	.07	-.03	.04	**.24****	-.02	.02	**-.34****	.02	.02	-.03	-.10
12. Crash own fault	**-.31****	**-.32****	**-.25****	**-.24****	**-.17***	**-.18***	-.09	**-.21****	**-.19***	.00	-.16	**-.16***	**-.36****	-.09	.00	-.09	-.12
13. Crash others fault	**-.23****	**-.31****	**-.17***	-.15	-.11	-.07	-.04	-.09	-.05	.10	-.02	-.04	**-.32****	.02	.07	-.04	-.01
14. Number of ticket	**-.31****	**-.33****	**-.23****	**-.25****	**-.19***	**-.18***	-.12	**-.17***	**-.18***	.01	**-.17***	**-.18***	**-.39****	-.11	-.05	-.14	-.14

Note: Significance effects (* p<0.05; ** p<0.01) are in bold type face for emphasis.

EMT=Emotionality, SC=Self-control, WB=Well-being, SOC=Sociability, ESA= Emotional self-awareness, EE= Emotional expression, EAO= Emotional awareness of others, ER= Emotion reasoning, ESM= Emotional self-management, EMO= Emotional management of others, ESC= Emotional self-control, SEA= Self-emotion appraisal, OEA= Appraisal of others' emotion, UE= Use of emotion, RE= Regulation of emotion.

Table 2.4. Spearman's Correlations Between Dangerous Driving and Emotional Intelligence.

	Total EI	EMT	SC	WB	SOC	GENOS Total	ESA	EE	EAO	ER	ESM	EMO	ESC	SEA	OEA	UE	RE
1. Risky driving	**-.40****	**-.37****	**-.28****	**-.26****	**-.38****	**-.24****	**-.20***	**-.20***	**-.18***	-.06	**-.19***	**-.20***	**-.50****	**-.18***	**-.19***	**-.20***	**-.25****
2. Aggressive driving	**-.38****	**-.44****	**-.29****	**-.26****	**-.32****	**-.25****	**-.19***	**-.22****	**-.18***	-.05	**-.26****	**-.19***	**-.52****	-.15	-.10	**-.16***	**-.19***
3. Emotional driving	**-.24****	**-.31****	**-.19***	-.13	**-.30****	-.11	-.07	-.08	-.08	.03	-.13	-.05	**-.39****	-.13	-.10	-.12	**-.21****
4. Violation	**-.40****	**-.42****	**-.29****	**-.22****	**-.36****	**-.17***	-.14	**-.16***	-.11	.04	-.15	-.15	**-.48****	-.12	-.13	**-.17***	**-.20***
5. Errors	**-.35****	**-.35****	**-.24****	**-.21****	**-.37****	-.12	-.12	-.11	-.07	.09	-.11	-.09	**-.45****	-.10	-.08	**-.17***	**-.18***
6. Driving aggression	**-.36****	**-.36****	**-.26****	**-.23****	**-.31****	-.11	-.08	-.11	-.06	.06	-.11	-.07	**-.46****	-.14	-.13	**-.19***	**-.22****
7. Dislike of driving	.02	-.02	.04	.14	-.04	**.33****	**.29****	**.28****	**.32****	**.41****	**.28****	**.30****	-.00	**.19***	**.18***	.13	.11
8. Driving alertness	**.39****	**.28****	**.34****	**.42****	**.26****	**.59****	**.58****	**.54****	**.55****	**.54****	**.54****	**.57****	**.28****	**.42****	**.41****	**.36****	**.29****
9. Irritation overtaken	**-.28****	**-.29****	**-.22****	**-.22****	**-.14**	-.08	-.04	-.10	-.06	.09	-.08	-.06	**-.35****	**-.16***	-.11	**-.18***	**-.20***
10. Overtaking tension	**-.20***	**-.23****	-.11	-.09	**-.20***	.07	.05	.04	.11	**.24****	.07	.06	**-.29****	-.06	.01	-.09	-.09
11. Driving stress	**-.21***	**-.23****	-.15	-.12	**-.20***	.02	.04	-.01	.05	.15	.01	.04	**-.35****	-.09	-.08	-.13	-.17*
12. Crash own fault	**-.28****	**-.30****	**-.23****	**-.21***	**-.19***	**-.17***	-.11	**-.18***	**-.16***	-.02	-.14	-.16	**-.37****	-.11	-.03	-.09	-.11
13. Crash others fault	**-.21****	**-.31****	**-.18***	-.12	-.15	-.04	-.05	-.05	-.02	.07	.03	-.01	**-.35****	.00	.06	-.06	-.02
14. Number of ticket	**-.27****	**-.31****	**-.20***	**-.22****	**-.17***	**-.18***	-.13	-.15	**-.17***	-.02	-.16	**-.17***	**-.39****	-.13	-.06	-.15	-.14

Note: Significance effects (* $p<0.05$; ** $p<0.01$) are in bold type face for emphasis.

EMT=Emotionality, SC=Self-control, WB=Well-being, SOC=Sociability, ESA= Emotional self-awareness, EE= Emotional expression, EAO= Emotional awareness of others, ER= Emotion reasoning, ESM= Emotional self-management, EMO= Emotional management of others, ESC= Emotional self-control, SEA= Self-emotion appraisal, OEA= Appraisal of others' emotion, UE= Use of emotion, RE= Regulation of emotion.

Using TEIQue EI to Predict Dangerous Driving Behaviors

Eleven regression analyses were performed to develop predictive models for dangerous driving behaviors (DDDI and DBQ) and driving stress (DBI) based on TEIQue subscales. Consistent with the correlational analysis reported in Table 2.5, emotionality was the most consistent component of EI that predicted all dangerous driving behaviors and most of the driving stress measures. Higher emotionality (i.e., better emotional perception and expression ability) resulted in less frequent dangerous driving (risky, aggressive, and emotional driving, as well as violations and errors) and less driving stress-related measures.

Using TEIQue EI to Predict Behavior Outcomes

To determine the unique contribution of each TEIQue EI subscale to predicting dangerous driving related outcomes, three hierarchical logistic regressions were performed to predict the number of active and passive crashes and the number of citations based on the four EI subscales (emotionality, self-control, well-being, and sociability). The outcome variables of crashes and citations were dichotomized (0= no crashes or citations, 1= at least one crash or citation) due to their highly skewed distributions presented in Table 2.6.

Table 2.5. Summary of Linear Regression Models Prediction Driving Behaviors.

	Driving behavior	F	R^2	Predicting variables	Beta
DDDI	1. Risky driving	F (4,150) =8.24 (p<0.01)	18%	Emotionality Self-control Well-being Sociability	-.362** .052 -.004 -.130
	2. Aggressive driving	F (4,150) =10.75 (p<0.01)	22.3%	Emotionality Self-control Well-being Sociability	-.474** .005 .007 -.009
	3. Negative emotional driving	F (4,150) =6.26 (p<0.01)	14.3%	Emotionality Self-control Well-being Sociability	-.334** -.028 .148 -.140
DBQ	4. Violations	F (4,150) =9.37 (p<0.01)	20.0%	Emotionality Self-control Well-being Sociability	-.436** .068 -.012 -.069
	5. Errors	F (4,150) =8.74 (p<0.01)	18.9%	Emotionality Self-control Well-being Sociability	-.413** .099 -.011 -.110
DBI	6. Driving aggression	F (4,150) =8.39 (p<0.01)	18.4%	Emotionality Self-control Well-being Sociability	-.389** .043 -.049 -.054
	7. Dislike of driving	F (4,150) =0.88 (p=0.47)	2.3%	Emotionality Self-control Well-being Sociability	.010 -.027 .193 -.124
	8. Driving alertness	F (4,150) =842 (p<0.01)	18.3%	Emotionality Self-control Well-being Sociability	.146 .055 .260* .027
	9. Irritation being overtaken	F (4,150) =4.61 (p<0.01)	11.0%	Emotionality Self-control Well-being Sociability	-.309** -.017 -.103 .097
	10. Overtaking tension	F (4,150) =3.02 (p<0.05)	7.5%	Emotionality Self-control Well-being Sociability	-.263** .058 .026 -.085
	11. Driving stress	F (4,150) =3.44 (p<0.05)	8.4%	Emotionality Self-control Well-being Sociability	-.264* .025 .035 -.087

* p<0.05; ** p<0.01

Table 2.6. Summary of Reported Crashes and Citations.

Active crashes		Passive crashes		Citations	
No crash	46.9%	No crash	29.9%	No citations	33.6%
1 crash	27.6%	1 crash	30.4%	1 citation	29.6%
2 to 6 crashes	25.5%	2 to 6 crashes	29.7%	2 to 6 citations	36.8%

The number of crashes and citations were tested using three binary logistic regression models based on the four EI subscales. Binary variables for crashes and citations were entered as the dependent variable, and the EI subscales (continuous variables) were used as independent variables. The results for the three regression models are presented in Table 2.7. Consistent with the correlation analysis, the regression models revealed that the EI subscale of emotionality was the only significant predictor for number of active crashes ($\chi 2 = 19.995$, $p<0.05$), passive crashes ($\chi 2 = 18.806$, $p<0.05$), and citations ($\chi 2 = 21.042$, $p<0.001$). The odds ratios revealed that a one-point increase of emotionality (e.g., score increase from 3 to 4) would decrease the odds of having active crashes by 53%, passive crashes by 63%, and citations by 57%. However, the EI subscales of well-being, self-control, and sociability failed to predict crashes and citations.

Table 2.7. Results of Logistic Regression between Crashes, Citations, and EI subscales.

Predictor	R^2	B	SE	Sig.	Odds Ratio
1. Active crashes					
Well-being	0.164	-.202	.243	.407	.817
Self-control		-.297	.340	.382	.743
Emotionality		-.752	.277	.007	.471*
Sociability		.368	.334	.271	1.444
2. Passive crashes					
Well-being	0.157	.009	.252	.972	1.009
Self-control		-.109	.346	.752	.896
Emotionality		-1.010	.290	.001	.364*
Sociability		.457	.343	.182	1.580
3. Number of citations					
Well-being	0.173	-.250	.250	.318	.779
Self-control		-.077	.348	.824	.926
Emotionality		-.854	.286	.003	.426*
Sociability		.212	.337	.529	1.236

* $p<0.05$

Sample Size Estimation

A statistical power analysis was performed to check the adequacy of sample size and future directions. Faul et al. (2009) suggested using the random predictors model of G*Power for observational studies with multiple predictors (e.g., EI subscales), where participants and associated predictor values are sampled from an underlying population (e.g., drivers from the U.S. population). In this calculation, we used DDDI aggressive driving due to its significant ability to measure dangerous driving and four TEIQue subscales (emotionality, self-control, well-being, and sociability) as predictor variables. First, the effect size was calculated using this study parameter of sample size N=155, number of predictors=4, and observed R^2= 0.20. Next, the required sample size for future studies was calculated using the desired power=0.95, α=0.01, and the number of predictors=4. The G*power suggested a sample of 125 would be adequate to achieve a desired statistical power of 0.95. However, due to the limited scope and small sample size, this pilot study did not analyze other significant confounding variables such as demographics (e.g., age, sex, geography, education) and driving habits (e.g., miles driven, years of driving license). Therefore, a much larger sample (over 300) is suggested if researchers are interested in incorporating those factors in their analysis.

Discussion

Previous research has identified that various emotional intelligence scales were correlated with dangerous driving behaviors. However, there are different models and measures of EI available, and no clear guidance was provided in those studies regarding which measure was more appropriate in the driving context or why they chose one over the others. Thus, this pilot study aimed to investigate various dimensions of dangerous driving using three reliable measures of EI based on different models recognized by researchers. Moreover, this study provides

guidelines for measuring driving behaviors that could be useful for future research and the direction of a sample size to achieve a robust statistical power.

The correlation analysis discovered that only trait EI measure TEIQue was significantly correlated to the self-reported driving behaviors as well as the behavior caused adverse outcomes (e.g., crashes and citations). These results indicate that drivers with lower EI scores in these subscales act more dangerously on the road than higher-scoring drivers. In addition, the emotionality subscale of TEIQue emerged as a strong predictor of dangerous driving behaviors and related safety outcomes, which implies that improving drivers' emotionality (i.e., empathy, emotional perception and expression, and relationship management) may reduce dangerous driving behaviors.

This study also used the GENOS and WLEIS scales and did not find a significant correlation with dangerous driving behaviors. This reflects the Hayley et al. (2017) study, which did not find a strong correlation between GENOS EI and dangerous driving. A possible explanation is that both GENOS and WLEIS scales were developed to measure workplace-related EI; therefore, despite changing the wording of these items to encompass more than the workplace setting, these measures still failed to produce significant results in the driving context. Thus, this study result suggests that TEIQue is the most appropriate EI measure to predict dangerous driving behaviors, and GENOS and WLEIS scales are suggested to be excluded from future traffic safety studies. While only the Total EI and emotionality subscales of the TEIQue were found to be strongly correlated with dangerous driving behaviors, more correlations may be possible with a scale explicitly built to measure EI while driving.

Furthermore, this study considered three driving behavior measures (DDDI, DBQ, and DBI) commonly used in previous road safety research. However, the DDDI and DBQ measures

of dangerous driving behaviors produced stronger correlations with EI than the DBI scale. Therefore, the DBI scale can be omitted from future research, as other scales can better measure aggressive driving (e.g., DDDI). Though DDDI and DBQ both measure similar contexts of dangerous driving behaviors, there were some differences between these two measures. DDDI subscales of risky and aggressive driving measure many similar items used in the DBQ violations subscale. However, DDDI allowed measuring unique dimensions of emotional driving (e.g., driving with frustration or anger), while DBQ allowed measuring driving errors (e.g., mistakes, slips, and lapses). Depending on the research interest, either one or both could be useful in future research. It is important to mention that the DBQ original scale was developed over thirty years, and researchers should be careful to use that scale by modifying items with the changing driving context or a modified validated version (Cordazzo et al., 2014). While only the Total EI and emotionality subscales of the TEIQue were found to be strongly correlated to dangerous driving behaviors, it may be considered that with a slight alteration to make the scale more appropriate for a driving context, more correlations may be possible. This indicates a need for a scale explicitly built to measure EI while driving.

Previous studies did not provide clear guidelines about the sample size required for future studies. Therefore, given the number of variables used to predict dangerous driving behaviors, this study analyzed the adequacy of sample size using four subscales of TEIQue and achieved significant statistical power (>0.95). Thus, this study suggests a larger sample (N>300) will be required if researchers are interested in using more variables to control for the effects of demographics or other social/personal factors. A larger sample will improve upon previous research to provide more valid results than those with small samples.

This study needs to address some methodological limitations. First, although this study results showed a strong correlation between EI and driving behaviors, establishing the causal relationship of emotional intelligence on dangerous driving behaviors needs to be further explored with a more representative sample. Furthermore, the focus of this pilot study was to identify best measures of EI and driving behaviors; therefore, any demographic (e.g., age, gender) or other driving factors (e.g., experience, miles driven, or driving purpose) were not considered for analysis. This suggests that future studies need to investigate drivers' behaviors in the light of EI with different driving populations (e.g., commercial, non-commercial). Secondly, the self-reported measures used in this study may have influenced participants to produce socially desirable responses. However, because this study used survey items related to driving behaviors and emotional intelligence, the social desirability bias was not a concern (O'Connor et al., 2019; Reimer et al., 2006; Sullman & Taylor, 2010). Furthermore, the long survey with may have caused survey fatigue and affected the participants' response accuracy. However, survey fatigue was mitigated through compensation for being honest and accurate in participants' responses.

Conclusion

This study found that emotional intelligence is significantly correlated to and can predict dangerous driving behaviors and ensuing crashes and citations. These findings provide evidence for the need to incorporate emotional intelligence in the investigation of drivers' dangerous behaviors as a means of creating appropriate interventions. Emotional intelligence has been shown to be improved through training and education. If the findings from this study remain consistent, emotional intelligence can be used to develop traffic safety interventions to reduce drivers' unsafe activities on the road. This pilot study suggests that dangerous driving behaviors

should be analyzed by trait EI measures from the TEIQue, and driving should be measured by DDDI, DBQ, and the number of crashes and citations, with a larger sample size (N> 300) across different drivers' populations (e.g., commercial and non-commercial).

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CHAPTER THREE

HOW DOES EMOTIONAL INTELLIGENCE PREDICT DRIVING BEHAVIORS AMONG NON-COMMERCIAL DRIVERS?

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How Does Emotional Intelligence Predict Driving Behaviors Among Non-Commercial Drivers?

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Abstract

Dangerous driving behaviors have been found to be a leading contributor to vehicle crashes and fatalities, with more than 2.7 million people injured and 36,560 people killed in the United States in 2018 (NHTSA, 2020). Drivers' emotions have been found to be among the leading contributors to dangerous driving behaviors. Emotions can be measured and understood through one's emotional intelligence (EI). Previous research has confirmed the relationship between EI and dangerous driving behaviors among general driving populations in limited scope. This study analyzed dangerous driving behaviors (e.g., aggressive driving) among non-commercial US drivers. 615 US drivers ages 18 to 65 (M=31.14, SD=11.15) with valid US driver's licenses (non-commercial) participated in this study. Participants completed an online survey through Qualtrics that included the Trait Emotional Intelligence Questionnaire (TEIQue-SF) to measure different dimensions of EI and the Dula Dangerous Driving Index (DDDI) and the Driving Behavior Questionnaire (DBQ) to measure dangerous driving behaviors. Furthermore, participants reported their demographic information, including age, sex, and location. Correlation analysis revealed that significant associations exist between dangerous driving behaviors and EI. The emotionality component of EI was found to be the strongest predictor of dangerous driving behaviors. The findings concluded that participants with higher EI scores engaged in less dangerous driving behavior, resulting in fewer crashes and fatalities. Thus, promoting and improving EI may be useful in preventing risky driving among non-commercial drivers. Incorporating emotional intelligence education in driver's education, workplace training, and licensing procedures can be helpful to develop safer drivers. Further research is needed to investigate commercial drivers' behaviors in relation to EI.

Introduction

Motor vehicle crashes have been identified as a significant public health concern. The World Health Organization (2018) reported that about 1.35 million people die worldwide due to traffic crashes per year. Similarly, in the United States, the National Highway Traffic Safety Administration (NHTSA) reported that more than 2.7 million people were injured, and 36,096 people were killed by motor vehicle crashes in 2018 (NHTSA, 2020). Furthermore, non-commercial drivers represented 98.5% of the driver population and were responsible for 86% of total crashes (NHTSA, 2020). Non-commercial drivers have been defined as drivers who do not hold a Commercial Driver's License (CDL), drive vehicles under 8,000 lbs., and do not transport freight or more than 15 passengers. Due to the number of injuries and fatalities attributed to non-commercial drivers, this population is an important target for reducing road crashes and improving traffic safety overall. Therefore, it is necessary to understand the contributing factors to non-commercial drivers' road crashes.

Many factors have been associated with vehicular crashes, including vehicle defects, environment (i.e., road and weather conditions), and dangerous driving behaviors (Scott-Parker et al., 2012; Weng & Meng, 2012). The National Motor Vehicle Crash Causation Survey (NMVCCS) from 2005 to 2007 found that 94% of crashes occurred due to driving behaviors, while the other factors contributed insignificantly (Singh, 2015). Dangerous driving behaviors have been defined as any inappropriate driver activity that increases road hazards and the likelihood of a vehicle crash (Dula & Geller, 2003; Reason et al., 1990; Scott-Parker et al., 2012). Previous research classified dangerous driving behaviors into risky driving, aggressive driving, dangerous errors, and driving while experiencing negative emotions (Dula & Ballard, 2003; Reason et al., 1990). Multiple studies confirmed that dangerous driving behaviors such as

aggressive driving and driving errors can significantly predict crashes (de Winter et al., 2018; Dula & Geller, 2003; Sümer, 2003).

Drivers engage in dangerous driving for various reasons, including fatigue and drowsiness, distracted driving, and driving under the influence of alcohol or drugs (NHTSA, 2020). In addition, many psychological factors, such as personality traits and emotions, have been found to be contributing factors to dangerous driving behaviors (Iversen & Rundmo, 2002; Ulleberg & Rundmo, 2003). Evidence in safety research suggested that drivers' emotions can particularly influence dangerous driving behaviors (Arnau-Sabates et al., 2012; Dula & Ballard, 2003). Previous research also found strong correlations between different emotions (e.g., frustration, anger, and sadness) and aggressive driving (Deffenbacher et al., 2003; Dula & Ballard, 2003; James & Nahl, 2000). Emotional intelligence is an emerging concept that considers different factors to identify an individual's ability to understand, manage, and respond to different emotions.

Emotional intelligence (EI) has been described as understanding and differentiating between emotions and using this information to then guide thoughts and behaviors (Mayer et al., 1990). There are two broader ideas of EI known as ability and trait models. The ability model of EI assesses emotion-related cognitive abilities (e.g., emotional perception and expression) through a performance test (similar to an IQ test) instead of only relying on self-reported emotional, social, and personality-related factors (Mayer et al., 2003). In contrast, the trait model assesses emotional ability, as well as social competencies, skills, and behaviors through a self-reported measure (Bar-On & Parker, 2000; Pérez et al., 2005; Petrides, 2011). Bar-On (1997) explained that considering only mental ability (such as in the ability model) failed to explain one's behavior adequately. Instead, Bar-On (1997) suggested incorporating non-cognitive

capabilities (e.g., adaptability, optimism) that also influence one's emotional ability to succeed by coping with their environment and stressors. Driving is known to be affected by the environment (e.g., weather, traffic) and other road users' activities, which influence drivers' emotional states as well as social (e.g., cooperating with other drivers) and personality (e.g., impulsiveness) components (Iversen & Rundmo, 2002; Ulleberg & Rundmo, 2003). Therefore, trait EI is more appropriate in the driving context.

Emotional intelligence is comprised of important factors that influence behaviors, such as self-control (e.g., impulse control, emotional regulation), emotionality (e.g., emotional awareness, emotional expression), and sociability (e.g., social awareness, emotion management) (Petrides & Furnham, 2001). Multiple studies have found that emotional intelligence components are also significantly related to dangerous driving behaviors (Arnau-Sabates et al., 2012; Falahi & Goudarzi, 2015; Hayley et al., 2017). Smorti et al. (2018) used total EI and found it was correlated to risky and aggressive driving, but they did not explain which individual subscales were associated with driving behaviors. Moreover, Arnau-Sabates et al. (2012) found that EI components of emotional regulation, empathy, and impulse control were negatively correlated to dangerous driving behaviors. Similarly, Hayley et al. (2017) found that lower emotional recognition and expression scores produced aggressive driving (e.g., speeding, weaving in and out of traffic) and driving with negative emotions. Research has also shown that lower emotional regulation ability significantly predicts aggressive driving (Hancock et al., 2012; Sani et al., 2017). In comparison, drivers with greater emotional regulation abilities demonstrated more adaptive and safe driving behaviors (Trógolo et al., 2014). Furthermore, Falahi and Goudarzi (2015) stated that drivers with higher social awareness and relationship management scores had significantly fewer driving violations and errors.

Though these studies found some relationships between EI and various dangerous driving behaviors and unexpected outcomes, their results varied. Confounding factors including cultural driving norms, sample demographics, and the measures used could all be contributing factors to the variability found in these studies. These studies investigated different driving behaviors in the context of EI, such as aggressive and negative emotional driving (Hayley et al., 2017; Smorti et al., 2018), driving violations and errors (Falahi & Goudarzi, 2015), number of citations (Smorti et al., 2018), and driving attitudes (Arnau-Sabates et al., 2012). The varying results of these studies may not only be from the measurement differences, but also from sampling-related issues such as limited by age groups, gender, or geography (Arnau-Sabates et al., 2012; Falahi & Goudarzi, 2015; Hayley et al., 2017; Smorti et al., 2018). To overcome these differences, the current study used a non-student population and quota sampling to ensure that age (18-65 years), gender (equal distribution of males and females), and geography (both urban and rural drivers within the US) were adequately considered.

The current research indicates that emotional factors are linked with dangerous driving behaviors, but the methodological limitations suggest a comprehensive investigation to understand the relationship between EI and dangerous driving behaviors accurately. Furthermore, non-commercial drivers represent the majority of the driving population, and their behaviors are different compared to commercial drivers due to the vehicle types and driving habits (Chapman et al., 2001; Walton, 1999). Therefore, this study considers dangerous driving behaviors examined in previous studies with a non-commercial driver sample. Data using a comprehensive compilation of valid measurements of driving behaviors and a convenience sample can enhance and validate the findings of the existing relationship. It is expected that lower EI can predict higher dangerous driving behaviors in a non-commercial driver population.

Methods

Participants

A total of 610 US drivers ages 18-65 (M = 31.16 years, SD = 11.18 years) participated in the study between November 21 and December 5, 2019. Non-commercial drivers (with a valid license) who drove their vehicles every day or most days of the week were invited to participate in the survey and received a small incentive. A quota sampling method was used to ensure a sample with balanced age and gender distributions and a range of risky driving evident by reported crashes and citations. The final sample comprised 50.2% young drivers (ages 18-26), 50.3% female, 87.8% from urban areas, 36.9% with a college degree or more, 42.1% drivers with at-fault crashes, and 60.7% drivers with at least one citation. Table 3.1 summarizes the desired quota and actual breakdown of the respondents.

Table 3.1. Quota for Respondents.

Condition Given	Desired (%)	Actual (%)
Female	50%	50.3%
Young drivers (ages 18 to 26)	50%	50.2%
One or more at-fault crashes	20%	42.1%
One or more fines for moving citations	20%	60.7%

Design and Procedure

This study's data were collected based on the provided quota using a paid panel of respondents from Qualtrics, an American software company that provides survey services. Participants completed the anonymous web-based survey first consisting of demographic information (e.g., age, gender, geographical location, education, marital status, and language) and general driving history (e.g., miles driven, crashes, and citations). In addition, participants completed three questionnaires: the Trait Emotional Intelligence Questionnaire-Short Form (TEIQue-SF) to measure EI and the Dula Dangerous Driving Index (DDDI) and Driving

Behavior Questionnaire (DBQ) designed to measure dangerous driving behaviors. The means, standard deviations, and scale reliability of all measures are given in Table 2. Participants were instructed to complete the survey within one sitting and set aside enough time to complete all questions.

Emotional Intelligence Measure

TEIQue-SF was used, which consists of 30 items developed from the original version of 151 items (Petrides & Furnham, 2001). This scale considers a wide range of emotional and social attributes, which is applicable to a variety of research and applied contexts (e.g., educational, clinical, occupational, and organizational). Participants were asked to select an answer on a 7-point Likert scale ranging from completely disagree (1) to completely agree (7). The scale provided a total EI score along with four factors. Alpha reliabilities for the total EI, well-being, self-control, emotionality, and sociability were 0.91, 0.70, 0.70, 0.80, and 0.65, respectively.

5. Emotionality: Reflected an individual's ability to recognize and process emotions (e.g., "Many times, I cannot figure out what emotion I am feeling").
6. Self-control: Assessed an individual's ability to regulate their emotions and impulses (e.g., "I usually find it difficult to regulate my emotions").
7. Sociability: Evaluated an individual's social interactions and impact on the community (e.g., "I can deal effectively with people").
8. Well-being: Measured an individual's satisfaction with life (e.g., "I generally do not find life enjoyable").

Driving Behaviors Measures

Dula Dangerous Driving Index (DDDI)

The Dula Dangerous Driving Index (DDDI) was used to measure self-reported (intentional) risky and aggressive behaviors (Dula & Ballard, 2003). The DDDI consists of 28 questions, rated on a 5-point Likert scale (1=almost never, 5=almost always). Three subscales were generated from the questionnaire:

4. Risky driving (12 questions, score 12–60): This measured the willingness to engage in unsafe driving behaviors (e.g., "I will race a slow-moving train to a railroad crossing").
5. Negative emotional driving (9 questions, score 9–45): This determined drivers' irritability and anger when driving and their tendency to become annoyed with other drivers (e.g., "Passengers in my car/truck tell me to calm down").
6. Aggressive driving (7 questions, score 7–35): This assessed behaviors that were intentionally meant to annoy, irritate, or punish other drivers (e.g., "I would tailgate a driver who annoys me").

A low score represented safe driving behaviors, and a high score represented dangerous driving behaviors. Alpha reliabilities for risky, aggressive, and negative emotional driving were 0.89, 0.87, and 0.81, respectively.

Driving Behavior Questionnaire (DBQ)

The Driving Behavior Questionnaire (DBQ) was used to measure self-reported intentional violations and unintentional driving errors (Reason et al., 1990). The DBQ consisted of 36 questions, rated on a 6-point Likert scale (1=almost never, 6=almost always). The two subscales were as follows:

3. Violations (13 questions, score 13–78): This assessed drivers' intentional deviations from safe driving practices (e.g., "Disregard the speed limits late at night or early in the morning").
4. Errors (23 questions, score 23–138): This measured drivers' faults in judgment or decision making (e.g., "Misjudge your gap in a car park and nearly or actually hit an adjoining vehicle").

The two-factor structure that was used in this study had been validated (Cordazzo et al., 2014). A low score meant safe driving behaviors, and a high score represented dangerous driving behaviors. Alpha reliabilities for the violations and errors were 0.98 and 0.96, respectively. However, the DBQ violations subscale measured similar behaviors as the DDDI risky driving; therefore, this study omitted the DBQ violations subscale from further analysis.

Table 3.2. Summary of Scales and Internal Reliability.

Scale Name	Number of Items	Measures	Mean	SD	Internal reliability
TEIQue-SF	30	1. Total EI	4.78	0.81	0.905
		2. Well-Being	5.13	1.04	0.800
		3. Self-Control	4.41	0.99	0.695
		4. Emotionality	4.86	0.95	0.712
		5. Sociability	4.66	0.91	0.641
DDDI	28	6. Risky driving	20.28	7.39	0.878
		7. Aggressive driving	12.71	5.19	0.855
		8. Emotional driving	22.78	5.92	0.800
DBQ	36	9. Errors	41.24	15.95	0.950
		10. Violations	25.28	9.57	0.896

Statistical Analysis

The survey responses were reviewed, and a total of 28 records were removed for inconsistencies, such as multiple missed responses or all responses being the same. Next, bivariate correlation analysis was performed to understand fundamental relationships between EI

and forms of dangerous driving. Multiple hierarchical regression analyses were performed to evaluate how well the EI measures predicted various dangerous driving behaviors. All statistical analyses were conducted using the IBM SPSS statistics software package v.27, and all tests were two-tailed with conventional 95% confidence ($p < 0.05$) as the significance threshold.

Results

Correlation analysis

Table 3 lists correlations between demographics, dangerous driving behaviors (risky, aggressive, emotional driving, and errors), and EI (total EI, emotionality, self-control, well-being, and sociability). Total EI and the subscales of EI were correlated with more frequently reported dangerous driving behaviors. Consistent with the TEIQue EI scale development, all subscales significantly correlated with the Total EI score. Considering driving behaviors, age was related to driving errors, while gender was related to risky driving behaviors. In terms of EI, age was related to emotionality and self-control, while gender was related to only self-control.

Using EI Subscales to Predict Dangerous Driving Behaviors

Four separate hierarchical regression analyses were performed to determine the unique contribution of each EI subscale (emotionality, self-control, well-being, and sociability) in predicting dangerous driving behaviors (risky driving, aggressive driving, negative emotional driving, and errors). In each of the regression analyses, age and sex were entered in the first step to control for their effects, and the EI subscales were then entered in the second step. The results are presented in Table 3.4. Driver's age appeared to be a significant predictor for driving errors, and sex became a significant predictor for risky driving behaviors. Consistent with the

correlation analysis reported in Table 3.3, older drivers reported significantly fewer errors, while male drivers reported more risky driving behaviors.

After controlling for age and sex, emotionality was the most consistent component of EI that predicted all dangerous driving behaviors. Higher emotionality (e.g., better emotional perception and expression ability) resulted in less frequent dangerous driving behaviors (risky, aggressive, emotional driving, and errors). In addition, higher well-being (e.g., more happiness and stronger self-esteem) predicted aggressive driving and driving errors. Furthermore, higher sociability (e.g., highly social person) resulted in more risky and emotional driving, and lower self-control predicted only emotional driving.

Table 3.3. Correlations Between Demographics, Behaviors, and EI Scales.

	1	2	3	4	5	6	7	8	9	10	11	12
1. Age												
2. Sex	-0.08											
3. Geography	-0.04	0.01										
4. Education	-0.02	0.01	0.38**									
5. Risky driving	-0.06	-0.13**	-0.02	0.00								
6. Aggressive driving	-0.04	-0.08	-0.03	-0.04	**0.72****							
7. Emotional driving	-0.03	0.04	-0.01	0.01	**0.61****	**0.63****						
8. Driving Errors	-.13**	-0.01	0.02	0.06	**0.70****	**0.54****	**0.41****					
9. Total EI	0.11**	-0.05	0.01	0.02	**-0.31****	**-0.28****	**-0.27****	**-0.37****				
10. Emotionality	0.11**	0.06	0.02	0.05	**-0.38****	**-0.30****	**-0.26****	**-0.36****	**0.82****			
11. Self-Control	0.16**	-0.19**	0.02	0.00	**-0.22****	**-0.21****	**-0.32****	**-0.26****	**0.79****	**0.53****		
12. Well-Being	0.03	0.01	0.05	0.03	**-0.27****	**-0.25****	**-0.21****	**-0.31****	**0.86****	**0.59****	**0.62****	
13. Sociability	0.04	-0.05	-0.04	-0.08	-0.15**	-0.14**	-0.10*	-0.26**	**0.75****	**0.51****	**0.47****	**0.57****

Note: Significance effects (* $p<0.05$; ** $p<0.01$) are in bold type face for emphasis.

Table 3.4. Results of Hierarchical Regression Models Predicting Dangerous Driving.

Variable	R^2	*F*	*Beta*
1. Risky driving			
Step 1			
Age	2.00%	F (2,607) =6.31	-0.070
Sex		(p<0.01)	0.130**
Step 2			
Emotionality			-0.345**
Self-control	16.60%	F (6,603) =20.02	-0.033
Well-being		(p<0.01)	-0.099
Sociability			0.095*
2. Aggressive driving			
Step 1			
Age	0.90%	F (2,607) =2.61	-0.051
Sex		(p=0.07)	0.081
Step 2			
Emotionality			-0.222**
Self-control	10.60%	F (4,603) =11.95	-0.066
Well-being		(p<0.01)	-0.116*
Sociability			0.067
3. Negative emotional driving			
Step 1			
Age	0.20%	F (2,607) =0.73	-0.028
Sex		(p=0.48)	-0.038
Step 2			
Emotionality			-0.168**
Self-control	13.50%	F (6,603) =13.93	-0.287**
Well-being		(p<0.01)	-0.001
Sociability			0.115*
4. Driving Errors			
Step 1			
Age	1.40%	F (2,607) =5.29	-0.131**
Sex		(p<0.01)	0.018
Step 2			
Emotionality			-0.236**
Self-control	15.60%	F (6,603) =18.63	-0.013
Well-being		(p<0.01)	-0.124*
Sociability			-0.064

Note: (R^2 change) * p<0.05; ** p<0.01

Discussion

This study aimed to investigate dangerous driving behaviors in the context of emotional intelligence. Overall, the results showed that greater EI scores related to less frequent dangerous driving behaviors. The EI subscale of emotionality best predicted dangerous driving behaviors. This study showed that drivers with lower emotionality engaged in more frequent dangerous driving behaviors, including risky, aggressive, and emotional driving as well as driving errors. Drivers with higher emotionality have been known to better understand and express their emotions, have greater empathy for others, and have a strong ability to maintain healthy relationships (Petrides & Furnham, 2001). In the driving context, drivers with lower emotionality often failed to recognize and manage their emotions (e.g., “Many times, I can’t figure out what emotion I'm feeling”), were less empathetic toward other road users (e.g., “I often find it difficult to see things from another person’s viewpoint”), and thereby engaged in more dangerous driving (e.g., “I would tailgate a driver who annoys me”) (Arnau-Sabates et al., 2012; Hayley et al., 2017; Pearson et al., 2013). Hayley et al. (2017) reported that emotional recognition and expression can predict risky and negative emotional driving, consistent with this study’s findings. Similarly, drivers with lower empathy make more driving errors than those with higher empathy (Owsley et al., 2003).

Furthermore, drivers with higher well-being reported less aggressive driving and fewer driving errors. Individuals with higher well-being were more optimistic, happier, and had greater self-esteem (Petrides, 2009). Previous research suggested that a high level of happiness related to well-being contributed to fewer traffic violations and decreased crash risk (Isler & Newland, 2017). Furthermore, a driver with higher self-esteem was more likely to be careful and patient on the road, make fewer driving errors, and act less aggressively.

Moreover, higher sociability (e.g., highly social person) was related to more risky and emotional driving. Individuals with higher sociability are great at social interactions, more confident, and believe in their ability to affect others' emotions. Previous research found that individuals with extraverted personalities were more prone to risky driving behaviors and traffic crashes (Dahlen & White, 2006). Similarly, extroverted individuals with fewer social interactions experienced different types of negative emotions (e.g., driving alone may feel isolating), including frustration and sadness, which could lead to negative emotional driving (Erzen & Çikrikci, 2018). In addition, this study found that drivers' lower self-control led to negative emotional driving. Drivers with low self-control were more prone to impulsive behaviors and struggled to regulate their emotions (e.g., "I usually find it difficult to regulate my emotions"), which could have increased their negative emotional driving (e.g., "I lose my temper while driving") (Petrides, 2009).

In regard to demographics, this study found older drivers made fewer dangerous errors compared to young drivers. It is possible that with years of driving experience, drivers become familiar with traffic systems and vehicle operations, which reduces the number of driving errors. Borowsky et al. (2010) found in their simulated study that older and experienced drivers were able to detect more potential hazards on the road, and thereby made fewer errors. However, another study reported that driving errors increased among older drivers (ages 70 to 88 years) due to cognitive limitations caused by aging (Anstey & Wood, 2011). As the present study did not consider drivers over the age of 65, the negative effects of aging did not impact the results. This study found risky, aggressive, and negative emotional driving were not related to age, while other studies suggested a significant correlation exists (Rhodes & Pivik, 2011; Shinar & Compton, 2004).

Moreover, this study found male drivers reported more risky driving behaviors (e.g., "I consider myself to be a risk-taker") compared to female drivers. The majority of driving safety literature asserted that male drivers were prone to risky driving behaviors, consistent with this study's findings (Arnett, 1996; Rhodes & Pivik, 2011). However, this study found that aggressive and negative emotional driving were not associated with drivers' gender. In contrast, Shinar and Compton (2004) found male drivers exhibited more aggressive behaviors on the road compared to female drivers. This study used a stratified sample to achieve a quota of participants with crashes and citations, and the aim was to investigate EI and driving behaviors rather than demographics, which could account for the discrepancy between other driving literature and this study.

Even though this study had a robust methodology, there were some limitations. The self-reported EI and dangerous driving measures used in this study could have influenced participants to produce socially desirable responses. However, research has found that social desirability bias is not as strong in surveys that use items related to driving behaviors, like the one used in this study (Sullman & Taylor, 2010). Therefore, this study suggests using real-time driving behavior data (e.g., drive cam, simulations) in the future to validate this study's results. Moreover, this study used an EI measure not designed for the driving context. This study recommends the development of a driver-specific EI scale that could more accurately predict driving behaviors. This scale could be useful for drivers' assessment (i.e., licensing) and recruitment procedures. Furthermore, the survey length was long, which could have caused survey fatigue and affected the participants' ability to respond accurately. However, participants were compensated for being honest and accurate in their responses, which was intended to mitigate possible survey fatigue. This study also used a convenience sample with demographic quotas to ensure sufficient

response variation. Whereas this sampling method supported the analysis of relationships between variables, the mean values of these variables were not representative of the general population. Furthermore, given the different licensing procedures for commercial drivers, drivers with a CDL were excluded from this study. Future research should investigate commercial drivers' behaviors separately. While this study's results show a strong correlation between EI and driving behaviors, establishing the causal relationship of emotional intelligence on dangerous driving behaviors needs to be further explored through experimental studies.

Conclusion

This study found that emotional intelligence is significantly related to dangerous driving behaviors for non-commercial drivers. This strong correlation indicates that emotional intelligence may be a significant area of improvement for reducing dangerous driving behaviors. With these relationships in mind, the findings provide strong evidence for the need to incorporate emotional intelligence into the investigation of drivers' dangerous behaviors as a means of understanding and intervening in them. Emotional intelligence theories suggest that emotions are adaptive when emotion-related information can be perceived, understood, and managed effectively (Mayer et al., 1990; Salovey & Sluyter, 1997). Therefore, emotional intelligence training as a form of driving skill development could be introduced into driving education and traffic safety programs (Clarke, 2006). In addition, ongoing training and assessment should strongly consider emotional intelligence to target and improve drivers' behaviors. This study also suggests that state and federal administrations should promote emotional intelligence safety campaigns to increase safe driving awareness.

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CHAPTER FOUR

THE INFLUENCE OF EMOTIONAL INTELLIGENCE ON DANGEROUS DRIVING: A COMPARISON BETWEEN COMMERCIAL AND NON-COMMERCIAL DRIVERS

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The Influence of Emotional Intelligence on Dangerous Driving: A Comparison Between Commercial and Non-Commercial Drivers

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Abstract

Driver populations operating with a Commercial Driving License (CDL) experience different levels of fatal and serious injury crash risk than driver populations operating with a Non-Commercial Driving License (non-CDL). Dangerous driving behaviors have been found to be a leading contributor to the risk of a fatal or serious injury crash for both driving groups. Emotional Intelligence (EI) has proven to be a significant predictor of dangerous driving behaviors among non-CDL drivers; however, no studies have investigated EI and CDL drivers separately or compared CDL and non-CDL driving groups in terms of relative differences in EI and dangerous driving. Understanding these differences will guide the development and implementation of more effective strategies while addressing the specific traffic safety issues experienced by these groups. This study compares reported dangerous driving and emotional intelligence (EI) of a sample of 585 CDL and 615 non-CDL drivers. Participants completed an online survey through Qualtrics that included the Trait Emotional Intelligence Questionnaire (TEIQue-SF), the Dula Dangerous Driving Index (DDDI), and the Driving Behavior Questionnaire (DBQ). Analyses confirmed that (1) CDL drivers had lower EI than non-CDL drivers; (2) CDL drivers were more likely to report more dangerous driving behaviors; and (3) lower EI was associated with increased reported dangerous driving especially among CDL drivers. Therefore, promoting and improving EI may be useful in preventing dangerous driving.

Keywords: driving behaviors; road safety; emotional intelligence; dangerous driving; non-commercial driver, commercial driver

Introduction

Commercial drivers play a significant role in transporting consumer goods and passengers. In 2018, over 11 billion tons of freight were transported, and over 4.5 billion passengers traveled by bus in the United States (American Public Transportation Association, 2018; U.S. Department of Transportation, 2020). In 2018, commercially licensed drivers represented only 1.5% (3.5 million) of the U.S. driver population but contributed significantly (13%) to the total crashes (NHTSA, 2020). In addition, 176,000 people were injured and 4,136 were killed by commercial vehicles (Federal Highway Administration, 2019). Of these deaths, 67% were other-vehicle occupants, and 15% were pedestrians, indicating that commercial drivers create significant hazards for other road users (U.S. Department of Transportation, 2020). Therefore, it is important to understand the various factors that contribute to commercial motor vehicle crashes in order to increase traffic safety.

Many factors have been associated with commercial vehicle road crashes, including vehicle errors, environment, work-related factors, and driver behavior (Hickman et al., 2020; Scott-Parker et al., 2012; Weng & Meng, 2012). The Large Truck Crash Causation Study (2007) found that dangerous driving behaviors alone contributed to 88% of crashes (Singh, 2015). Dangerous driving behaviors can be defined as inappropriate driver activities that increase road hazards for drivers and other road users. These behaviors have often been identified as aggressive driving, deliberate violations, and driving errors (Dula & Geller, 2003; Reason et al., 1990; Scott-Parker et al., 2012). Previous research has found risky and aggressive driving (Dula & Ballard, 2003; Sümer, 2003), violations (Iversen & Rundmo, 2004), and dangerous errors (de Winter et al., 2018) significantly predict crashes and citations. Therefore, to understand causes of crashes for commercial drivers, it is necessary to thoroughly investigate these dangerous driving behaviors.

Many factors can lead a commercial driver to engage in dangerous driving behaviors, including fatigue caused by long driving, sleep deprivation, and drug- or alcohol-impaired driving (NHTSA, 2020). While commercial drivers' work-related factors have been well studied in terms of dangerous driving, their personal factors have not been studied in the safety literature. Commercial drivers' personal factors, including personality traits and emotions, have been found to be correlated to dangerous driving behaviors (Iversen & Rundmo, 2002; Ulleberg & Rundmo, 2003). In general, drivers' emotions (e.g., anger, happiness) have been found to significantly contribute to dangerous driving behaviors (e.g., violations, aggressive driving) (Dahlen & White, 2006; Deffenbacher et al., 2003; Dula & Ballard, 2003; Mesken et al., 2007). Drivers' emotions on the road can be stimulated by different factors, such as slow or heavy traffic, other drivers' risky activities (e.g., lane change without proper signal), and personal and work-related factors (Deffenbacher et al., 2003; Underwood et al., 1999). Commercial drivers experience more emotional and mental health problems than non-commercial drivers due to their type of work and its associated factors such as driving fatigue, stints away from their families, social isolation, and disrespectful behaviors from other road users (Shattell et al., 2012; Shattell et al., 2010). Shattell et al. (2010) found that occupational and emotional stress predisposed commercial drivers to engage in general risky behaviors (e.g., substance misuse and unsafe sex), which have a significant correlation to risky driving behaviors and fatal road crashes (Li et al., 2013). Therefore, commercial drivers' dangerous behaviors need to be further investigated in the context of emotion-associated factors.

Drivers' emotions can be better understood by assessing their emotional intelligence. Emotional intelligence (EI) measures an individual's ability to understand and express different types of emotions and to then use this information to guide their thoughts and behaviors (Mayer et al., 1990). While researchers have studied emotional intelligence in the

context of other dangerous behaviors like drug use and unsafe sex, it has not been widely explored in the driving context. Only a few studies investigated the relationship between EI and dangerous driving behaviors for non-commercial populations (Ahmed et al., 2021; Arnau-Sabates et al., 2012; Hayley et al., 2017). Arnau-Sabates et al. (2012) found that EI subscales of emotional self-regulation, empathy, and impulse control were negatively correlated with dangerous driving behaviors, including speeding and driving under the influence of alcohol or drugs (DUI). In addition, Ahmed et al. (2021) found that drivers with a lower emotionality component of EI (i.e., the ability to perceive and express emotions) predicted more frequent dangerous driving behaviors. These findings are supported by a study done by Hayley et al. (2017), which showed that lower emotional recognition and expression scores produced aggressive driving (e.g., speeding, weaving in and out of traffic), driving violations (e.g., DUI), and driving with negative emotions. In addition, Falahi and Goudarzi (2015) reported that drivers with higher EI scores in social awareness and relationship management had significantly lower driving violations and errors. Interestingly, Smorti et al. (2018) found that total EI (i.e., overall EI) was correlated with the outcomes of dangerous driving behaviors (citations).

No study has considered a commercial driver population in the context of emotional intelligence and dangerous driving behaviors. Work and family issues greatly contribute to commercial drivers' emotion-induced behaviors, which can be addressed by the EI components of emotionality (i.e., understand and express emotions), well-being (i.e., being healthy and happy), and sociability (i.e., enjoying more social interactions) (Shattell et al., 2012). Therefore, research is needed to explore the relationship between EI and dangerous driving behaviors for commercial drivers and identify the difference with non-commercial drivers. This study hypothesizes that (1) higher emotional intelligence will be correlated with lower dangerous driving behaviors among commercial drivers and (2) that the relationship

between EI and driving behaviors is stronger for commercial drivers than non-commercial drivers as supported by commercial drivers' higher number of crash involvement and more emotional problems (Shattell et al., 2012; Shattell et al., 2010). To test these hypotheses, this study uses a dataset that measures both commercial and non-commercial drivers' dangerous behaviors and EI as well as performs a series of analyses to identify commercial drivers' dangerous behaviors' relationship with EI and how it differs from non-commercial drivers. By understanding the differences between the types of drivers, it may be possible to develop effective strategies to mitigate the unique factors that predispose drivers in these groups to dangerous driving that can result in fatal crashes. Thus, this article will first present the relationship between EI and dangerous driving behaviors among commercial drivers and then compare the relationship of EI and dangerous driving between commercial and non-commercial drivers.

Methods

Design and Procedure

This study surveyed two different populations: 595 commercial drivers with CDL licenses and 615 non-commercial drivers with typical driving licenses. Drivers who drove their vehicles every day or most days were able to participate in the survey and received a small incentive. Participants completed the anonymous web-based survey consisting of demographic information (age, sex, geographical location, education, marital status, language), general driving history (e.g., miles driven, years with a valid license, number of crashes and citations), the Trait Emotional Intelligence Short Form (TEIQue-SF) questionnaire to measure EI, and the Dula Dangerous Driving Index and Driving Behavior Questionnaire (DDDI and DBQ) to measure dangerous driving behaviors. These measures were found to be valid and reliable (Cordazzo et al., 2014; Dula & Ballard, 2003; O'Connor

et al., 2019). Participants were instructed to complete the survey within one sitting and to set aside enough time to complete all questions. This article will present the survey findings as two separate studies. The first study presents the relationship between emotional intelligence and dangerous driving behaviors for commercial drivers, while the second study compares this relationship between commercial and non-commercial drivers.

Participants

Commercial Driver Participants:

A total of 595 U.S. commercial drivers (with a valid CDL license) ages 18-65 (M = 29.16 years, SD = 7.88 years) completed the study. Table 4.1 summarizes the quota target and actual participation of the respondents. The final commercial driver sample comprised 49.2% young drivers (ages 18-26), 49.9% female, 52.1% from urban areas, 51.9% with a college degree or more, 53.1% drivers with at-fault crashes, and 66.4% drivers with at least one citation.

Table 4.1. Quota for Commercial Respondents

Condition Given	Desired (%)	Actual (%)
Female	50%	49.9%
Young drivers (ages 18 to 26)	50%	49.2%
One or more at-fault crashes	20%	53.1%
One or more fines for moving citations	20%	66.4%

Non-Commercial Driver Participants:

A total of 615 U.S. non-commercial drivers (with a valid regular driving license) ages 18-65 (M = 31.16 years, SD = 11.18 years) completed the study. Table 4.2 summarizes the quota target and actual participation of the respondents. The final sample comprised 50.2% young drivers (ages 18-26), 50.3% female, 87.8% from urban areas, 36.9% with a college degree or more, 42.1% drivers with at-fault crashes, and 60.7% drivers with at least one citation.

Table 4.2. Quota for Non-Commercial Respondents

Condition Given	Desired (%)	Actual (%)
Female	50%	50.3%
Young drivers (ages 18 to 26)	50%	50.2%
One or more at-fault crashes	20%	42.1%
One or more fines for moving citations	20%	60.7%

Questionnaires

The Trait Emotional Intelligence Questionnaire

The Trait Emotional Intelligence Questionnaire Short Form (TEIQue-SF) consists of 30 items developed from the original version of 151 items (Petrides, 2009). This scale considers a wide range of emotion-related attributes that are applicable to a variety of research and applied contexts (e.g., educational, clinical, occupational, and organizational). Participants were asked to select an answer on a 7-point Likert scale (1=completely agree, 7=completely disagree) . The scale provided a total EI score along with scores on four factors.

1. Total EI (30 Questions): This evaluates an individual's general emotional functioning on 15 facets of trait EI.
2. Emotionality (8 questions): This reflects an individual's ability to recognize and process emotions (e.g., Many times I cannot figure out what emotion I am feeling).
3. Self-control (6 questions): This evaluates a person's ability to regulate their emotions and impulses (e.g., I usually find it difficult to regulate my emotions).
4. Sociability (6 questions): This emphasizes the individual's social interactions and impact on the community (e.g., I can deal effectively with people).
5. Well-being (6 questions): This measures an individual's satisfaction with life (e.g., I generally do not find life enjoyable).

Dula Dangerous Driving Index (DDDI)

The Dula Dangerous Driving Index (DDDI) was used to measure self-reported risky and aggressive behaviors (Dula & Ballard, 2003). The DDDI consists of 28 questions rated on a 5-point Likert scale (1=almost never, 5=almost always). Three subscales were generated from the questionnaire:

7. Risky driving (12 questions, score 12–60): This measures the willingness to engage in unsafe driving behavior (e.g., I will race a slow-moving train to a railroad crossing).
8. Aggressive driving (7 questions, score 7–35): This assesses behaviors that are intentionally meant to annoy, irritate, or punish other drivers (e.g., I would tailgate a driver who annoys me).
9. Negative emotional driving (9 questions, score 9–45): This measures irritability and anger when driving and the tendency to become annoyed with other drivers (e.g., Passengers in my car/truck tell me to calm down).

Driving Behavior Questionnaire (DBQ)

The Driver Behavior Questionnaire (DBQ) was used to measure self-reported intentional violations and unintentional driving errors (Reason et al., 1990). The DBQ consists of 36 questions rated on a 6-point Likert scale (1=almost never, 6=almost always). The two subscales are as follows:

5. Violations (13 questions, score 13–78): This assesses drivers' intentional deviations from safe driving practices (e.g., Disregard the speed limits late at night or early in the morning).
6. Errors (23 questions, score 23–138): This measures drivers' faults in judgment or decision making (e.g., Misjudge your gap in a car park and nearly or actually hit an adjoining vehicle).

The two-factor structure that was used in this study has been validated (Cordazzo et al., 2014). A low score means safe driving behaviors, and a high score represents dangerous driving behaviors.

Scales' Reliability

Table 4.3 presents all the driving behaviors and EI subscales' means, standard deviation, and alpha reliability for commercial and non-commercial drivers. The driving behaviors subscales in DDDI and DBQ showed strong reliability, but the EI subscales of well-being, self-control, sociability, and emotionality showed low reliability, specifically for commercial drivers. Therefore, we used total EI and omitted the four EI subscales for the rest of the analyses.

Table 4.3. Summary of Scales and Internal Reliability.

Scale name	Number of Items	Measures	Commercial Drivers			Non-commercial Drivers		
			Mean	SD	Internal reliability	Mean	SD	Internal reliability
DDDI	28	Risky driving	29.61	12.59	0.94	20.54	7.91	0.89
		Aggressive driving	17.58	7.53	0.91	12.86	5.44	0.87
		Emotional driving	26.01	7.67	0.85	22.90	6.06	0.81
DBQ	36	Violation	37.31	16.59	0.95	25.28	9.57	0.89
		Errors	62.00	28.58	0.98	41.81	17.10	0.96
TEIQue-SF	30	Total EI	4.49	0.73	0.85	4.78	0.81	0.91
		Emotionality	4.37	0.89	0.59	4.86	0.95	0.71
		Self-control	4.30	0.76	0.28	4.41	0.99	0.69
		Well-being	4.84	1.02	0.64	5.13	1.04	0.80
		Sociability	4.46	0.85	0.42	4.66	0.91	0.64

Commercial Drivers' Dangerous Driving Relationship to EI

The first set of analyses was to understand commercial drivers' dangerous behaviors in the context of emotional intelligence. First, bivariate correlation analysis was performed to understand fundamental relationships between demographics, total EI, and dangerous driving behaviors. Then, multiple hierarchical regression analyses were performed to evaluate how

well total EI predicted various dangerous driving behaviors. All statistical analyses were conducted using the IBM SPSS statistics software package v.27, and all tests were two-tailed with conventional 95% confidence ($p < 0.05$) as the significance threshold.

Correlation Analysis

Table 4.4 lists correlations between demographics, dangerous driving behaviors (risky, aggressive, and emotional driving as well as driving violations and errors), and total EI. Total EI was significantly correlated with dangerous driving behaviors. The only demographic variable that was consistently related to dangerous driving behaviors was the sex of the driver.

Table 4.4. Pearson Correlations Between Demographics, Behaviors, and Total EI.

	1	2	3	4	5	6	7	8	9
1. Age									
2. Sex	-0.07								
3. Geography	-0.07	0.06							
4. Education	-0.01	0.03	**0.58****						
5. Risky driving	0.05	**-0.19****	0.02	0.02					
6. Aggressive driving	0.06	**-0.19****	-0.01	0.02	0.86**				
7. Emotional driving	0.05	**-0.11****	-0.03	0.01	0.80**	0.78**			
8. Violations	-0.01	**-0.18****	0.02	0.04	0.85**	0.79**	0.72**		
9. Errors	-0.03	**-0.16****	0.01	0.03	0.84**	0.78**	0.70**	0.95**	
10. Total EI	0.07	0.02	-0.03	-0.01	**-0.44****	**-0.44****	**-0.32****	**-0.45****	**-0.46****

Note: Significance effects (* $p<0.05$; ** $p<0.01$) are in bold type face for emphasis

Predicting Driver Behaviors with Total EI

To determine the unique contribution of total EI, five separate hierarchical regression analyses were performed to predict each type of dangerous driving behavior (risky driving, aggressive driving, negative emotional driving, violations, and errors). In each of the regression analyses, sex (only significantly correlated to driving behaviors) was entered in the first step to control for effect, and total EI was then entered in the second step. The results are

presented in Table 4.5. Consistent with the correlation analysis reported in Table 4, male drivers reported significantly higher dangerous driving behaviors than female drivers. After controlling for age and sex, total EI successfully predicted all dangerous driving behaviors. Higher total EI resulted in less frequent dangerous driving (risky, aggressive, and emotional driving, as well as violations and errors).

Table 4.5. Results of Hierarchical Regression Models Predicting Dangerous Driving.

Variable	R^2	F	B
5. DDDI Risky driving			
Step 1			
Sex	3.6%	F (1,593) =22.00, (p<0.01)	4.76**
Step 2			
Total EI	22.5%	F (1,592) =144.30, (p<0.01)	-7.46 **
6. DDDI Aggressive driving			
Step 1			
Sex	3.6%	F (1,593) =21.96, (p<0.01)	4.69**
Step 2			
Total EI	22.7%	F (1,592) =146.85, (p<0.01)	-4.49**
7. DDDI Negative emotional driving			
Step 1			
Sex	1.3%	F (1,593) =7.69, (p<0.01)	1.73**
Step 2			
Total EI	11.4%	F (1,592) =37.92, (p<0.01)	-3.32**
8. DBQ Violations			
Step 1			
Sex	3.4%	F (1,593) =20.86, (p<0.01)	4.57**
Step 2			
9. Total EI	23.3%	F (1,592) =153.29, (p<0.01)	-10.09**
10. DBQ Errors			
Step 1			
Sex	2.6%	F (1,593) =15.99, (p<0.01)	4.00**
Step 2			
Total EI	23.7%	F (1,592) =163.88, (p<0.01)	-12.80**

Note: (R^2 change) * p<0.05; ** p<0.01

Discussion

This study pioneered an investigation of commercial drivers' dangerous driving behaviors in the context of emotional intelligence. Overall, the results show that greater EI relates to less frequent dangerous driving behaviors. Commercial drivers' total EI, which reflects their general emotional functioning, showed strong predictability of different types of dangerous driving such as aggressive driving, driving violations, and dangerous errors consistent with a previous study of non-commercial drivers (Smorti et al., 2018). Though other studies discovered the different components of total EI, such as emotionality, well-being, emotion recognition and expression, relationship management, emotion regulation, impulsiveness, empathy, and social awareness were significantly related to non-commercial drivers' dangerous behaviors, this study cannot confirm them individually (Ahmed et al., 2021; Arnau-Sabates et al., 2012; Falahi & Goudarzi, 2015; Hayley et al., 2017). However, this study suggests that improving commercial drivers' overall emotional intelligence can lead them to control their dangerous behaviors and thereby reduce the likelihood of fatal road crashes. Furthermore, this study investigated commercial drivers' sex in relationship to EI and dangerous driving behaviors and found that commercial male drivers reported more dangerous driving than female drivers. Previous research stated that female drivers were safer on the road, and their crash rates were significantly lower than male drivers (Harré et al., 1996; Massie et al., 1995; NHTSA, 2021).

Comparisons Between Commercial and Non-Commercial Drivers

The second study's set of analyses was to understand the difference between commercial and non-commercial drivers in the context of dangerous driving behaviors and emotional intelligence. First, two multivariate analyses of covariance (MANCOVA) were conducted to understand the differences between commercial and non-commercial drivers

regarding dangerous driving and emotional intelligence. Several demographics such as age, gender, and driving habits (i.e., driving miles per week and years with a license) were included as statistical covariates in these analyses potentially affecting driver behavior and emotional intelligence. Next, five moderation analyses were conducted to explore differences between groups in terms of the relationship between EI and dangerous driving. All statistical analyses were conducted using the IBM SPSS statistics software package v.27, and all tests were two-tailed with conventional 95% confidence ($p < 0.05$) as the significance threshold.

Comparison of Dangerous Driving Between Drivers' Group

The first MANCOVA was conducted to examine differences in dangerous driving behaviors between the commercial and non-commercial samples. Risky, aggressive, negative emotional driving, driving violations, and error subscales were entered as the dependent variables, and the drivers' group (commercial and non-commercial) was used as the fixed factor. Age, sex, geography, education level, years with a license, and miles driven per week were included as covariates in the analysis to control for their effects. Among these covariates, age (Wilks' $\lambda = 0.99$, $F = 2.27$, $p < 0.05$), sex (Wilks' $\lambda = 0.96$, $F = 10.17$, $p < 0.001$), and the number of years with a driving license (Wilks' $\lambda = 0.99$, $F = 3.32$, $p < 0.05$) also reached significance. Results showed a significant main effect of the drivers' group for dangerous driving overall (Wilk's $\lambda = 0.83$ $F = 49.85$, $p < 0.001$). Based on this result, when controlling for demographics, univariate analysis of covariance (ANCOVA) for each behavior showed significant effects of drivers' group on risky, aggressive, and emotional driving and driving violations and errors. As shown in Table 4.6, commercial drivers reported significantly higher dangerous driving behaviors than non-commercial drivers.

Table 4.6. MANCOVA Difference in Driving Behaviors Among CDL and Non-CDL.

Variables	CDL			Non-CDL			Univariate Driver's Group F (1,1196)	Drivers Group Effect
	Mean	SD	Adjusted Mean	Mean	SD	Adjusted Mean		
Risky Driving	29.61	12.59	29.36	20.54	7.91	20.71	203.69**	0.15
Aggressive Driving	17.58	7.52	17.47	12.86	5.44	12.96	141.05**	0.11
Emotional driving	26.01	7.67	25.89	22.90	6.06	22.97	51.62**	0.04
Violations	37.31	16.59	36.91	25.61	10.26	25.90	191.35**	0.14
Errors	62.00	28.58	61.30	41.81	17.10	42.32	193.76**	0.14

Note: Adjusted means are adjusted based on the participant's age, sex, geography, education level, license year, and miles driven per week. ** $p<0.001$

Comparison of Emotional Intelligence Between Drivers' Group

The second MANCOVA was conducted to examine differences in emotional intelligence between the commercial and non-commercial samples. Total EI was entered as the dependent variable, and the drivers' group was used as the fixed factor. Age, sex, geography, education level, years with a driving license, and miles driven per week were included as covariates in the analysis to control for their effects. Results showed a significant main effect of the drivers' group with a Wilk's $\lambda = 0.98$ ($F = 16.74$, $p < 0.001$). Among the covariates, sex (Wilk's $\lambda = 0.96$, $F = 9.38$, $p < 0.001$) and the number of years with a driving license (Wilk's $\lambda = 0.98$, $F = 3.76$, $p < 0.05$) also reached significance. When controlling for demographics, univariate ANCOVA showed significant effects of drivers' groups on total EI. As shown in Table 4.7, non-commercial drivers reported significantly higher EI than commercial drivers.

Table 4.7. MANCOVA Difference in Emotional Intelligence Among CDL and Non-CDL.

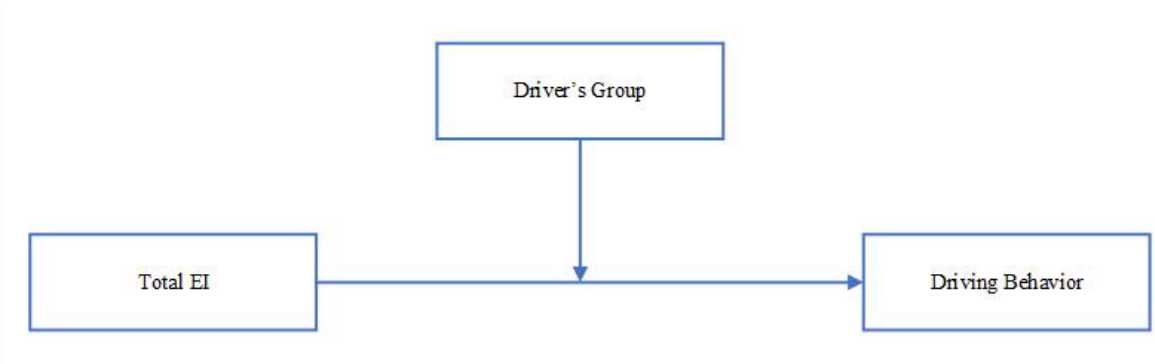
Variables	CDL			Non-CDL			Univariate Driver's Group F (1,1196)	Drivers Group Effect
	Mean	SD	Adjusted Mean	Mean	SD	Adjusted Mean		
Total EI	4.49	0.73	4.51	4.77	0.82	4.75	27.58**	0.02

Note: Adjusted means are adjusted based on the participant's age, sex, geography, education level, license year, and miles driven per week. * $p<0.01$, ** $p<0.001$

Moderation Analysis: Exploring Relationship Between EI and Dangerous Driving

Five moderation analyses were conducted using Andrew Hayes' process macro to predict each of the five forms of dangerous driving (risky, aggressive, emotional driving, driving violations, and errors) in respect to total EI. In these analyses, each driving behavior was a criterion variable, total EI was the predictor variable, and the drivers' group (dichotomous, CDL=1, non-CDL=0) was used as a moderator variable (Figure 4.1).

Figure 4.1. Moderation Analysis of Driver Group on Relationship Between EI and Driving Behaviors.



In these analyses, both total EI and group membership were significant predictors of each type of reported behavior. The higher the total EI, the lower the self-reported dangerous driving behaviors. In addition, there was also a significant interaction between total EI and group membership, which demonstrates that the relationship between driving behavior and total EI was moderated by group membership. The influence of the driver's group as a moderator can be explained by the unstandardized regression coefficient for total EI predicting driving behaviors at two conditional values: (a) non-commercial drivers and (b) commercial drivers (presented in Table 4.8). Results showed that commercial drivers have stronger associations between total EI and dangerous driving behaviors compared to non-commercial drivers (b is significantly higher than a).

The influence of the driver's group as a moderator can be further understood by plotting the simple slopes for each behavior with total EI. A simple slope is defined as the

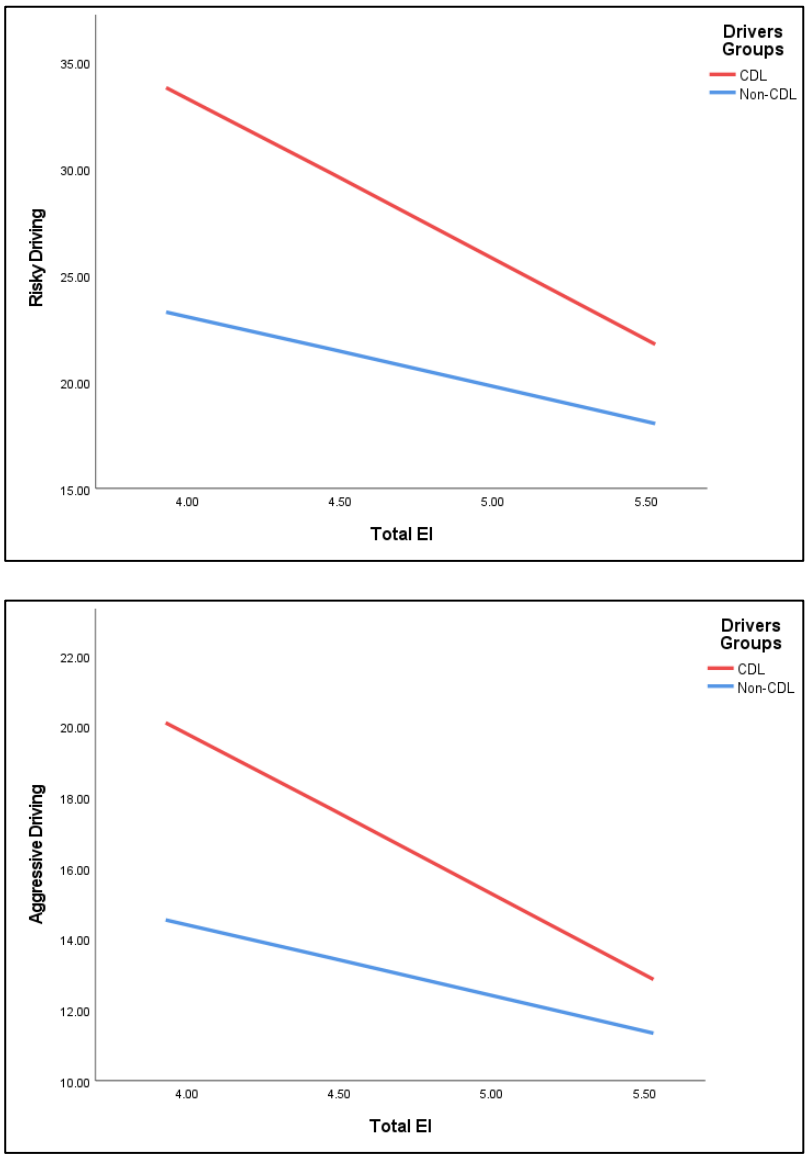
regression of the outcome (driving behaviors) on the predictor (EI) at a specific value of the moderator (CDL or non-CDL). Simple slopes shown in Figure 4.2 provides visual differences between drivers' groups (CDL and non-CDL) regarding the associations between behaviors and total EI. Consistent with the regression results, simple slopes show that total EI reduced all dangerous driving behaviors for commercial drivers at a higher rate than for non-commercial drivers.

Table 4.8. Summary of Regression Models Predicting Behaviors Based on Total EI.

Outcome Variables	Model	Main Effect (B)		Moderator Effect
		Total EI	Drivers' group	Total EI x Drivers' group
Risky driving	R^2=30.08% F(3,1206)=172.96, p<0.001	-3.26	27.31	ΔR^2=2.07% F(1,1206)=35.77, p<0.001 (a) –3.26, (b)=-7.52
Aggressive driving	R^2=25.50% F(3,1206)=137.59, p<0.001	-2.00	15.53	ΔR^2=1.97% F(1,1206)=31.82, p<0.001 (a) -2.00, (b) -4.53
Emotional driving	R^2=14.02% F(3,1206)=65.57, p<0.001	-2.20	7.66	ΔR^2=0.39% F(1,1206)=5.50, p=0.019 (a) -2.20, (b) -3.34
Violations	R^2=30.27% F(3,1206)=174.49, p<0.001	-4.19	37.35	ΔR^2=2.38% F(1,1206)=41.12, p<0.001 (a) -4.19, (b) -10.17
Errors	R^2=32.15% F(3,1206)=40.77, p<0.001	-8.00	63.02	ΔR^2=2.29% F(1,1206)=40.77, p<0.001 (a) -8.00, (b) -18.03

Note: Main effects of total EI and drivers' group in the prediction of dangerous driving behaviors are reported as unstandardized beta coefficients. The effect of drivers' group as a moderating variable is reported as the additional contribution of the interaction between total EI and driver's group to the model predicting driving behaviors. The influence of drivers' group as a moderator is described in terms of the unstandardized regression coefficient for the total EI predicting driving behaviors at two conditional values: (a) non-commercial drivers and (b) commercial drivers.

Figure 4.2. Simple Slopes Between Driving Behaviors and Total EI (CDL and Non-CDL)



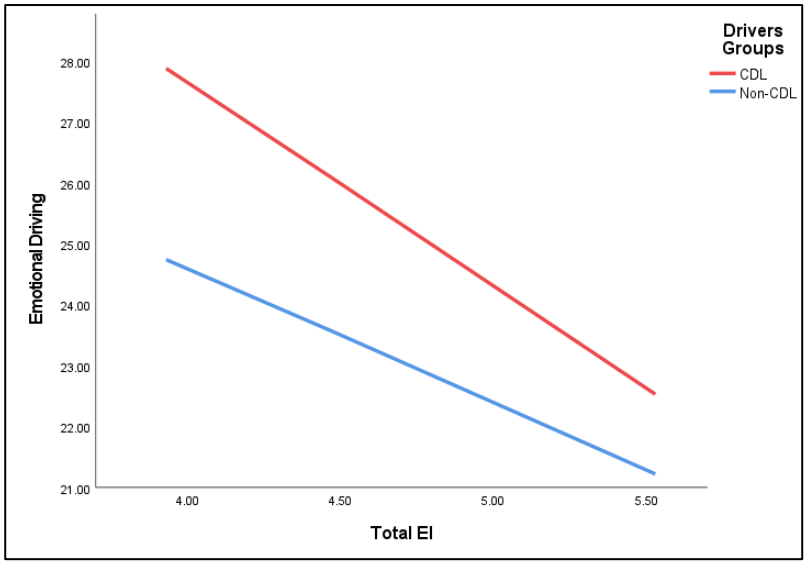
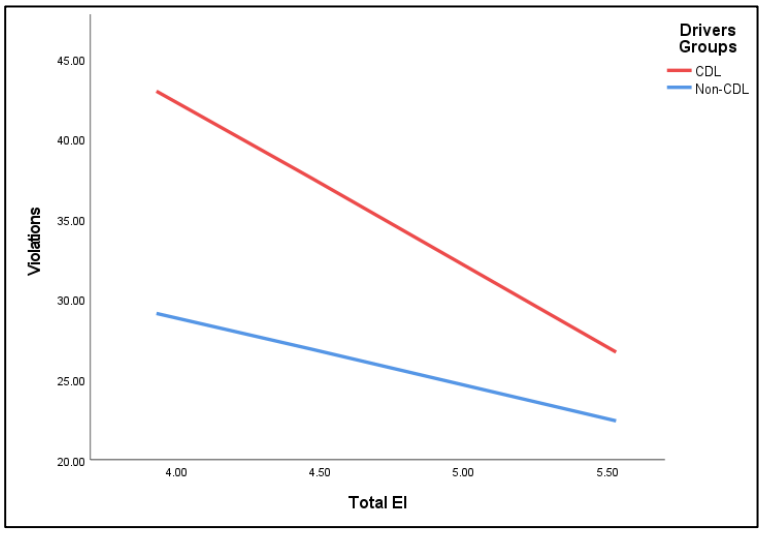
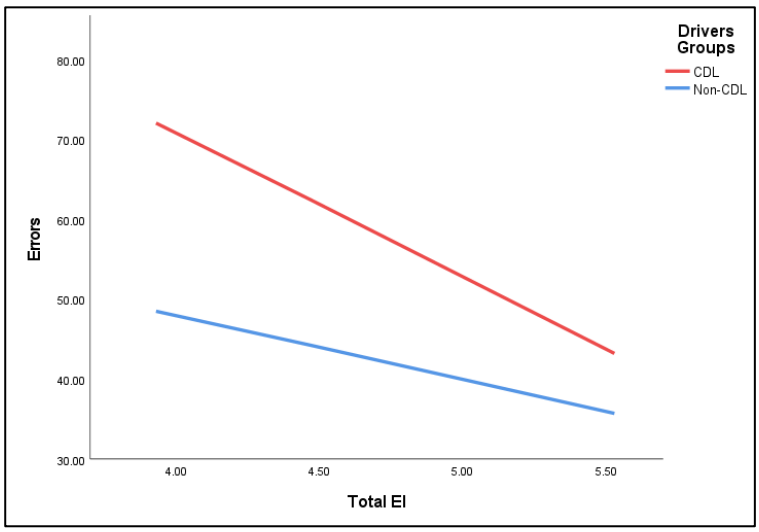


Figure 4.2 Continued





Discussion

This study collected data about dangerous driving and EI in commercial and non-commercial drivers to understand the disproportional representation of CDL drivers in crash fatalities. We examined how the CDL and non-CDL groups differ (1) in terms of reported dangerous driving, (2) in terms of reported EI, and (3) the relationship between EI and dangerous driving.

First, MANCOVA analysis revealed that commercial drivers reported more dangerous driving behaviors than non-commercial drivers in terms of risky, aggressive, emotional driving, driving violations, and errors. These findings are consistent with U.S. national statistics, which reported that commercial drivers' number of fatalities and crashes increased consistently in the last 12 years due to dangerous driving behaviors (FMCSA, 2018). Second, this study further analyzed the difference between the two driving populations based on EI. MANCOVA analyses revealed that commercial drivers reported significantly lower EI scores than non-commercial drivers. Commercial drivers' lower EI was related to their higher levels of dangerous driving behaviors; non-commercial drivers' higher EI was related to their lower levels of dangerous driving behaviors. It is noteworthy that the effect size found in these analyses suggests that drivers in the two groups had larger differences in driving behaviors than EI.

Third, regression analyses revealed that both EI and drivers' groups were significant predictors of all dangerous driving. The overall EI score showed a strong negative association with all dangerous driving behaviors for both types of drivers. However, this relationship between dangerous driving and EI was significantly moderated by group membership. Specifically, the relationship of total EI with dangerous driving was significantly stronger among commercial drivers.

Limitations and Future Research Direction

This study acknowledges some methodological limitations. First, this study used a convenience quota sample to ensure a balanced demographic distribution (e.g., age, sex) and a range of risky driving outcomes (e.g., crashes and citations), which may have prevented the generalizability of these results. While this study's results showed a strong correlation between EI and driving behaviors, establishing the causal relationship of emotional intelligence on dangerous driving behaviors needs to be further explored with a more representative sample and experimental designs. Second, the self-reported measures used in this study may have influenced participants to produce socially desirable responses. However, because this study used survey items related to driving behaviors and trait emotional intelligence, the social desirability bias was not as strong (O'Connor et al., 2019; Reimer et al., 2006; Sullman & Taylor, 2010). Therefore, this study suggests collecting real-time driving behavior data (e.g., drive cam, simulations) for future research to further validate this study's findings. Furthermore, the survey length was long, which could have caused survey fatigue and affected the participants' ability to respond accurately. However, participants were compensated for being honest and accurate in their responses, intended to mitigate possible survey fatigue. Finally, this study used an EI measure not developed for a driving context. This study recommends creating a driving-specific EI scale to accurately predict driving behaviors. Such a scale could be useful for commercial drivers' assessment (i.e., licensing) and recruitment procedures.

Conclusion and Future Recommendation

This study first analyzed how commercial drivers' dangerous behaviors were related to their emotional intelligence. Consistent with previous studies of non-commercial drivers, this study found that emotional intelligence can significantly predict different dimensions of dangerous driving behaviors for commercial drivers. Furthermore, this study compared the

difference in the relationship between EI and dangerous driving behaviors between the two driving groups. This study found EI is more strongly associated with reducing commercial drivers' dangerous behaviors on the road compared to their non-commercial counterparts. This research concludes that improving emotional intelligence will be useful in reducing unsafe and dangerous driving behaviors. These findings provide strong evidence for the need to incorporate emotional intelligence into dangerous driving behavior interventions for both driving groups, and, more specifically, for commercial drivers to reduce their higher fatal crash involvement. Emotional intelligence theories confirm that emotions are adaptive when emotion-related information can be perceived, understood, and managed effectively (Mayer et al., 1990; Salovey & Sluyter, 1997). Training and education can significantly improve emotional intelligence (Clarke, 2006; Ulleberg & Rundmo, 2003). Therefore, incorporating emotional intelligence in drivers' education curricula and licensing procedures may be helpful in improving road safety. Moreover, future commercial drivers' training and professional development should strongly consider emotional intelligence to improve drivers' behaviors on the road. Commercial trucking and logistics companies (e.g., private trucking companies, UPS, FedEx) can also consider emotional intelligence assessment and training as part of their recruitment and promotion process. This study also suggests that state and federal administrations may want to promote safety campaigns based on emotional intelligence to increase safe driving awareness. This intervention would not be very difficult to implement, while the positive impacts could be significant.

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CHAPTER FIVE

A PILOT STUDY OF DEVELOPING A SCALE TO ASSESS EMOTIONAL INTELLIGENCE IN THE CONTEXT OF DRIVING

Introduction

Growing evidence in safety research suggests that drivers' emotions can influence dangerous driving behaviors, potentially leading to an increase in dangerous behaviors while emotionally heightened (Arnau-Sabates et al., 2012; Dula & Ballard, 2003). Thus, it is important to understand how emotions function in the driving context. The role of emotions in social behaviors became popular through a theoretical framework of emotional intelligence (EI) (Mayer & Salovey, 1997; Salovey & Mayer, 1990). Mayer et al. (1990) defined emotional intelligence as understanding and differentiating between emotions and using this information to guide thoughts and behaviors. At present, there are three types of EI models known as the ability, trait, and mixed EI models. These models have each developed unique measures to assess individuals' emotional intelligence, such as administered tests and self-reported surveys. While over 30 EI measures are available based on the three different overarching models, measures that are appropriate for assessing drivers' EI have not yet been identified. Furthermore, in previous studies that have considered EI in the driving context, researchers have not discussed why they choose one measure or model over the others.

In a review of different EI models and measures, O'Connor et al. (2019) suggested using the ability EI measures where an excellent theoretical understanding of emotions is needed, which is not the case for general drivers. Moreover, only a few reliable and valid ability tests are available, and those are difficult to administer due to the accessibility in the survey settings (e.g., MSCEIT). In contrast, mixed and trait model measures have been found better at predicting behaviors, and there are many options available due to their ease to use in

different survey platforms. Given the limitations of ability EI measures, thus multiple studies have investigated dangerous driving behaviors in the context of mixed and trait EI measures (Ahmed et al., 2022; Arnau-Sabates et al., 2012; Falahi & Goudarzi, 2015; Hayley et al., 2017; Smorti et al., 2018). Studies that measured EI by mixed or trait scales found that lower EI is significantly related to more frequent dangerous driving behaviors. In particular, trait EI has been associated with safety-related outcomes such as citations (Smorti et al., 2018). However, the validity of the conclusion that EI is related to dangerous driving and traffic safety outcomes depends on the validity of the measures used to assess EI in the driving context. Previous research investigating dangerous driving has relied on EI scales that were not designed for the road safety context. The scales used in some of those studies remain questionable due to lack of justification of use and theoretical framework validity in the road safety context.

This study acknowledges the need for an EI measure in the context of driving to better assess drivers' emotional intelligence. In order to develop an EI scale in the driving context, the existing mixed and trait EI measures were considered based on their appropriate theoretical construct, reliability, and predictability of behaviors. However, it is not possible to use multiple measures in a single survey due to survey fatigue and the accuracy of response. Thus, this study selected the TEIQue, as reviewers highly emphasized this measure’s strong predictability of emotional self-efficacy and behavioural tendencies (O'Connor et al., 2019). Moreover, previous studies found that the Trait emotional intelligence measures (e.g., TEIQue, EQ-i) (Ahmed et al., 2022; Arnau-Sabates et al., 2012; Smorti et al., 2018) have shown promising predictability and validity in assessing analyzing dangerous driving behaviors. In addition, this study also considered the mixed model measure GENOS EI as another study regarding traffic safety has shown that the scale has significant correlations with dangerous driving behaviors (Hayley et al., 2017). This study aims to identify EI

measures for the driving context in order to develop an EI scale specific to traffic safety to analyze dangerous driving behaviors accurately.

Materials and Methods

Determination of EI Scale Design

Two questionnaires were developed to determine the source items for a new drivers' emotional intelligence scale. To adapt the TEIQue-SF (30 items) and GENOS-SF (14 items) to the driving context, three behavior analysts specialized in the area of social and emotional skills with knowledge and experience in the different aspects of survey item construction developed the first set of items. For example, the item "Others admire me for being relaxed" was changed to "Others would describe me as an anxious driver." 16 out of 30 TEIQue-SF questions were reverse coded to keep consistency with the original scale. However, GENOS-SF items were not reverse coded for the same reason. Participants responded to the TEIQue-SF questions using a seven-point Likert scale with options ranging from 1 (strongly disagree) to 7 (strongly agree), and GENOS-SF items with options ranging from 1 (almost never) to 5 (almost always).

Participants

A total of 204 U.S. drivers ages 18-80 (M = 46.19 years, SD = 17.18 years) participated in the study between February 10 and 12, 2021. Only drivers with a valid license who drove their vehicles every day or most days were able to participate in the survey and received a small incentive. The random sample comprised 16.2% young drivers (ages 18-26), 51.0% female, and 17.2% from rural U.S. areas. The gender, age, and geography distributions were representative of the U.S. population. Table 5.1 summarizes the respondents' demographics.

Table 5.1. Demographics of Respondents.

Sex		Age		Geography	
Male	100	18-26	33	Urban	169
Female	104	27-80	171	Rural	35

Design and Procedure

This study's data were collected using a paid panel of respondents from Qualtrics, a private U.S.-based company that provides survey services. Participants completed the anonymous web-based survey consisting of demographic information (age, gender, geographical location, education, marital status, and language), general driving history (e.g., miles driven, crashes, and citations), the reworded Trait Emotional Intelligence Questionnaire (TEIQue-SF), reworded GENOS-SF (WEIS), and the Dula Dangerous Driving Index (DDDI). Participants were instructed to complete the survey within one sitting and to set aside enough time to complete all questions.

EI Measures

The Trait Emotional Intelligence Questionnaire-Short Form (TEIQue-SF)

The Trait Emotional Intelligence Questionnaire -- Short Form (TEIQue-SF) consists of 30 items developed from the original version of 151 items (Petrides, 2009). This scale considers a wide range of emotion-related attributes applicable to a variety of research and applied contexts (e.g., educational, clinical, occupational, and organizational) (O'Connor et al., 2019). Participants were asked to select an answer on a seven-point Likert scale ranging from completely disagree (1) to completely agree (7). The scale provided a total EI score along with scores on four factors.

(1) Emotionality (8 questions): Reflects an individual's ability to recognize and process emotions (e.g., "People who drive with me often complain that I don't treat other drivers right.").

(2) Self-control (6 questions): Evaluates a person's ability to regulate their emotions and impulses (e.g., "I usually find it difficult to regulate my emotions while driving").

(3) Sociability (6 questions): Emphasizes the individual's social interactions and impact on the community (e.g., "I can deal effectively with other drivers.").

(4) Well-being (6 questions): Measures an individual's satisfaction with life (e.g., "I generally don't find driving enjoyable.").

GENOS EI-SF

The GENOS EI 70-item questionnaire (Palmer et al., 2009) was developed for use in the workplace to measure three broader aspects of EI (emotion recognition, reasoning with emotions, and management of emotions) through seven factors (10 items for each factor). This study used the short version of the original scale (14 items) and reworded the questions to better fit in the driving context (e.g., "I am aware of my mood state while driving."). Items were scored on a 5-point Likert scale from almost never (1) to almost always (5). The total EI score was calculated by adding items for each participant, ranging from 14-to 70.

Validation Measures

The reworded TEIQue-SF and GENOS-SF were used to assess drivers' emotional intelligence. In addition, participants' dangerous driving behaviors were measured with the Dula Dangerous Driving Index (DDDI). The DDDI measure was used to analyze the predictive validity of the two emotional intelligence scales. The description of each scale is given below.

Dula Dangerous Driving Index (DDDI)

The Dula Dangerous Driving Index (DDDI) consists of 28 questions, rated on a five-point Likert scale (1=almost never, 5=almost always) (Dula & Ballard, 2003). Three

subscales were generated from the questionnaire, and a low score on each subscale represents safe driving behaviors, whereas a high score represents dangerous driving behaviors.

(1) Risky Driving (12 questions, scores range from 12 to 60): This measures the willingness to engage in unsafe driving behavior (e.g., “I will race a slow-moving train to a railroad crossing”).
(2) Negative Emotional Driving (9 questions, scores range from 9 to 45): This measures irritability and anger when driving and the tendency to become annoyed with other drivers (e.g., “Passengers in my car/truck tell me to calm down”).
(3) Aggressive Driving (7 questions, scores range from 7 to 35): This assesses behaviors that are intentionally meant to annoy, irritate, or punish other drivers (e.g., “I would tailgate a driver who annoys me”).

Statistical Analysis

All scales and subscales were calculated (EI and driving behaviors) following the respective scale’s scoring methods. Next, we assessed the internal consistency of the existing measures by calculating Cronbach’s alpha and McDonald’s omega coefficients. In addition, the predictive validity of TEIQue-SF and GENOS EI was assessed in the driving context by analyzing the correlation and regression results with DDDI scores and self-reported crashes and citations.

In the second phase, two exploratory functional analyses (EFA) were conducted using principal axis factoring (minimum loading >0.40) and oblique rotation (Promax with delta=0 and kappa= 4) to investigate the factor structure of the TEIQue-SF and GENOS EI items. The EFA significance was measured by the Kaiser-Meyer-Olkin (KMO) index and Bartlett’s test of sphericity. In addition, the number of factors was determined according to the Kaiser criterion (eigenvalue greater than 1) and scree test (Kaiser, 1960). The new scale’s scores

were calculated based on the EFA solution, and Cronbach's alpha and McDonald's omega coefficients were reported. Finally, another correlation analysis was conducted with the new scales. All statistical analyses were conducted using the IBM SPSS statistics software package v.27, and all tests were two-tailed with conventional 95% confidence ($p < 0.05$) as the significance threshold.

Results

Scale Reliability Using Original Scoring Methods

The internal consistency of the GENOS EI and TEIQue-SF was estimated by calculating Cronbach's alpha and McDonald's omega coefficients. Table 5.2 shows the means, standard deviations, Cronbach's alpha, and McDonald's omega coefficients for the GENOS EI and TEIQue total EI, self-control, emotionality, well-being, and sociability subscales. GENOS EI showed poor internal reliability Compared to TEIQue-SF. TEIQue subscale sociability showed poor internal consistency and is excluded from the regression analysis.

Table 5.2. Means, Standard Deviations, and Scales' Reliability.

	Mean	Standard deviations	Cronbach's alpha	McDonald's omega
GENOS EI	50.24	7.95	0.746	0.578
TEIQue Total EI	4.73	0.85	0.897	0.911
TEIQue Emotionality	4.24	1.34	0. 875	0.869
TEIQue Self-control	4.98	0.99	0.609	0.678
TEIQue Well-being	5.29	0.96	0.636	0.609
TEIQue Sociability	4.21	0.69	0.123	0.244

Predictive Validity Using Original Scales

Correlation Analysis Between Demographics, EI, Driving Behaviors, and Behavior Outcomes

Tables 5.3 and 5.4 show Pearson and Spearman's correlation coefficients between demographics, EI (GENOS EI, TEIQue-SF), DDDI, and the number of crashes and citations.

GENOS EI and TEIQue-SF subscales were negatively correlated with driving behaviors, crashes, tickets, indicating that higher EI was associated with less dangerous driving behaviors. The TEIQue-SF subscales showed stronger correlations with driving behaviors than GENOS EI.

Using EI Subscales to Predict Dangerous Driving Behaviors

Several linear regressions were conducted to predict the DDDI subscales of risky, aggressive, and negative emotional driving using the TEIQue and GENOS EI subscales separately. As presented in Table 5.5, GENOS EI significantly predicted all dangerous driving behaviors. Similarly, Tables 5.6 and 5.7 show that TEIQue-SF total EI, emotionality, and self-control subscales significantly predicted all dangerous driving behaviors. Consistent with correlation analyses presented in Tables 5.3 and 5.4, regression results show that TEIQue-SF has a stronger association with dangerous driving behaviors than GENOS EI.

Table 5.3. Pearson's Correlations Between Demographics, Behaviors, and EI Scales.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
14. Age														
15. Sex	-0.118													
16. Geography	0.130	.192**												
17. Risky driving	-.258**	-.218**	-.331**											
18. Aggressive driving	-.261**	-.203**	-.307**	.930**										
19. Emotional driving	-.247**	-0.133	-.191**	.827**	.864**									
20. Crash at fault	-.145*	-.176*	-.171*	.559**	.536**	.443**								
21. Crash at others' fault	-.205**	-.226**	-.254**	.621**	.589**	.486**	.880**							
22. No of tickets	-.168*	-.260**	-.232**	.630**	.563**	.439**	.752**	.740**						
23. GENOS EI	.264**	0.017	0.036	**-.325****	**-.329****	**-.257****	**-.282****	**-.319****	**-.284****					
24. TEIQue Total EI	.286**	0.124	.172*	**-.616****	**-.610****	**-.473****	**-.498****	**-.529****	**-.511****	.713**				
25. Emotionality	.195**	.232**	.246**	**-.680****	**-.653****	**-.527****	**-.537****	**-.581****	**-.570****	.473**	.866**			
26. Self-control	.322**	0.084	0.053	**-.492****	**-.516****	**-.419****	**-.406****	**-.422****	**-.415****	.700**	.859**	.614**		
27. Well-being	.272**	-0.080	0.046	**-.291****	**-.289****	**-.176***	**-.235****	**-.251****	**-.220****	.720**	.738**	.385**	.686**	
28. Sociability	0.110	0.035	.142*	**-.455****	**-.450****	**-.351****	**-.400****	**-.376****	**-.421****	.411**	.749**	.676**	.519**	.391**

Note: Significance effects (* $p<0.05$; ** $p<0.01$) are in bold type face for emphasis

Table 5.4. Spearman's Correlations Between Demographics, Behaviors, and EI Scales.

	1	2	3	4	5	6	7	8	9	10	11	12		
1. Age														
2. Sex	-0.124													
3. Geography	0.134	.193**												
4. Risky driving	-.343**	-.156*	-.304**											
5. Aggressive driving	-.319**	-.170*	-.273**	.833**										
6. Emotional driving	-.288**	-0.064	-.152*	.785**	.780**									
7. Crash at fault	-.214**	-.152*	-.199**	.432**	.404**	.371**								
8. Crash at others' fault	-.251**	-.208**	-.303**	.475**	.463**	.386**	.794**	1.000						
9. No of tickets	-.219**	-.278**	-.262**	.489**	.483**	.379**	.673**	.610**						
10. GENOS EI	.281**	0.025	0.064	**-.335****	**-.345****	**-.239****	**-.334****	**-.348****	**-.311****					
11. TEIQue Total EI	.289**	0.114	.180**	**-.529****	**-.556****	**-.386****	**-.503****	**-.496****	**-.479****	.730**				
12. Emotionality	.216**	.170*	.211**	**-.515****	**-.520****	**-.410****	**-.439****	**-.479****	**-.449****	.531**	.863**	1.000		
13. Self-control	.327**	0.097	0.091	**-.519****	**-.580****	**-.407****	**-.457****	**-.425****	**-.434****	.714**	.873**	.672**		
14. Well-being	.287**	-0.082	0.067	**-.320****	**-.320****	**-.191****	**-.329****	**-.273****	**-.244****	.720**	.787**	.500**	.695**	
15. Sociability	0.111	0.031	.155*	**-.320****	**-.356****	**-.245****	**-.408****	**-.339****	**-.411****	.435**	.715**	.599**	.514**	.437**

Note: Significance effects (* $p<0.05$; ** $p<0.01$) are in bold type face for emphasis

Table 5.5. Linear Regression Analyses using GENOS EI.

Predicted variable	Predictor variable	R^2	F	Beta
Risky Driving	GENOS EI	10.1%	F (1,203) =23.86, (p<0.001)	-0.325**
Aggressive Driving	GENOS EI	10.8%	F (1,203) =24.44, (p<0.001)	-0.329**
Emotional Driving	GENOS EI	6.1%	F (1,203) =14.24, (p<0.001)	-0.257**

Note: ** p<0.01, *p<0.05

Table 5.6. Linear Regression Analyses using TEIQue Total EI.

Predicted variable	Predictor variable	R^2	F	Beta
Risky Driving	TEIQue Total EI	37.9%	F (1,203) =123.40, (p<0.001)	-0.616**
Aggressive Driving	TEIQue Total EI	37.2%	F (1,203) =119.76, (p<0.001)	-0.610**
Emotional Driving	TEIQue Total EI	22.4%	F (1,203) =58.35, (p<0.001)	-0.473**

Note: ** p<0.01, *p<0.05

Table 5.7. Linear Regression Analyses using TEIQue Subscales.

Predicted variable	Predictor variable	R^2	F	Beta
Risky Driving	Emotionality	47.3%	F (3,203) =59.84	-0.604**
	Self-control		(p<0.001)	-0.153
	Well-being			0.046
Aggressive Driving	Emotionality	44.4%	F (3,203) =55.00	-0.535**
	Self-control		(p<0.001)	-0.247**
	Well-being			0.087
Emotional Driving	Emotionality	31.0%	F (3,203) =29.92	-0.422**
	Self-control		(p<0.001)	-0.285**
	Well-being			0.182*

Note: ** p<0.01, *p<0.05

Exploratory Factor Analysis -GENOS EI

First EFA was conducted with the initial set of GENOS EI items using principal axis factoring (minimum loading >0.40) and oblique rotation (Promax with delta=0 and kappa= 4). The significance of EFA was confirmed by the KMO index (0.884) and Bartlett's test of sphericity ($\chi^2_{91, N=204} = 1215.69$, $p < 0.001$). The Kaiser criterion and scree test indicated a

two-factor structure, where the first factor had eight items and the second factor had six items. Table 5.8 presents the respective items in each factor with the factor loadings. The first factor (can be labeled as "Drivers' Anxiety") explained 30.37% of the total variance, and the second factor ("Drivers' Emotionality") explained 19.72%.

Table 5.8. Three-Factor Structure of GENOS EI.

GENOS Items	**Factors**	
	Anxiety	Emotionality
I understand the things that make people feel optimistic.	0.773	
I appropriately communicate decisions to the people important in my life.	0.726	
When upset while driving, I still think clearly.	0.716	
I am effective in helping others feel positive on the road.	0.697	
I effectively deal with things that annoy me while driving.	0.691	
I am aware of my mood state while driving.	0.682	
I consider the way other drivers may react to my driving decisions.	0.644	
When I get frustrated, I discuss my frustration appropriately.	0.595	
I fail to handle stressful situations while driving effectively.		0.784
I fail to recognize how my feelings influence my driving behaviors.		0.775
I have trouble finding the right words to express how I feel.		0.750
I find it difficult to identify the things that motivate others using the road (drivers, pedestrians, bicyclists, etc.).		0.677
I don't know what to do or say when drivers get upset.		0.642
I fail to keep calm in difficult driving situations.		0.642

Scale Reliability-GENOS EI

The internal consistency of each dimension was estimated by calculating Cronbach's alpha and McDonald's omega coefficients in the total sample. Table 5.9 shows the means, standard deviations, Cronbach's alpha, and McDonald's omega coefficients for anxiety and emotionality.

Table 5.9. Means, Standard Deviations, and Scales' Reliability.

	Mean	Standard deviations	Cronbach's alpha	McDonald's omega
Anxiety	28.96	6.51	0.879	0.879
Emotionality	21.28	5.84	0.860	0.861

Exploratory Factor Analysis -TEIQue-SF

An EFA was conducted with the initial set of TEIQue-SF items using principal axis factoring (minimum loading >0.40) and oblique rotation (Promax with delta=0 and kappa= 4). The significance of EFA was confirmed by the KMO index (0.920) and Bartlett's test of sphericity ($\chi^2_{435,\ N=204} = 4171.54$, $p < 0.001$). The Kaiser criterion and scree test indicated a two-factor structure, where the first factor had 16 items and the second factor had 13 items. Table 5.10 presents the respective items in each factor with the factor loadings. The first factor (labeled as "Drivers' Self-control") explained 32.78% of the total variance, and the second factor ("Drivers' Emotionality") explained 19.56%. One item (26) had to remove due to poor factor loadings.

Table 5.10. Three-Factor Structure of GENOS EI.

TEIQue Items	**Factors**	
	Emotionality	Self-esteem
On the whole, I have a gloomy feeling about driving.	0.891	
People who drive with me often complain that I don't treat other drivers right.	0.858	
I often find it difficult to adjust my driving to traffic and driving conditions.	0.848	
I normally find it difficult to stay motivated as a driver.	0.826	
I usually find it difficult to regulate my emotions while driving.	0.814	
I often find it difficult to care about other road users on the road with me.	0.812	
I tend to change my mind frequently while driving.	0.807	
I often find it difficult to see things from another driver's viewpoint.	0.782	
I tend to get involved in driving situations, which I wish I could have avoided.	0.766	
I generally don't find driving enjoyable.	0.764	
Many times, I can't figure out what emotion I'm feeling.	0.756	
I find it difficult to think that other road users are similar to me.	0.674	
I often find it difficult to assert myself in traffic.	0.644	
I often pause and think about my feelings while driving.	0.643	
Expressing my emotions while driving to other road users is not a problem for me.	0.526	

Table 5.10 Continued

I'm usually able to influence the behavior and feelings of other road users.	0.505	
I don't seem to have any influence over other road users.		
Generally, I'm able to adapt to different traffic and driving situations.		0.825
On the whole, I'm able to deal with driving-related stress.		0.772
On the whole, I'm pleased with my driving.		0.745
I can deal effectively with other drivers.		0.737
I generally believe that I am safe when I drive.		0.716
On the whole, I'm highly motivated to be a safe and courteous driver.		0.708
I feel that I have a number of good driving qualities.		0.704
I'm usually able to find ways to control my emotions while driving.		0.678
I would describe myself as good at resolving conflict with other road users.		0.610
I believe I'm better than the average driver.		0.593
Others admire me for being a relaxed driver.		0.581
I'm normally able to see things from another road user's perspective and experience their emotions.		0.515
I tend to "back down while driving" even if I know I have the right of way.		0.426

Scale Reliability-TEIQue-SF

The internal consistency of each dimension was estimated by calculating Cronbach's alpha and McDonald's omega coefficients in the total sample. Table 5.11 shows the means, standard deviations, Cronbach's alpha, and McDonald's omega coefficients for the TEIQue-SF.

Table 5.11. Means, Standard Deviations, and Scales' Reliability.

	Mean	Standard deviations	Cronbach's alpha	McDonald's omega
Emotionality	4.53	1.45	0.953	0.955
Self-esteem	5.09	0.77	0.788	0.844

Predictive Validity of New GENOS EI and TEIQue-SF

Correlation Analysis Between Demographics, EI, Driving Behaviors, and Behavior Outcomes

Tables 5.12 and 5.13 show Pearson and Spearman's correlation coefficients between demographics, new EI scales, DDDI, and the number of crashes and citations. GENOS emotionality and TEIQue-SF emotionality subscales were negatively correlated with driving behaviors. These results indicate that increasing drivers' emotionality is associated with less dangerous driving behaviors. The GENOS anxiety and TEIQue-SF self-esteem showed weak to no correlations with dangerous driving behaviors and crashes and citations.

Using EI Subscales to Predict Dangerous Driving Behaviors

Six separate linear regression analyses were conducted to predict the DDDI subscales of risky, aggressive, and negative emotional driving using the GENOS and TEIQue-sf emotionality subscales. As presented in Table 5.6, GENOS EI significantly predicted all dangerous driving behaviors. Similarly, Tables 5.14 and 5.15 show that TEIQue-SF total EI, emotionality, and self-control subscales significantly predicted all dangerous driving behaviors. Consistent with correlation analyses presented in Tables 5.12 and 5.13, regression results show that both emotionality scales have a robust association with dangerous driving behaviors.

Table 5.12. Pearson's Correlations Between Demographics, Behaviors, and EI Scales.

	1	2	3	4	5	6	7	8	9	10	11	12
1. Age												
2. Sex	-0.118											
3. Geography	0.130	.192**										
4. Risky driving	-.258**	-.218**	-.331**									
5. Aggressive driving	-.261**	-.203**	-.307**	.930**								
6. Emotional driving	-.247**	-0.133	-.191**	.827**	.864**							
7. Crash at fault	-.145*	-.176*	-.171*	.559**	.536**	.443**						
8. Crash at others' fault	-.205**	-.226**	-.254**	.621**	.589**	.486**	.880**					
9. No of tickets	-.168*	-.260**	-.232**	.630**	.563**	.439**	.752**	.740**				
10. GENOS Anxiety	0.090	-0.086	-.140*	.191**	.167*	.181**	0.097	0.113	0.088			
11. GENOS Emotionality	.259**	0.119	.206**	**-.656****	**-.634****	**-.552****	**-.493****	**-.561****	**-.484****	-.174*		
12. TEIQue Emotionality	.237**	.204**	.250**	**-.693****	**-.676****	**-.547****	**-.554****	**-.584****	**-.575****	-0.004	.764**	
13. TEIQue Self-esteem	.175*	-.172*	-.166*	0.073	0.048	0.099	0.045	0.030	0.068	.607**	0.037	-0.003

Note: Significance effects (* $p<0.05$; ** $p<0.01$) are in bold type face for emphasis

Table 5.13. Spearman's Correlations Between Demographics, Behaviors, and EI Scales.

	1	2	3	4	5	6	7	8	9	10	11	12
1. Age												
2. Sex	-0.124											
3. Geography	0.134	.193**										
4. Risky driving	-.343**	-.156*	-.304**									
5. Aggressive driving	-.319**	-.170*	-.273**	.833**								
6. Emotional driving	-.288**	-0.064	-.152*	.785**	.780**							
7. Crash at fault	-.214**	-.152*	-.199**	.432**	.404**	.371**						
8. Crash at others' fault	-.251**	-.208**	-.303**	.475**	.463**	.386**	.794**					
9. No of tickets	-.219**	-.278**	-.262**	.489**	.483**	.379**	.673**	.610**				
10. GENOS Anxiety	.144*	-0.131	-.155*	0.004	-0.016	0.036	0.047	0.060	0.055			
11. GENOS Emotionality	.293**	0.048	.166*	**-.474****	**-.451****	**-.398****	**-.394****	**-.463****	**-.356****	0.064		
12. TEIQue Emotionality	.266**	0.135	.216**	**-.549****	**-.566****	**-.439****	**-.465****	**-.476****	**-.455****	.164*	.672**	
13. TEIQue Self-esteem	.159*	-.186**	-.174*	-0.084	-0.107	-0.018	0.002	0.020	0.098	.631**	.200**	.202**

Note: Significance effects (* $p<0.05$; ** $p<0.01$) are in bold type face for emphasis

Table 5.14. Linear Regression Analyses using GENOS Emotionality.

Predicted variable	Predictor variable	R^2	F	Beta
Risky Driving	Emotionality	43.0%	F (1,203) =152.47, (p<0.001)	-0.656**
Aggressive Driving	Emotionality	40.2%	F (1,203) =135.68, (p<0.001)	-0.634**
Emotional Driving	Emotionality	30.4%	F (1,203) =88.35, (p<0.001)	-0.552**

Note: ** p<0.01, *p<0.05

Table 5.15. Linear Regression Analyses using TEIQue Total EI.

Predicted variable	Predictor variable	R^2	F	Beta
Risky Driving	Emotionality	48.0%	F (1,203) =186.41, (p<0.001)	-0.693**
Aggressive Driving	Emotionality	45.7%	F (1,203) =170.06, (p<0.001)	-0.676**
Emotional Driving	Emotionality	30.0%	F (1,203) =86.41, (p<0.001)	-0.547**

Note: ** p<0.01, *p<0.05

Discussion

Emotional intelligence has been found to be significantly correlated with dangerous driving behaviors. However, previous studies investigated driving behaviors using EI scales that were not specific to the driving context. The driving context is unique due to the multiple processing abilities that are required in order to be considered a safe driver. Therefore, to better understand the relationship between EI and driving behavior, it is necessary for the validity and reliability of future research to develop a more relevant measure of EI for the driving context. This pilot study's aim was to identify a usable valid measure to develop a reliable scale to assess drivers' emotional intelligence and appropriate methods for analysis.

After carefully reviewing different measures and previous correlations to the dangerous driving behaviors, this study considered the short version of the TEIQue and GENOS EI scales. This paper considered two different methodological approaches to assess which might be useful in developing the drivers' EI scale (DEIS). The first set of analyses used the original scale's scoring methods to calculate emotional intelligence scores and investigate dangerous driving behaviors. The correlational analyses showed that the TEIQue was more strongly associated with driving behaviors than the GENOS EI. In addition to the total EI score, the TEIQue emotionality and self-control subscales showed strong predictability of dangerous driving behaviors. These findings also indicate that using the TEIQue EI scale would be useful not only in investigating drivers' overall EI, but also other EI-related factors. It is important to note that the reworded EI scales using driving-related terms showed better correlations than their original form, indicating that changing the items wording was effective in achieving more valid results.

Furthermore, this paper considered the factor analysis approach to reveal the number of factors and which items fit the driving context better. The analysis for GENOS EI revealed a two-factor structure for GENOS EI can be labeled as anxiety and emotionality. First, the anxiety subscale measures a driver's optimism, communication, upset, self-esteem, and emotional awareness. In addition, the emotionality subscale measures a driver's empathy, emotion perception and expression, stress management, and use of emotion. The analysis for the TEIQue-SF revealed another two-factor structure for TEIQue EI which can be labeled as emotionality and self-esteem. The emotionality subscale measures a driver's empathy, emotional perception and expression, emotion regulation, motivation, assertiveness, and impulsiveness. Similarly, the self-esteem subscale measures a driver's competencies regarding emotional control, self-esteem,

empathy, and adaptability. Therefore, the analysis revealed highly applicable components of each scale for the driving context.

The internal consistency coefficients confirmed the reliability of each of the identified subscales, both GENOS and TEIQue. The predictive validity of these subscales was examined by analyzing correlations and regression outputs with risky, aggressive, and emotional driving. Only emotionality subscales from GENOS and TEIQue EI showed negative correlations with all dangerous driving behaviors and related adverse outcomes. The emotionality subscale, which considers significant items related to emotional recognition and expression, emotion regulation, and empathy, appears to be most predictive of risky driving behaviors. Increasing drivers' emotionality may significantly reduce drivers' risky, aggressive, and emotional driving and resultant crashes and citations.

Though GENOS EI shows some promising prospects in predicting drivers' behaviors, it has several limitations. The short version of GENOS EI has only a few facets of EI, and one item cannot explain a facet accurately. Moreover, it did not consider other important factors related to emotions such as impulsiveness, stress management, self-motivation, empathy, and adaptability (Petrides, 2009). In addition, Palmer et al. (2009) acknowledged the limitations that their scale was only designed for the workplace. In contrast, TEIQue-SF was designed for the general population, considered all-important facets, and found valid in predicting driving behaviors using original scoring and factor analysis methods.

Conclusion and Next Steps

This study aimed to identify EI measures for the driving context in order to develop an EI scale specific to traffic safety to analyze dangerous driving behaviors accurately. This research

concludes that a drivers' emotional intelligence scale (DEIS) should be adapted from the existing TEIQue-SF scale due to its broader aspects of emotional intelligence which are highly applicable to a driving context. In addition, this study used an exploratory factor analysis approach to identify possible factors from GENOS and TEIQue EI, which was not verified by a confirmatory factor analysis due to the small sample size. Future research should acquire a larger sample to use exploratory factor analysis to construct the scale and verify the construct using confirmatory factor analysis. Furthermore, this pilot study could not confirm the concurrent validity of the scale construction due to not incorporating additional EI measures. Future studies should include general emotional intelligence measures besides the reworded items to validate the construction of a new scale for the driving context. While the sample was representative of non-commercial drivers, the sample was not representative of all drivers on the road and did not consider all driving populations (e.g., commercial drivers); thus, results may need to be further validated. A large drivers' sample with balance age, gender, and different drivers' population should be considered to improve the analysis accuracy.

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CHAPTER SIX

DEVELOPING A SCALE TO ASSESS EMOTIONAL INTELLIGENCE IN THE CONTEXT OF DRIVING

Contribution of Authors and Co-Authors

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Developing a Scale to Assess Emotional Intelligence in the Context of Driving

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Developing a Scale to Assess Emotional Intelligence in the Context of Driving

Traffic fatalities have been identified as an important public health issue, and human factors have been shown to be a significant contributor to road crashes. Previous research has confirmed the relationship between emotional intelligence (EI) and dangerous driving behaviors. However, most of the emotional intelligence measures used in the driving context were designed to measure general EI, not specific to driving. Therefore, this study aimed to develop and validate a Drivers' Emotional Intelligence Scale (DEIS). The DEIS consists of 29 items that generate a total driver's EI score and three subscales labeled as emotionality, self-control, and anxiety. Psychometric properties showed the scale to be valid and reliable. Furthermore, predictive validity confirmed that the DEIS subscales have significant correlations with driving behaviors and related outcomes such as crashes and citations. The emotionality subscale was the most significant predictor of risky, aggressive, and emotional driving. Therefore, this study suggests using emotionality as the short form of Drivers' Emotional Intelligence (DEIS-SF). Future research and recommendations are discussed.

Introduction

Motor vehicle crashes are a significant public safety concern in the United States and globally. In the United States, vehicle crashes are one of the leading causes of death and injury. The National Highway Traffic Safety Administration reported that more than 2.7 million people were injured, and 36,096 people were killed by motor vehicle crashes in 2019 (NHTSA, 2020). Previous research has confirmed that dangerous driving behaviors -- aggressive driving, driving violations, and driving errors -- were significantly correlated with road crashes and fatalities (de Winter et al., 2018; Dula & Ballard, 2003; Iversen & Rundmo, 2004; Sümer, 2003). Drivers engage in dangerous driving because of psychological factors, such as their personality traits and emotions (Iversen & Rundmo, 2002; Ulleberg & Rundmo, 2003). Growing evidence in safety research suggests that drivers' emotions can particularly influence dangerous driving behaviors (Arnau-Sabates et al., 2012; Dula & Ballard, 2003). Thus, it is important to consider emotions and how they function in the driving context.

Emotions and Emotional Intelligence

Emotions can be influenced by a person's interaction with the environment (e.g., driving) (Lazarus & Lazarus, 1991). Previous research identified that individuals' emotional abilities, such as understanding and managing emotions, contribute to a person's social functioning (Denham et al., 2003; Eisenberg et al., 2000; Savage, 2002). The role of emotion in social functioning became popular through a theoretical framework of emotional intelligence (EI) (Mayer & Salovey, 1997; Salovey & Mayer, 1990). Mayer et al. (1990) defined emotional intelligence as understanding and differentiating between emotions and using this information to guide thoughts and behaviors. Their model encompasses four emotional abilities: perceiving,

understanding, managing, and using emotions. EI became a popular topic globally in 1995 when Danial Goleman reintroduced EI as a set of emotional competencies and skills through his best-selling book "Emotional Intelligence" (Goleman, 1995). Researchers have developed different models and measures of EI in the field of psychology, education, and management. There has been little to no research of models and measures of EI in traffic safety. This article describes the development of a driving-specific emotional intelligence measure.

Dimensions of Emotional Intelligence

At present, there are three types of EI models known as ability, trait, and mixed EI. However, the latter two are considered similar due to their self-reported assessment process and will be discussed as the mixed model to keep this review simple (Mayer, Salovey, et al., 2008). Ability EI, first introduced by Mayer et al. (1990), considered EI as a set of interrelated mental skills measured by a performance test (similar to an IQ test). An example of the ability EI measure is Mayer–Salovey–Caruso Emotional Intelligence Test (MSCEIT) which assesses an individual's ability to understand and manage emotions by a given set of emotional problems (Mayer et al., 2003). This measure evaluates participants' EI by comparing the response with experts or a normative sample. In contrast, mixed model EI, sometimes referred to as a personality or trait approach, combined different constructs, including emotional competencies and personality traits, and measured through a self-report inventory (O'Connor et al., 2019). Examples of mixed model measures are Bar-On Emotional Quotient Inventory (EQ-*i*) (Bar-On, 1997), Trait Emotional Intelligence Questionnaire (TEIQue) (Petrides & Furnham, 2001), Self-Report EI Test (SEIT) (Schutte et al., 1998), and Wong and Law Emotional Intelligence (WLEIS) (Wong & Law, 2002). However, the correlations between ability (MSCEIT) and mixed

EI measures (EQ-*i* and SEIT) have been found to be very low, indicating these two models' distinct characteristics yield different information about the same person (Brackett & Mayer, 2003). These findings lead to an argument about which measure is better or more accurate in measuring EI.

Measurement of Emotional Intelligence

The ability EI measures claimed to be better than the mixed model ones because they do not rely on participants' self-reporting. Instead, the ability EI measures focus on problem-solving skills and are not predisposed to participants' socially desirable responses (Mayer et al., 2000). However, others argued that self-report measures of EI have better utility as these scales were designed to assess 'typical performance' instead of 'maximal performance' (Gignac, 2010). Maximal performance of EI describes the highest level of emotional ability at a particular time (e.g., assessment time). Researchers argued that emotions could not be measured accurately at a specific time and there are no correct or incorrect ways of feeling, and thus experts' evaluations of emotions may not be the most reliable measure (Pérez et al., 2005). Furthermore, Petrides (2009) criticized that the ability measure (MSCEIT) had psychometric problems, and the scoring procedure was invalid given the shortcomings of factor analysis, correlation with other variables, and considering them into regression equations. In contrast, the fundamental limitation of mixed model measures is self-report procedures. However, self-report EI has been found less biased or less likely to be fake in personal development or research settings (O'Connor et al., 2019). While ability EI only focused on the cognitive aspect, mixed EI measures emotional self-efficacy and typical behaviors in an emotional situation, which made mixed EI more popular over ability EI. However, while over 30 EI measures are available based on different models, which measures

are more appropriate for measuring drivers' EI has not been identified. Furthermore, studies that consider EI in the driving context have not discussed why they picked one scale over the others. Though it is beyond the scope of this study to evaluate all measures in terms of validity and usability, this paper will highlight the suggestion of O'Connor et al. (2019).

Ability or Mixed EI

There are arguments regarding which EI measures better predict behaviors. However, in a review of different EI models and measures, O'Connor et al. (2019) suggested using the ability EI measures where an excellent theoretical understanding of emotions is needed, which is not the case for general drivers. Moreover, few reliable and valid ability tests are available, and those are hard to administer (e.g., MSCEIT). In contrast, mixed model measures have been found better at predicting behaviors, and there are many options available due to their rising popularity over the last few decades. Given the limitations of ability EI measures, multiple studies have investigated dangerous driving behaviors in the context of mixed EI measures (Ahmed et al., 2022; Arnau-Sabates et al., 2012; Falahi & Goudarzi, 2015; Hayley et al., 2017; Smorti et al., 2018). Those studies found that lower EI measured by mixed models is significantly related to more frequent dangerous driving behaviors. Similarly, mixed EI has also been associated with safety-related outcomes such as citations (Smorti et al., 2018). However, the validity of the conclusion that EI is related to dangerous driving and traffic safety outcomes depends on the validity of the measures used to assess EI in the driving context. Previous research investigating dangerous driving has relied on EI scales not designed for the road safety context. The scales used in some of those studies remain questionable. For example, two studies used mixed EI scales designed for the workplace (e.g., GENOS), found weak correlations with driving behaviors, and no

justifications were given for using them (Falahi & Goudarzi, 2015; Hayley et al., 2017). Therefore, we suggest that workplace, leadership, and management-related EI scales should not be considered in developing a drivers-specific EI scale.

Trait EI Scales

Though many mixed EI scales were focused on the workplace, there are other aims for general use. O'Connor et al. (2019) explicitly emphasized choosing the trait theory based mixed EI measures (e.g., TEIQue) if the research aims to assess emotional self-efficacy and behavioral tendencies. In particular, trait EI has been found to be associated with adaptive coping styles (e.g., driving, job) and deviant behaviors (Austin et al., 2010; Petrides et al., 2004; Petrides et al., 2007). Furthermore, there are many choices of EI scales based on trait theory that has been used in a wide range of research, including psychology, social science, workplace, and organizational behaviors (Petrides, 2009). In this article, we will discuss the most renowned trait EI measures: SEIS (Schutte et al., 1998), Bar-On EQ-*i* (Bar-On, 1997), Trait Meta-Mode Scale (TMSS) (Salovey et al., 1995), and TEIQue (Petrides & Furnham, 2001). SEIS is a 33 items inventory that assesses three dimensions of EI: appraisal and expression of emotions, regulation of emotion, and use of emotion. Other researchers scrutinized the psychometric properties of SEIS due to inconsistent and unclear factor structure (Austin et al., 2004; Saklofske et al., 2003). Moreover, many researchers debated the legitimacy of SEIS in the trait EI domain as this scale was developed based on the ability model of EI proposed by Salovey and Mayer (1990). Similarly, EQ-*i* was a commercially successful trait EI measure consisting of 133 items to measure 15 subscales and five factors of EI. Though the EQ-*i* scale was applied to many psychological and social research, including the driving context (Arnau-Sabates et al., 2012), this

measure was also criticized in different articles. For example, Pérez et al. (2005) stated that the EQ-*i* scale was based on a well-being inventory that included many irrelevant facets, such as problem-solving, reality testing, and independence; while ignoring other important factors, including emotion perception, emotion expression, and emotion regulation (Pérez et al., 2005). Another common trait EI measure was TMSS comprises 30 items to produce emotional attention, emotional regulation, and emotional clarity. TMSS was also criticized for not considering the complete trait EI sampling domain and overlooked many core facets (Pérez et al., 2005). Moreover, this scale was not designed to produce a total EI score that should be considered for data analysis and interpretation (Salovey et al., 1995). With the limitations of TMSS, a recent study proposed an EI scale for young drivers based on the TMMS (Belastegi-Axpe et al., 2020). However, the authors did not explain why they used TMMS instead of other validated trait EI measures but acknowledged the limitation of the sample, which impugned the validity of this scale.

TEIQue

Given the limitations of other trait EI measures, researchers identified TEIQue as an excellent measure assessing four factors (emotionality, self-control, well-being, and sociability) and 15 facets of EI (O'Connor et al., 2019). Petrides and Furnham (2001) provided a solid theoretical framework in developing TEIQue, which has been accepted by the pioneer researchers in this field. The sampling domain of TEIQue EI included the core facets common in more than one EI measure and excluded elements identified in a single measure. As a result, the reliability and validity of the TEIQue scale were evident in many studies, and it is free to use for research purposes (Andrei et al., 2016). Furthermore, Cooper and Petrides (2010) developed a

short version of TEIQue (known as TEIQue-SF) with 30 items from the core 15 facets that showed incremental validity in interdisciplinary research (Cooper & Petrides, 2010). This short form of TEIQue measures total EI and four factors (similar to the full scale) and is easy to administrate in any survey setting. Nevertheless, the TEIQue scale has shown predicting validity in assessing dangerous driving behaviors and drivers caused adverse road safety occurrences (Ahmed et al., 2022; Smorti et al., 2018). TEIQue-SF could be an emerging tool in developing an emotional intelligence scale in the driving safety context.

Research Objectives

This study acknowledged the need for an EI measure in the context of drivers to better assess their emotional intelligence. Thus, we aim to develop a drivers' EI scale using TEIQue-SF, considering the validity and reliability in predicting behaviors (O'Connor et al., 2019). Notably, this study incorporates a driver's sample consisting of a balanced age and gender distribution, an inclusive driving population (commercial and non-commercial), and representation of a large geographical area (U.S. urban and rural). Moreover, this study not only develops the DEIS scale but also validates the scale's use in predicting drivers' dangerous behaviors. In so doing, this tool may help inform new methods of traffic safety intervention intended to reduce dangerous driving related to extreme emotions.

Materials and Methods

Development of DEIS

The drivers' EI scale (DEIS) was based on the TEIQue scale short form (30 items) (Petrides, 2009) that was found to be highly related to dangerous driving behaviors and related adverse

outcomes in previous studies (Ahmed et al., 2022; Smorti et al., 2018). To adapt the TEIQue-SF to the driving context, three behavior analysts, specialized in the area of social and emotional skills with knowledge and experience in the different aspects of survey item construction, developed the first set of items for the drivers' EI scale (DEIS). For example, the item "Others admire me for being relaxed" was changed to "Others would describe me as an anxious driver" (reverse scored).

A pilot study (N=150) with the first set of questions was conducted to evaluate participants' understanding of the items. The face validity and predictive validity of the items were analyzed, and the final set of questions was developed by the experts. In addition, 17 out of 30 questions were reverse coded to ensure consistent answers. Participants responded to all 30 questions using a seven-point Likert scale with options ranging from 1 (strongly disagree) to 7 (strongly agree). The original and final reworded items are shown in Appendix 1.

Participants

The Institutional Review Board (IRB) at Montana State University provided ethical clearance for the study prior to data collection. A total of 1800 U.S. drivers ages 18-80 (M = 49.55 years, SD = 17.71 years) participated in the study between May 28 and June 14, 2021. Only drivers with a valid license who drove their vehicles every day or most days were able to participate in the survey and received a small incentive. The random sample comprised 11.3% young drivers (ages 18-26), 50.8% female, and 19.0% from rural U.S. areas. The gender, age, and geography distributions were representative of the U.S. In addition, 11.2% of drivers held a commercial driver's license and drove for work purposes, which was higher than the national trend. Table 6.1 summarizes the demographics of the respondents.

Design and Procedure

This study's data were collected using a paid panel of respondents from Qualtrics, a private U.S.-based company that provides survey services. Participants completed the anonymous web-based survey consisting of demographic information (age, gender, geographical location, education, marital status, and language), general driving history (e.g., miles driven, crashes, and citations), the Drivers' Emotional Intelligence Scale (DEIS), Trait Emotional Intelligence Questionnaire (TEIQue-SF), Wong's Emotional Intelligence Scale (WEIS), and the Dula Dangerous Driving Index (DDDI). Participants were instructed to complete the survey within one sitting and to set aside enough time to complete all questions.

Validation Measures

To assess drivers' emotional intelligence, the TEIQue-SF and WEIS were used. The TEIQue-SF and WEIS were used to conduct a concurrent validity of the DEIS. Participants' dangerous driving behaviors were measured with the Dula Dangerous Driving Index (DDDI). The DDDI measure was used to analyze the predictive validity of the DEIS. The description of each scale is given below.

The Trait Emotional Intelligence Questionnaire (TEIQue)

The Trait Emotional Intelligence Questionnaire -- Short Form (TEIQue-SF) consists of 30 items developed from the original version of 151 items (Petrides, 2009). This scale considers a wide range of emotion-related attributes, which are applicable to a variety of research and applied contexts (e.g., educational, clinical, occupational, and organizational) (O'Connor et al., 2019). Participants were asked to select an answer on a seven-point Likert scale ranging from

completely disagree (1) to completely agree (7). The scale provided a total EI score along with scores on four factors.

(4) Emotionality (8 questions): Reflects an individual's ability to recognize and process emotions (e.g., "Many times, I cannot figure out what emotion I am feeling").

(5) Self-control (6 questions): Evaluates a person's ability to regulate their emotions and impulses (e.g., "I usually find it difficult to regulate my emotions").

(6) Sociability (6 questions): Emphasizes the individual's social interactions and impact on the community (e.g., "I can deal effectively with people").

(7) Well-being (6 questions): Measures an individual's satisfaction with life (e.g., "I generally do not find life enjoyable").

Wong's Emotional Intelligence Scale (WEIS)

The 16-item WEIS EI scale was designed to assess EI for leadership and management (Wong & Law, 2002). However, in the context of traffic safety, there is no published research. Participants answered each item on a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5).

(8) Regulation of Emotion (4 questions): Measures individuals' ability to manage their own emotions (e.g., "I am quite capable of controlling my own emotions").

(9) Self-Emotion Appraisal (4 questions): Measures individuals' ability to understand and express their own emotions (e.g., "I always know whether or not I am happy").

(10) Appraisal of Others' Emotions (4 questions): Assesses peoples' ability to perceive and understand the emotions of others (e.g., "I am sensitive to the feelings and emotions of others").

(11) Use of Emotion (4 questions): Measures individuals' ability to use their emotions effectively (e.g., "I always tell myself I am a competent person").

Dula Dangerous Driving Index (DDDI)

The Dula Dangerous Driving Index (DDDI) consists of 28 questions, rated on a five-point Likert scale (1=almost never, 5=almost always) (Dula & Ballard, 2003). Three subscales were generated from the questionnaire, and a low score on each subscale represents safe driving behaviors, whereas a high score represents dangerous driving behaviors.

(1) Risky Driving (12 questions, scores range from 12 to 60): This measures the willingness to engage in unsafe driving behavior (e.g., "I will race a slow-moving train to a railroad crossing").

(2) Negative Emotional Driving (9 questions, scores range from 9 to 45): This measures irritability and anger when driving and the tendency to become annoyed with other drivers (e.g., "Passengers in my car/truck tell me to calm down").

(3) Aggressive Driving (7 questions, scores range from 7 to 35): This assesses behaviors that are intentionally meant to annoy, irritate, or punish other drivers (e.g., "I would tailgate a driver who annoys me").

Statistical Analysis

The sample was divided into two sub-samples to cross-validate the DEIS items. The first set was labeled as exploratory and the other as confirmatory. The first sample ($N_{Exploratory}$= 900) was used to conduct an exploratory functional analysis (EFA) using principal axis factoring (minimum loading >0.40) and oblique rotation (Promax with delta=0 and kappa= 4) to investigate the factor structure of the DEIS items. The EFA significance was measured by the Kaiser-Meyer-Olkin (KMO) index and Bartlett's test of sphericity. In addition, the number of factors was determined according to the Kaiser criterion (eigenvalue greater than 1) and scree test (Kaiser, 1960).

The second subsample ($N_{Confirmatory}$ = 900) was used for confirmatory factor analysis (CFA). The CFA provides support for the construct validity of DEIS. Goodness-of-fit was assessed by means of the Tucker-Lewis index (TLI), the comparative fit index (CFI), the root mean square error of approximation (RMSEA), and standardized root mean square residuals (SRMR). A TLI around 0.90 (Whittaker, 2011) indicates the data were a good fit in the model, a CFI above 0.95 suggests the model fit is acceptable (Schermelleh-Engel et al., 2003), and an RMSEA less than 0.05 (Finch & West, 1997) suggests a good model fit.

In addition, we assessed the internal consistency of the DEIS by calculating Cronbach's alpha and McDonald's omega coefficients. The concurrent validity of DEIS was analyzed by conducting a Spearman's correlation with two other EI scales (TEIQue and WEIS). In addition, the predictive validity of DEIS in the driving context was assessed by analyzing the correlation and regression results with DDDI scores and self-reported crashes and citations.

Results

Exploratory Factor Analysis (EFA)

An EFA was conducted with the initial set of DEIS items using principal axis factoring (minimum loading >0.40) and oblique rotation (Promax with delta=0 and kappa= 4). The significance of EFA was confirmed by the KMO index (0.957) and Bartlett's test of sphericity ($\chi^2_{435,\ N=900} = 11{,}872.14$, $p < 0.001$). The Kaiser criterion and scree test indicated a three-factor structure, where the first factor had 12 items, the second factor had 11 items, and the third factor had six items. Table 6.2 presents the respective items in each factor with the factor loadings. The first factor (labeled as "Drivers' Self-control") explained 31.27% of the total variance, the second factor ("Drivers' Emotionality") explained 10.81%, and the third factor ("Drivers' Anxiety") explained 2.11%. One item ("I often pause and think about my feelings while driving") was removed from the scale due to weak commonality (0.29) and factor loadings.

Confirmatory Factor Analysis (CFA).

To test and confirm the three-factor structure obtained in the EFA, a CFA with maximum likelihood was conducted in the second subsample ($N_{Confirmatory} = 900$). The correlations between factors were as follows: (Self-control/Emotionality) = -0.60, (Self-control/Anxiety) =-0.54, and (Emotionality/Anxiety) =0.89. The goodness-of-fit indices indicated good model fit: $\chi^2/df = 2.62$ ($\chi^2_{372,\ N=900} = 973.47$; p=0.000), TLI = 0.94, CFI = 0.95, and RMSEA = 0.042 (90% CI = between 0.039 and 0.045). Therefore, the results confirm the construct validity of the three-factor structure.

Scale Reliability

The internal consistency of each dimension was estimated by calculating Cronbach's alpha and McDonald's omega coefficients in the total sample. Table 6.3 shows the means, standard deviations, Cronbach's alpha, and McDonald's omega coefficients for the DEIS (overall), as well as self-control, emotionality, and anxiety subscales.

Concurrent Validity

Correlation Analysis Between DEIS, TEIQue, and WLEIS

Spearman's correlation coefficients between the DEIS, WEIS, and TEIQue EI are presented in Table 6.4. The DEIS subscales are significantly correlated to the TEIQue and WEIS EI subscales, which concurrently validates the scale construction. Only the WEIS subscales of regulation of emotions and use of emotions showed moderate correlations (0.24 and 0.39) with the DEIS subscale of anxiety, which is also significant. It is noteworthy that all DEIS items were reworded from TEIQue, and thus significant correlations exist between these two scales as expected.

Predictive Validity

Correlation Analysis Between DEIS, Driving Behaviors, and Behavior Outcomes

Table 6.5 shows Spearman's correlation coefficients between DEIS, DDDI, and the number of crashes and citations. DEIS subscales were negatively correlated with driving behaviors, indicating that increasing EI was associated with less dangerous driving behaviors. The DEIS showed strong correlations with driving behaviors and moderate to weak correlations with crashes and citations.

Using DEIS EI Subscales to Predict Dangerous Driving Behaviors

Three multiple linear regressions were conducted to predict the DDDI subscales of risky, aggressive, and negative emotional driving using the three DEIS subscales. As presented in Table 6.6, the emotionality and self-control subscales of the DEIS predicted all dangerous driving behaviors significantly, while anxiety predicted only emotional driving.

Using the DEIS to Predict Behavior Outcomes: Crashes and Citations

To determine the contribution of DEIS to dangerous driving related outcomes, three hierarchical logistical regressions were performed. The outcome variables were dichotomized (0= no crashes or no citations, 1= at least one crash or citation) due to their highly skewed distributions, presented in Table 6.7.

As presented in Table 6.8, emotionality appeared as the most significant predictor for active crashes ($\chi 2 = 113.94$, $p<0.001$), passive crashes ($\chi 2 = 98.04$, $p<0.001$), and citations ($\chi 2 = 179.17$, $p<0.001$). The odds ratios showed that a one point increase of emotionality (e.g., score increased from 3 to 4) would decrease the odds of having active crashes by 53.6%, passive crashes by 42.9%, and citations by 61.6%. Moreover, the self-control subscale predicted the number of citations ($\chi 2 = 179.17$, $p<0.001$). The results revealed that a one point increase in drivers' self-control would decrease the odds of having citations by 21.2%. The anxiety subscale failed to predict any behavior-related outcomes.

Discussion

Emotional intelligence has been found to be significantly correlated with dangerous driving behaviors. However, previous studies investigated driving behaviors using EI scales not

specific to the driving context. Therefore, to better understand the relationship between EI and driving behavior, it is necessary to develop a more relevant measure of EI for the driving context. The present study is aimed to develop a reliable scale to measure drivers' emotional intelligence (DEIS) and validate it with driving behaviors and outcomes.

The DEIS inventory is a 29-item self-report measure based on the Trait Emotional Intelligence Questionnaire-Short Form (TEIQue-SF). Factor analysis revealed a three-factor structure labeled as emotionality, self-control, and anxiety. First, the emotionality subscale measures a driver's empathy, emotion perception, emotion regulation, and impulsiveness. In addition, the self-control subscale measures a driver's competencies regarding emotional control, ability to manage stress, self-esteem related to driving, and adaptability. Finally, the anxiety subscale measures a driver's anxiousness, lack of assertiveness, and lack of happiness on the road.

The internal reliability coefficients confirmed the reliability of each of the DEIS subscales. External validity was examined by analyzing correlation coefficients between the three DEIS subscales and the original TEIQue-SF and Wong EI subscales. The results supported the validity of the DEIS as the correlation was high with the TEIQue-SF and the WEIS EI. Furthermore, the predictive validity of the DEIS was examined by analyzing correlations and regression outputs with risky, aggressive, and emotional driving as well as crashes and citations. All DEIS subscales showed negative correlations with all dangerous driving behaviors and related adverse outcomes. Increasing drivers' emotionality and self-control may significantly reduce drivers' risky, aggressive, and emotional driving as well as crashes and citations. In other words, drivers who recognize and express their emotions can control their emotions, have

empathy toward other drivers, are less impulsive, believe in their driving abilities, and may engage in less risky, aggressive, or emotional driving, which may result in fewer crashes and citations. In addition, drivers who better understand their driving anxiety may be less likely to engage in emotional driving. The emotionality subscale appears to be most predictive of risky driving and negative outcomes. Therefore, this study suggests using the emotionality subscale as a short version of the DEIS to explore and explain drivers' dangerous behaviors.

To date, only one previous study has developed an EI scale for drivers; however, it had several limitations (Belastegi-Axpe et al., 2020). The items used appeared repetitive (e.g., "I pay attention to the emotions I feel while driving" and "I pay attention to my emotions and mood before and while driving") and unrelated to driving. Moreover, it appeared to use only a few constructs of EI (e.g., emotion perception, emotion regulation) rather than considering other important factors related to emotions (e.g., impulsiveness, stress management, self-motivation, empathy, and adaptability) (Petrides, 2009). In addition, Belastegi-Axpe et al. (2020) acknowledged their sample limitations given that the study used no adult drivers, did not consider commercial and non-commercial populations and used a sample from a small geographical area. Moreover, the authors did not provide any predictive validity of their scale, and no other study established the validity of this scale in the driving context. The present study addressed all these limitations and aimed to develop a drivers' EI scale (DEIS) using all EI related components found related to driving behaviors.

Limitations and Future Direction

The present study's findings need to be considered under some methodological limitations. First, the self-reported measures used in this study may have influenced participants

to report socially desirable responses. However, because this study used survey items related to driving behaviors, the social desirability bias was not as strong (Reimer et al., 2006; Sullman & Taylor, 2010). Second, the risky and aggressive driving subscales showed a highly skewed response (most reported safe behaviors), which could influence the predictive validity results, but Spearman's correlation was used as a non-parametric test to confirm the correlation, which does not depend on data distribution. Moreover, the analyses used in this study were correlational and could not establish a causal link between emotional intelligence and these behaviors and outcomes. Future research should try to establish causality through experimental designs that best isolate emotional intelligence as the sole variable affecting dangerous driving. In addition, the sample was highly represented by non-commercial drivers (90%), thus results may not be representative of the commercial population. Therefore, this study suggests validating this DEIS scale with different dangerous driving measures and actual driving behaviors specific to high-risk populations.

Conclusion and Recommendations

A drivers' emotional intelligence scale (DEIS) has been adapted from the existing TEIQue scale for the driving context. Using a sample of drivers from across the U.S., the DEIS predicted risky, aggressive, and emotional driving and involvement in crashes (both at fault and no-fault) and citations. The associations found between emotional intelligence and behaviors and outcomes were meaningful, indicating that strategies seeking to reduce traffic-related serious injuries and fatalities may benefit from growing emotional intelligence among drivers. The three subscales of the DEIS considered not only basic emotions but also incorporated other emotion-

related personality traits, which better explain driving behaviors. This study recommends the following steps:

(1) Continue to gather evidence about the association between emotional intelligence and traffic safety through experimental design.
(2) Identify opportunities to test interventions designed to grow emotional intelligence and improve traffic safety.
(3) Begin to educate appropriate stakeholders about the association between emotional intelligence and traffic safety.

Disclosure statement

The authors declare that the study was conducted in the absence of any financial relationships that could be seen as a potential conflict of interest.

Data availability statement

All relevant data are reported within the paper and are available from the corresponding author upon reasonable request.

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Appendices

Appendix 1

Original TEIQue Items and Reworded Items for DEIS

TEIQue-SF	DEIS
Expressing my emotions with words is not a problem for me. (TEIQue-SF_1)	Managing my emotions while driving is not a problem for me. (TEIQue_1_EM)
I often find it difficult to see things from another person's viewpoint. (TEIQue-SF_2)	I often find it difficult to see things from another driver's viewpoint. (TEIQue_2_EM)
On the whole, I'm a highly motivated person. (TEIQue-SF_3)	On the whole, I'm highly motivated to be a safe and courteous driver. (TEIQue_3)
I usually find it difficult to regulate my emotions. (TEIQue-SF_4)	I usually find it difficult to regulate my emotions while driving. (TEIQue_4_SC)
I generally don't find life enjoyable. (TEIQue-SF_5)	I generally don't find driving enjoyable. (TEIQue_5_WB)
I can deal effectively with people. (TEIQue-SF_6)	I cooperate effectively with other drivers. (TEIQue_6_SO)
I tend to change my mind frequently. (TEIQue-SF_7)	I tend to change my mind frequently while driving. (TEIQue_7_SC)
Many times, I can't figure out what emotion I'm feeling. (TEIQue-SF_8)	Many times, I can't figure out what emotion I'm feeling. (TEIQue_8_EM)
I feel that I have a number of good qualities. (TEIQue-SF_9)	I feel that I have a number of good driving qualities. (TEIQue_9_WB)
I often find it difficult to stand up for my rights. (TEIQue-SF_10)	I often find it difficult to assert myself in traffic. (TEIQue_10_SO)
I'm usually able to influence the way other people feel. (TEIQue-SF_11)	I'm usually able to influence the behavior and feelings of other road users. (TEIQue_11_SO)
On the whole, I have a gloomy perspective on most things. (TEIQue-SF_12)	On the whole, I have a gloomy feeling about driving. (TEIQue_12_WB)
Those close to me often complain that I don't treat them right. (TEIQue-SF_13)	People who drive with me often complain that I don't treat other drivers right. (TEIQue_13_EM)
I often find it difficult to adjust my life according to the circumstances. (TEIQue-SF_14)	I often find it difficult to adjust my driving to traffic and driving conditions. (TEIQue_14)
On the whole, I'm able to deal with stress. (TEIQue-SF_15)	On the whole, I'm able to deal with driving-related stress. (TEIQue_15_SC)

I often find it difficult to show my affection to those close to me. (TEIQue-SF_16)	I often find it difficult to care about other road users on the road with me. (TEIQue_16_EM)
I'm normally able to "get into someone's shoes" and experience their emotions. (TEIQue-SF_17)	I'm usually able to see things from another road user's perspective. (TEIQue_17_EM)
I normally find it difficult to keep myself motivated. (TEIQue-SF_18)	I normally find it difficult to stay motivated as a driver. (TEIQue_18)
I'm usually able to find ways to control my emotions when I want to. (TEIQue-SF_19)	I'm usually able to find ways to control my emotions while driving. (TEIQue_19_SC)
On the whole, I'm pleased with my life. (TEIQue-SF_20)	On the whole, I'm pleased with my driving. (TEIQue_20_WB)
I would describe myself as a good negotiator. (TEIQue-SF_21)	I would describe myself as good at resolving conflict with other road users. (TEIQue_21_SO)
I tend to get involved in things I later wish I could get out of. (TEIQue-SF_22)	I tend to get involved in driving situations, which I wish I could have avoided. (TEIQue_22_SC)
I often pause and think about my feelings. (TEIQue-SF_23)	I often pause and think about my feelings while driving. (TEIQue_23_EM)
I believe I'm full of personal strengths. (TEIQue-SF_24)	I understand my strengths and weaknesses as a driver very well. (TEIQue_24_WB)
I tend to "back down" even if I know I'm right. (TEIQue-SF_25)	I tend to get intimidated by stressful driving situations. (TEIQue_25_SO)
I don't seem to have any power at all over other people's feelings. (TEIQue-SF_26)	I worry that other drivers get upset with me. (TEIQue_26_SO)
I generally believe that things will work out fine in my life. (TEIQue-SF_27)	I generally believe that I am safe when I drive. (TEIQue_27_WB)
I find it difficult to bond well even with those close to me. (TEIQue-SF_28)	I find it difficult to think that other road users are similar to me. (TEIQue_28_EM)
Generally, I'm able to adapt to new environments. (TEIQue-SF_29)	Generally, I'm able to adapt to different traffic and driving situations. (TEIQue_29)
Others admire me for being relaxed. (TEIQue-SF_30)	Others would describe me as an anxious driver. (TEIQue_30_SC)

Table 6.1. *Demographics of Respondents.*

Sex		Age		Geography		License Type	
Male	884	18-26	203	Urban	558	Commercial	196
Female	914	27-80	1597	Rural	1241	Non-Commercial	1558

Table 6.2. *Three-Factor Structure of DEIS.*

DEIS Items	Factor		
	Self-control	Emotionality	Anxiety
1. On the whole, I'm highly motivated to be a safe and courteous driver.	0.760		
2. I feel that I have a number of good driving qualities.	0.757		
3. I'm usually able to find ways to control my emotions while driving.	0.719		
4. Generally, I'm able to adapt to different traffic and driving situations.	0.716		
5. On the whole, I'm able to deal with driving-related stress.	0.707		
6. On the whole, I'm pleased with my driving.	0.700		
7. I cooperate effectively with other drivers.	0.699		
8. I generally believe that I am safe when I drive.	0.662		
9. I would describe myself as good at resolving conflict with other road users.	0.649		
10. I'm usually able to see things from another road user's perspective.	0.648		
11. I understand my strengths and weaknesses as a driver very well.	0.625		
12. Managing my emotions while driving is not a problem for me.	0.547		
13. People who drive with me often complain that I don't treat other drivers right.		0.747	
14. I often find it difficult to care about other road users on the road with me.		0.706	
15. I tend to get involved in driving situations, which I wish I could have avoided.		0.630	
16. I usually find it difficult to regulate my emotions while driving.		0.604	
17. I often find it difficult to see things from another driver's viewpoint.		0.598	
18. I'm usually able to influence the behavior and feelings of other road users.		0.579	
19. I tend to change my mind frequently while driving.		0.543	
20. I find it difficult to think that other road users are similar to me.		0.518	
21. I often find it difficult to adjust my driving to traffic and driving conditions.		0.499	

Table 6.2 Continued

DEIS Items	Factor		
	Self-control	Emotionality	Anxiety
22. Many times, I can't figure out what emotion I'm feeling.		0.492	
23. I normally find it difficult to stay motivated as a driver.		0.432	
24. I often pause and think about my feelings while driving.			
25. I tend to get intimidated by stressful driving situations.			0.674
26. I generally don't find driving enjoyable.			0.584
27. I worry that other drivers get upset with me.			0.556
28. I often find it difficult to assert myself in traffic.			0.546
29. Others would describe me as an anxious driver.			0.528
30. On the whole, I have a gloomy feeling about driving.			0.455

Table 6.3. *Means, Standard Deviations, and Scales' Reliability.*

	Mean	Standard deviations	Cronbach's alpha	McDonald's omega
DEIS EI	5.31	0.81	0.922	0.925
DEIS Emotionality	5.16	0.94	0.830	0.859
DEIS Self-control	5.55	0.86	0.901	0.901
DEIS Anxiety	5.09	1.19	0.826	0.828

Table 6.4. *Spearman's Correlation Between DEIS, TEIQue, and WLEIS.*

	DEIS Total EI	DEIS Emotionality	DEIS Self-control	DEIS Anxiety
TEIQue Total EI	0.78**	0.70**	0.66**	0.64**
TEIQue Emotionality	0.68**	0.67**	0.57**	0.52**
TEIQue Self-control	0.74**	0.66**	0.62**	0.62**
TEIQue Well-being	0.68**	0.58**	0.62**	0.55**
TEIQue Sociability	0.58**	0.50**	0.48**	0.53**
WEIS Total EI	0.58**	0.48**	0.61**	0.43**
WEIS Self emotional appraisal	0.55**	0.46**	0.57**	0.42**
WEIS Regulation of emotions	0.40**	0.36**	0.45**	0.24**
WEIS Use of emotions	0.51**	0.40**	0.54**	0.39**
WEIS Others' emotional appraisal	0.54**	0.45**	0.56**	0.43**

Note: **p< 0.01

Table 6.5. *Spearman's Correlation Between DEIS, Behaviors, and Outcomes.*

	DEIS EI	DEIS Emotionality	DEIS Self-control	DEIS Anxiety
Risky Driving	-0.42**	-0.43**	-0.31**	-0.30**
Aggressive Driving	-0.44**	-0.43**	-0.36**	-0.32**
Emotional Driving	-0.40**	-0.40**	-0.31**	-0.35**
Crash Fault	-0.23**	-0.23**	-0.14**	-0.19**
Crash Not Fault	-0.19**	-0.21**	-0.09**	-0.19**
Tickets	-0.28**	-0.29**	-0.18**	-0.21**

Note: **p< 0.01

Table 6.6. *Summary of Linear Regression Analyses.*

Predicted variable	Predictor variable	R^2	F	Beta
Risky Driving	Emotionality	29.0%	F (3,1796)	-0.523**
	Self-control		=244.87	-0.035**
	Anxiety		(p<0.001)	0.004
Aggressive Driving	Emotionality	26.8%	F (3,1796)	-0.453**
	Self-control		=219.30	-0.103**
	Anxiety		(p<0.001)	-0.005
Negative Emotional Driving	Emotionality	19.6%	F (3,1796)	-0.340**
	Self-control		=146.25	-0.056*
	Anxiety		(p<0.001)	-0.091**

Note: ** p<0.01, *p<0.05

Table 6.7. *Summary of Reported Crashes and Citations.*

Active Crashes (i.e., at fault)		Passive Crashes (i.e., not at fault)		Citations	
No crashes	90.9%	No crashes	84.9%	No citations	86.5%
1 or more crashes	9.1%	1 or more crashes	15.1%	1 citation	13.5%

Table 6.8. *Summary of Logistic Regression Analyses.*

Predicted variable	Predictors	R^2	B	Odds
Active crashes (Crashes own fault-Yes vs No)	Emotionality	13.5%	-0.767**	0.464
	Self-control		-0.085	0.919
	Anxiety		-0.081	0.922
Passive crashes (Crashes at others fault-Yes vs. No)	Emotionality	9.3%	-0.560**	0.571
	Self-control		0.117	1.124
	Anxiety		-0.144	0.866
Citations (Citations Yes vs. No)	Emotionality	17.3%	-0.958**	0.384
	Self-control		-0.239**	0.788
	Anxiety		0.111	1.118

Note: (R^2 change) * $p<0.05$; ** $p<0.01$

CHAPTER SEVEN

GENERAL DISCUSSION

Introductory Comments

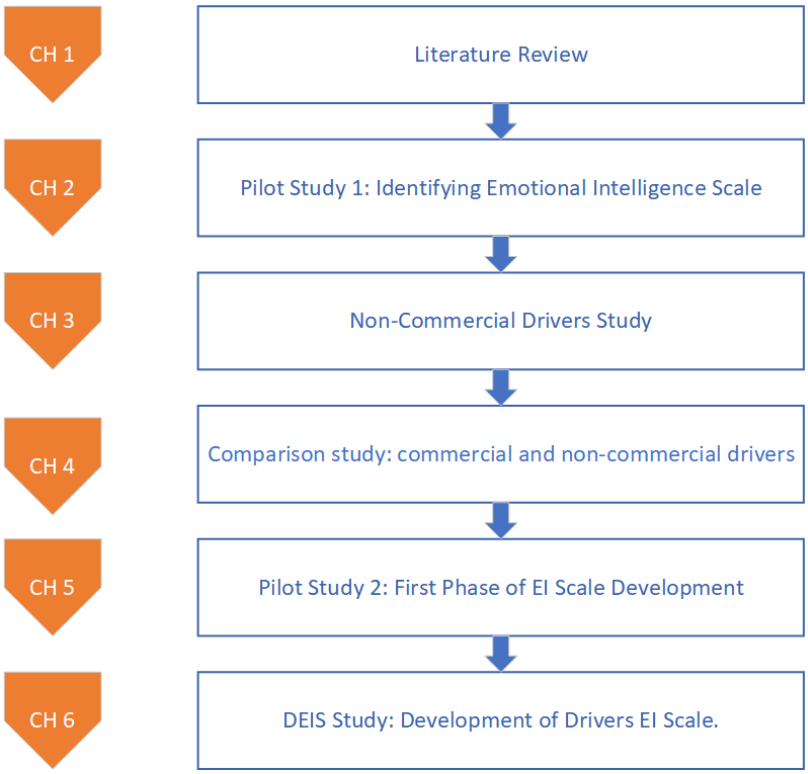
Emotional Intelligence (EI) theory provides a framework for understanding how an individual's emotional skills can influence their behaviors, decision making, and interactions with others. It is a concept that has been applied in many social and psychological fields. However, in the field of traffic safety, its application has been limited. This dissertation explored how emotional intelligence can be a useful framework for understanding drivers' dangerous behaviors and how it could be utilized to improve road safety.

The research reported in this dissertation had three objectives:

1. Identify the most appropriate measure of emotional intelligence for the driving context.
2. Examine the correlations between emotional intelligence and dangerous driving behaviors in different risk exposure groups (commercial and non-commercial drivers).
3. Develop an emotional intelligence measure specific to the context of driving.

These objectives have been investigated through several studies and reported through the chapters of this dissertation. The flow chart in Figure 7.3 gives an overview of how the dissertation was outlined. This final chapter comprises an overall discussion of the findings reported in those chapters. The strengths and limitations of the research will also be discussed. In addition, the practical and methodological implications of the research findings will then be addressed, and future research endeavors suggested.

Figure 7.1: Flow Chart of Dissertation



Objective One: Identify the most appropriate measure of emotional intelligence for the driving context.

It was challenging to select appropriate measures of emotional intelligence from the more than 30 available measures, as no clear guidance was available for the context of traffic safety. While previous studies used different EI scales (e.g., GENOS, the Trait Emotional Intelligence Questionnaire (TEIQue), EQ-i, and Brad Berry-Greaves EI) to understand dangerous driving behaviors, none explained why they chose one measure over the others. Therefore, this research explored different models and measures of emotional intelligence to understand which could be appropriate in predicting driving behaviors. In the review process, scales from each model were

considered based on their validity and reliability, as well as their previous use in traffic safety or behavioral contexts. The pilot study's final EI measures consisted of TEIQue, GENOS EI, and Wong and Law EI. Ultimately, that study's results suggested that only one measure -- TEIQue -- was significantly and consistently correlated to the self-reported driving behaviors, as well as reliable and valid in measuring emotional intelligence.

Objective Two: Examine the correlations between emotional intelligence and dangerous driving behaviors in different risk exposure groups (commercial and non-commercial drivers).

After determining the measures and methods in the pilot study, this research investigated the relationship between emotional intelligence and dangerous driving behaviors among commercial and non-commercial drivers to understand the disproportionate representation of commercial drivers in crash fatalities. The results from Chapter 3 and Chapter 4 showed higher EI scores related to less dangerous driving behaviors for commercial and non-commercial drivers. Furthermore, regression analyses in Chapter 4 revealed that the total EI score had a strong negative association with all dangerous driving behaviors for both types of drivers. However, the relationship between EI and dangerous driving was significantly stronger among commercial drivers compared to their non-commercial counterparts. Commercial drivers reported more dangerous driving behaviors and lower EI scores than non-commercial drivers. These results imply that commercial drivers' lower EI was related to their higher levels of dangerous driving behaviors, and non-commercial drivers' higher EI was related to their lower levels of dangerous driving behaviors.

Objective Three: Develop an emotional intelligence measure in the context of driving.

To better understand the relationship between EI and driving behaviors, it was necessary to develop an EI measure specific to the driving context. This research conducted a pilot study to identify EI measures for the driving context. One EI measure was identified, which was necessary to develop an EI scale specific to traffic safety in order to analyze dangerous driving behaviors accurately. Correlational and Factor Analysis reported in Chapter Five revealed that the TEIQue-SF has a stronger ability in assessing drivers' EI and predicting their dangerous behaviors than the GENOS EI. Using TEIQue-SF, this research developed the Drivers' Emotional Intelligence (DEIS) and then validated it with dangerous driving behaviors. As reported in Chapter Six, The DEIS inventory is a 29-item self-report measure that produced a three-factor structure labeled as emotionality, self-control, and anxiety.

First, the emotionality subscale measures a driver's empathy, emotion perception, emotion regulation, and impulsiveness. The self-control subscale measures a driver's competencies regarding emotional control, stress management, self-esteem related to driving, and adaptability. Finally, the anxiety subscale measures a driver's anxiousness, lack of assertiveness, and lack of happiness on the road. The internal reliability coefficients confirmed the reliability of each of the DEIS subscales.

Furthermore, the predictive validity of the DEIS was examined by analyzing correlations and regression analysis with dangerous driving behaviors. All DEIS subscales showed negative correlations with risky, aggressive, and emotional driving. However, the emotionality subscale appears to be most predictive of risky driving behaviors. Therefore, this research suggests using the emotionality subscale as a short version of the DEIS to explore and explain drivers' dangerous behaviors.

Implications of the research

A comprehensive study of dangerous driving behaviors in the context of emotional intelligence was conducted through this research. The investigation would be useful if effective countermeasures could be developed and implemented to improve road safety. While this research acknowledges some dangerous driving behaviors are unintentional (e.g., mistakes or slips), the majority of them are intentional and can be modified (O'Connell, 2002). While many behavioral approaches, such as drivers' training and culture-related factors, had been considered to improve drivers' behaviors, emotional intelligence has never been considered in this context. The practical and methodological countermeasure of this research's findings is discussed below.

Countermeasure implications

There is growing recognition that drivers engaging in multiple dangerous driving behaviors – such as not using a seat belt, speeding, and driving impaired – may require more intensive interventions than are typically provided to drivers who are cited for any one of these dangerous behaviors in isolation. Research has recognized significant associations between emotional intelligence and multiple dangerous driving behaviors. While the association between emotional intelligence and various dangerous driving behaviors is established in the literature, there is limited understanding of how to improve emotional intelligence and the underlying beliefs and behaviors of individuals engaging in multiple dangerous driving behaviors.

This research found that emotional intelligence can significantly predict different dimensions of dangerous driving behaviors for commercial and non-commercial drivers. This study also found that emotional intelligence is more strongly associated with reducing commercial drivers' dangerous behaviors on the road compared to their non-commercial

counterparts. This research concludes that improving emotional intelligence through training and education will be useful to reduce unsafe and dangerous driving behaviors. These findings provide strong evidence for the need to incorporate emotional intelligence into dangerous driving behavior interventions for both driving groups and, more specifically, for commercial drivers to reduce their higher rates of fatalities on the road.

Emotional intelligence theories confirm that emotions are adaptive when emotion-related information can be perceived, understood, and managed effectively (Mayer et al., 1990; Salovey & Sluyter, 1997). Training and education can significantly improve emotional intelligence (Clarke, 2006; Ulleberg & Rundmo, 2003). The potential to strengthen current countermeasures such as incorporating emotional intelligence in drivers' education curriculums and licensing procedures may be helpful in improving drivers' behaviors on the road. In addition, parents as the main driving supervisors of teen drivers should also be educated by incorporating emotional intelligence in the driving context when drivers are learning road rules and safety. State-issued guides and brochures for parents to teach their teens to drive should incorporate sections specific to emotional intelligence and the link with dangerous driving behaviors. Furthermore, law enforcement agencies need to be trained in emotional intelligence in the road safety context to better understand and manage road user behaviors and emotions while driving that contribute to violations or crashes. However, the effectiveness of all these countermeasures (e.g., CDL training, drivers Ed) needs to be evaluated periodically through different studies and experiments. Furthermore, these evaluations could explain if and how the growth of EI is effective in reducing dangerous driving behaviors among different driving populations.

Considering commercial drivers' safety, this research suggests that commercial drivers' training and professional development should strongly consider emotional intelligence as a way to improve drivers' behaviors on the road. Commercial trucking and logistics companies (e.g., private trucking companies, UPS, FedEx) can also consider emotional intelligence assessment and training as part of their recruitment and promotion process. The new DEIS scale developed by this research can be a useful tool in the assessment process. Finally, and most importantly, this study suggests that state and federal administrations may want to promote safety campaigns based on emotional intelligence to increase safe driving awareness.

Methodological Implication

The main methodological implication of this research is to measure drivers' emotional intelligence to examine relationships and correlations between EI and driving behaviors. The drivers' emotional intelligence scale (DEIS) was developed through EFA of self-reported emotional and personality factors using a US nationwide sample. In addition, the scale was further validated through a CFA using a second set of samples who participated in the same study. As a result, the total drivers' EI and three subscales labeled as emotionality, self-control, and anxiety were found reliable. The DEIS was developed from the TEIQue scale, an established emotional intelligence measure found strongly associated with driving behaviors, and used a Likert scale response like that of the TEIQue. In addition, the relationship between subscale scores and dangerous driving behaviors was examined, and significant results were found. Therefore, this research suggests that the DEIS can be used in road safety research as well as for countermeasure development and evaluation. Moreover, the short version of the DEIS (the emotionality subscale) would be appropriate for researchers interested in small questionnaires.

However, while the DEIS appears to be a valid and reliable emotional intelligence instrument, further validation is required through different methods, including application to different populations (e.g., commercial drivers, teen drivers) and examination with actual driving behaviors.

Contributions

There are a number of strengths associated with this research. Unlike other studies, this research encompasses multiple quantitative studies to fully understand the scope of emotional intelligence in the field of traffic safety. A clear guideline regarding emotional intelligence measures and methods specific to traffic safety was outlined. This research also investigated commercial and non-commercial drivers and showed the difference between the two distinct driving populations in terms of driving behaviors and emotional intelligence. Finally, this research reveals a new avenue for future studies with the development of a new emotional intelligence scale. Multiple dimensions of dangerous driving behaviors were investigated in these studies, including aggressive driving, emotional driving, and driving violations and errors, which can be useful in future research in determining appropriate measures to assess drivers' behaviors. This research used online surveys, which are easy to complete and cost-effective (Knapp & Kirk, 2003; Shih & Fan, 2009). The surveys were anonymous and confidential, which increased the accuracy of responses. Moreover, the participants reported considerable amounts of crashes and citations, which improved the understanding of behavior-related adverse outcomes. Participants completed the surveys at their convenience, which reduced their anxiety regarding impression management biases in their responses, and they were assumed to be honest (Scott-Parker, 2012).

Limitations

This research also acknowledges a number of limitations. The self-reported measures used in this study may have influenced participants to produce socially desirable responses, as well as the dangerous driving behaviors may not have been reported accurately. There are several reasons for using this methodology. Collecting participants' actual driving records was not possible due to privacy restrictions. In addition, most of the information regarding dangerous driving, emotional intelligence, driving history (e.g., crashes and citations), and demographics could not be collected any other way. Thus, self-report methods provided the best opportunity to obtain a large amount of information that would not be possible otherwise. Previous research has found that the social desirability bias is not significant in the surveys related to driving behaviors and trait emotional intelligence (O'Connor et al., 2019; Reimer et al., 2006; Sullman & Taylor, 2010). Moreover, self-reported crashes and citations have been found to be accurate compared to official records (Boufous et al., 2010).

Furthermore, the survey length was long, which could have caused survey fatigue and affected the participants' ability to respond accurately. However, participants were compensated for being honest and accurate in their responses, which was intended to mitigate possible survey fatigue. This research also used a convenience quota sample for commercial and non-commercial drivers to ensure a balanced demographic distribution (e.g., age, gender) and a range of risky driving outcomes (e.g., crashes and citations). (United States Census Bureau, 2019).

In particular, the commercial drivers' sample had an equal distribution of male and female drivers (50% each), while the population is mainly dominated by men (over 90%) (United States Census Bureau, 2019). The gender split of the sample is not the same as the

population which may have prevented the generalizability of commercial drivers' study results. However, this was not a problem for the non-commercial study as both population and sample has equal gender distribution (Statista, 2020).

The analyses used in this research were mostly correlational and could not establish a causal link between emotional intelligence and these behaviors and outcomes. In addition, the DEIS study used an exploratory factor analysis (EFA) approach instead of factor analysis on the original TEIQue scale's construct. However, Statistical Consulting and Research Services at Montana State University provided their expert opinion to use an EFA based solution for better accuracy and minimizing bias. The DEIS study sample was highly represented by non-commercial drivers (90%); thus, results may not be representative of the commercial population.

Moreover, the risky and aggressive driving subscales in the DEIS study were highly skewed (most reported safe behaviors), which could influence the predictive validity of the results. However, Spearman's correlation was used as a non-parametric test, and the results were similar to Pearson's correlations, which showed consistency with previous results. Finally, the DEIS study sample was collected during the COVID pandemic when people were not driving as regularly, which could have affected the study findings.

Future Research Directions

While much has been learned about emotional intelligence in the context of dangerous driving behaviors, much remains unknown. To Expand on the current research, family, friends, and coworker assessments of individuals in future studies could be included to understand the correlations between emotional intelligence and dangerous driving behaviors more accurately. In addition, measuring actual driving behaviors using in-vehicle technology and analyzing them

with respect to emotional intelligence could further improve these findings. Conducting longitudinal studies can improve our understanding of drivers' emotional intelligence and dangerous driving behaviors. Teen drivers could be examined because they are the most vulnerable driving population as they are still developing. Based on this research, experiments can be created on different driving populations such as truck drivers, white-collar employees, and students from driver's education programs. These experiments will allow for a greater understanding of the effect of emotional intelligence in improving driving behaviors. In addition, future research should try to establish causality through experimental designs that best isolate emotional intelligence as the sole variable affecting dangerous driving. One suggestion for a future study design is having one group of participants receive emotional intelligence training and the other group not, and then measuring the differences in driving behaviors.

Concluding Remarks

This chapter provides a general discussion of the main findings for the comprehensive study of dangerous driving behaviors in the context of emotional intelligence. This research aimed to address three objectives: identify the current emotional intelligence measures appropriate in the traffic safety context; understand commercial and non-commercial drivers' dangerous driving behaviors in the emotional intelligence context; and develop an emotional intelligence scale to understand drivers' emotion and personality factors fully and thereby guide future research and interventions. Every phase of this research has informed countermeasure development. Finally, the strengths and limitations of this research were discussed, and future research directions were suggested.

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APPENDICES

APPENDIX A

TRAIT EMOTIONAL INTELLIGENCE QUESSIONNAIRE SHORT FORM

TEIQue-SF

Instructions: Please answer each statement below by putting a circle around the number that best reflects your degree of agreement or disagreement with that statement. Do not think too long about the exact meaning of the statements. Work quickly and try to answer as accurately as possible. There are no right or wrong answers. There are seven possible responses to each statement ranging from 'Completely Disagree' (number 1) to 'Completely Agree' (number 7).

1 . . . . . 2 . . . . . 3 . . . . . 4 . . . . . 5 . . . . . 6 7
Completely Disagree **Completely Agree**

1. Expressing my emotions with words is not a problem for me.	1	2	3	4	5	6	7
2. I often find it difficult to see things from another person's viewpoint.	1	2	3	4	5	6	7
3. On the whole, I'm a highly motivated person.	1	2	3	4	5	6	7
4. I usually find it difficult to regulate my emotions.	1	2	3	4	5	6	7
5. I generally don't find life enjoyable.	1	2	3	4	5	6	7
6. I can deal effectively with people.	1	2	3	4	5	6	7
7. I tend to change my mind frequently.	1	2	3	4	5	6	7
8. Many times, I can't figure out what emotion I'm feeling.	1	2	3	4	5	6	7
9. I feel that I have a number of good qualities.	1	2	3	4	5	6	7
10. I often find it difficult to stand up for my rights.	1	2	3	4	5	6	7
11. I'm usually able to influence the way other people feel.	1	2	3	4	5	6	7
12. On the whole, I have a gloomy perspective on most things.	1	2	3	4	5	6	7
13. Those close to me often complain that I don't treat them right.	1	2	3	4	5	6	7
14. I often find it difficult to adjust my life according to the circumstances.	1	2	3	4	5	6	7
15. On the whole, I'm able to deal with stress.	1	2	3	4	5	6	7
16. I often find it difficult to show my affection to those close to me.	1	2	3	4	5	6	7
17. I'm normally able to "get into someone's shoes" and experience their emotions.	1	2	3	4	5	6	7
18. I normally find it difficult to keep myself motivated.	1	2	3	4	5	6	7
19. I'm usually able to find ways to control my emotions when I want to.	1	2	3	4	5	6	7
20. On the whole, I'm pleased with my life.	1	2	3	4	5	6	7
21. I would describe myself as a good negotiator.	1	2	3	4	5	6	7
22. I tend to get involved in things I later wish I could get out of.	1	2	3	4	5	6	7
23. I often pause and think about my feelings.	1	2	3	4	5	6	7
24. I believe I'm full of personal strengths.	1	2	3	4	5	6	7
25. I tend to "back down" even if I know I'm right.	1	2	3	4	5	6	7
26. I don't seem to have any power at all over other people's feelings.	1	2	3	4	5	6	7
27. I generally believe that things will work out fine in my life.	1	2	3	4	5	6	7
28. I find it difficult to bond well even with those close to me.	1	2	3	4	5	6	7
29. Generally, I'm able to adapt to new environments.	1	2	3	4	5	6	7
30. Others admire me for being relaxed.	1	2	3	4	5	6	7

Trait Emotional Intelligence Questionnaire – Short Form (TEIQue-SF). This 30-item form includes two items from each of the 15 facets of the TEIQue. Items were selected primarily on the basis of their correlations with the corresponding total facet scores, which ensured broad coverage of the sampling domain of the construct. The –SF can be used in research designs with limited experimental time or wherein trait EI is a peripheral variable. Although it is possible to derive from it scores on the four trait EI factors, in addition to the global score, these tend to have somewhat lower internal consistencies than in the full form of the inventory. The –SF does not yield scores on the 15 trait EI facets.

Scoring information for the TEIQue-SF is available at:
http://www.psychometriclab.com/Home/Default/14 Please note that we cannot provide any advice on how to run the syntax in SPSS or other statistical software.

Please make sure you read the FAQ section at http://www.psychometriclab.com/Home/Default/18. In particular, note that we do not provide free information regarding norms or free feedback reports. Norms and reports are available for a fee (email admin@teique.com for quotes).

Reference for the TEIQue-SF: Petrides, K. V. (2009). Psychometric properties of the Trait Emotional Intelligence Questionnaire. In C. Stough, D. H. Saklofske, and J. D. Parker, *Advances in the assessment of emotional intelligence*. New York: Springer. DOI: 10.1007/978-0-387-88370-0_5

For more information about the trait emotional intelligence research program go to:
www.psychometriclab.com

Please note that any and all commercial use of this instrument, or any adapted, modified, or derivative works thereof, is strictly prohibited.

APPENDIX B

GENOS EI SCALE

genos

Emotional Intelligence
Full Version (Self-Assessment)

Emotional Intelligence Self Assessment Version

Instructions

The Genos EI Self Assessment has been designed to measure how often you believe you demonstrate emotionally intelligent behaviours at work. There are no right or wrong answers. However, it is essential that your responses truly reflect your beliefs regarding how often you demonstrate the behaviour in question. You should not answer in a way that you think sounds good or acceptable. In general try not to spend too long thinking about responses. Most often the first answer that occurs to you is the most accurate. However, do not rush your responses or respond without giving due consideration to each statement. Below is an example.

Q. I display appropriate emotional responses in difficult situations.

You are required to indicate on the response scale how often you believe you demonstrate the behaviour in question. There are five possible responses to each statement (shown below). You are required to circle the number that corresponds to your answer where...

1 = Almost Never
2 = Seldom
3 = Sometimes
4 = Usually
5 = Almost Always

When considering a response it is important not to think of the way you behaved in any one situation, rather your responses should be based on your typical behaviour. Also, some of the questions may not give all the information you would like to receive. If this is the case, please choose a response that seems most likely. There is no time limit; however it should take between 15-25 minutes to complete.

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Emotional Intelligence Self-Assessment Version

Below are a series of statements. Please circle the number corresponding to the statement that is most indicative of the way you typically think, feel and act at work. If you make a mistake simply cross it out and fill in the correct response.

	Almost Never	Seldom	Sometimes	Usually	Almost Always
1. I am aware of things that upset me at work.	1	2	3	4	5
2. I effectively express how I feel about issues at work.	1	2	3	4	5
3. I am aware of the things that make colleagues feel satisfied at work.	1	2	3	4	5
4. I ask others how they feel about different solutions when problem solving at work.	1	2	3	4	5
5. I take criticism from colleagues personally.	1	2	3	4	5
6. I create a positive working environment for others.	1	2	3	4	5
7. I demonstrate enthusiasm appropriately at work	1	2	3	4	5
8. I am aware of when I am feeling negative at work.	1	2	3	4	5
9. I find it difficult to identify the things that motivate people at work.	1	2	3	4	5
10. I demonstrate to others that I have considered their feelings in decisions I make at work.	1	2	3	4	5
11. I express how I feel to the wrong people at work.	1	2	3	4	5
12. I fail to get colleagues to cooperate.	1	2	3	4	5
13. I motivate others toward work related goals.	1	2	3	4	5
14. I remain focused when anxious about something at work.	1	2	3	4	5
15. I am aware of how my feelings influence the way I respond to colleagues.	1	2	3	4	5
16. I express positive emotions I experience at work inappropriately.	1	2	3	4	5
17. I fail to identify the way people respond to me when building rapport.	1	2	3	4	5
18. I consider the organisation's values when making important decisions.	1	2	3	4	5
19. I engage in activities that make me feel positive at work.	1	2	3	4	5
20. When necessary I effectively demonstrate empathy to colleagues	1	2	3	4	5
21. I behave inappropriately when angry at work	1	2	3	4	5
22. I am aware of my body language at work.	1	2	3	4	5
23. I express how I feel at the appropriate time.	1	2	3	4	5
24. I understand the things that cause others to feel engaged at work.	1	2	3	4	5
25. I demonstrate to others that I have considered my own feelings when making decisions at work.	1	2	3	4	5
26. I ruminate about things that anger me at work.	1	2	3	4	5
27. I am effective in helping others feel positive at work.	1	2	3	4	5
28. I demonstrate excitement at work appropriately.	1	2	3	4	5
29. I am aware of my mood state at work.	1	2	3	4	5
30. When I am under stress I become impulsive.	1	2	3	4	5
31. I demonstrate an understanding of others' feelings at work.	1	2	3	4	5
32. I communicate decisions at work in a way that captures other's attention	1	2	3	4	5

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	Almost Never	Seldom	Sometimes	Usually	Almost Always
33. I effectively deal with things that annoy me at work.	1	2	3	4	5
34. I help people find effective ways of responding to upsetting events.	1	2	3	4	5
35. I fail to control my temper at work.	1	2	3	4	5
36. I am aware of the tone of voice I use to communicate with others at work.	1	2	3	4	5
37. I provide positive feedback to colleagues.	1	2	3	4	5
38. I fail to recognise when colleagues' emotional reactions are inappropriate	1	2	3	4	5
39. I gain stakeholders' commitment to decisions I make at work.	1	2	3	4	5
40. I appropriately respond to colleagues who frustrate me at work.	1	2	3	4	5
41. When colleagues are disappointed about something I help them feel differently about the situation.	1	2	3	4	5
42. I hold back my initial reaction when something upsets me at work.	1	2	3	4	5
43. I fail to recognise how my feelings drive my behaviour at work.	1	2	3	4	5
44. When I am happy at work I express how I feel effectively.	1	2	3	4	5
45. I identify others' non verbal emotional cues (e.g., body language).	1	2	3	4	5
46. I appropriately communicate decisions to stakeholders.	1	2	3	4	5
47. I demonstrate positive moods and emotions at work.	1	2	3	4	5
48. I help people deal with issues that cause them frustration at work.	1	2	3	4	5
49. I am impatient when things don't get done as planned at work.	1	2	3	4	5
50. I am aware of how my feelings influence the decisions I make at work.	1	2	3	4	5
51. When someone upsets me at work I express how I feel effectively.	1	2	3	4	5
52. I understand the things that make people feel optimistic at work.	1	2	3	4	5
53. I consider the way others may react to decisions when communicating them.	1	2	3	4	5
54. I quickly adjust to new conditions at work.	1	2	3	4	5
55. I don't know what to do or say when colleagues get upset at work.	1	2	3	4	5
56. When upset at work I still think clearly	1	2	3	4	5
57. I find it difficult to identify my feelings on issues at work.	1	2	3	4	5
58. I effectively express optimism at work.	1	2	3	4	5
59. I understand what makes people feel valued at work.	1	2	3	4	5
60. I take into account both technical information and the way I feel about different choices when making decisions at work.	1	2	3	4	5
61. I fail to handle stressful situations at work effectively.	1	2	3	4	5
62. I respond to events that frustrate me appropriately.	1	2	3	4	5
63. I am aware of things that make me feel positive at work.	1	2	3	4	5
64. I fail to resolve emotional situations at work effectively.	1	2	3	4	5
65. I have trouble finding the right words to express how I feel at work.	1	2	3	4	5
66. I identify the way people feel about issues at work.	1	2	3	4	5
67. I focus solely on facts and technical information related to problems when trying to derive a solution.	1	2	3	4	5
68. I fail to keep calm in difficult situations at work.	1	2	3	4	5
69. I explore the causes of things that upset me at work.	1	2	3	4	5
70. When I get frustrated with something at work I discuss my frustration appropriately.	1	2	3	4	5

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Scoring

**The information written below is consistent with SPSS syntax, so you should be able to copy and paste, if you use SPSS. Otherwise, the relevant information should be discernable and implementable in another program.

** These are the negatively keyed items that need to be reverse coded

```
RECODE
  q5 q9 q11 q12 q16 q17 q21 q26 q30 q35 q38 q43 q49 q55 q57 q61 q64 q65 q67
  q68  (MISSING=SYSMIS)  (1=5)  (2=4)  (3=3)  (4=2)  (5=1)  .
EXECUTE .
```

** These are the items that correspond to each subscale

```
COMPUTE esa = q1+q8+q15+q22+q29+q36+q43+q50+q57+q63 .
VARIABLE LABELS esa 'emotional self-awareness' .

COMPUTE ee = q2+q11+q16+q23+q37+q44+q51+q58+q65+q70 .
VARIABLE LABELS ee 'emotional expression' .

COMPUTE eao = q3+q9+q17+q24+q31+q38+q45+q52+q59+q66 .
VARIABLE LABELS eao 'Emotional Awareness of Others' .

COMPUTE er = q4+q10+q18+q25+q32+q39+q46+q53+q60+q67 .
VARIABLE LABELS er 'emotional reasoning' .

COMPUTE esm = q5+q19+q26+q33+q40+q47+q54+q61+q62+q69 .
VARIABLE LABELS esm 'emotional self-management' .

COMPUTE emo = q6+q12+q13+q20+q27+q34+q41+q48+q55+q64 .
VARIABLE LABELS emo 'emotional management of others' .

COMPUTE esc = q7+q14+q21+q28+q30+q35+q42+q49+q56+q68 .
VARIABLE LABELS esc 'emotional self-control' .

COMPUTE total_ei =
q6+q12+q13+q20+q27+q34+q41+q48+q55+q64+q5+q19+q26+q33+q40+q47+q54+q
61+q62+q69+q4+q10+q18+q25+q32+q39+q46+q53+q60+q67+q3+ q9+ q17+
   q24+ q31+ q38+ q45+ q52+ q59+ q66+ q2+ q11+ q16+ q23+ q37+ q44+ q51+
q58+ q65+ q70+ q1+ q8+ q15+ q22+ q29+ q36+ q43+ q50+ q57+ q63+ q7+ q14+
q21+ q28+ q30+ q35+ q42+ q49+ q56+ q68 .
VARIABLE LABELS total_ei 'total emotional intelligence' .
EXECUTE .
```


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APPENDIX C

WONG AND LAW EI SCALE

Wong & Law (2002) Emotional Intelligence Scale

This survey collects feedback on your ability to understand and manage your emotions.

Emotional Intelligence Items	Strongly Disagree						Strongly Agree
1. I have a good sense of why I have certain feelings most of the time.	1	2	3	4	5	6	7
2. I have a good understanding of my own emotions.	1	2	3	4	5	6	7
3. I really understand what I feel.	1	2	3	4	5	6	7
4. I always know whether or not I am happy.	1	2	3	4	5	6	7
5. I always know my friends' emotions from their behavior.	1	2	3	4	5	6	7
6. I am a good observer of others' emotions.	1	2	3	4	5	6	7
7. I am sensitive to the feelings and emotions of others.	1	2	3	4	5	6	7
8. I have a good understanding of the emotions of people around me.	1	2	3	4	5	6	7
9. I always set goals for myself and then try my best to achieve them.	1	2	3	4	5	6	7
10. I always tell myself that I am a competent person.	1	2	3	4	5	6	7
11. I am a self-motivated person.	1	2	3	4	5	6	7
12. I would always encourage myself to try my best.	1	2	3	4	5	6	7
13. I am able to control my temper and handle difficulties rationally.	1	2	3	4	5	6	7
14. I am quite capable of controlling my own emotions.	1	2	3	4	5	6	7
15. I can always calm down quickly when I am very angry.	1	2	3	4	5	6	7
16. I have good control of my own emotions.	1	2	3	4	5	6	7

Self-Emotion Appraisal	Others' Emotion Appraisal	Use of Emotions	Regulation of Emotion
1.	5.	9.	13.
2.	6.	10.	14.
3.	7.	11.	15.
4.	8.	12.	16.
Total:	Total:	Total:	Total:

APPENDIX D

DULA DANGEROUS DRIVING INDEX

Appendix

Dula Dangerous Driving Index

Note. Subscale items are denoted as follows: AD = aggressive driving; NE = negative emotions while driving; RD = risky driving; O = item omitted from subscales. Participants responded to the items with the following Likert scale: A = *never*, B = *rarely*, C = *sometimes*, D = *often*, E = *always*.

Participants received the following written directions: "Please answer each of the following items as *honestly* as possible. Please read each item carefully and then fill in the bubble/circle of the answer you choose on the form. If none of the choices seem to be your ideal answer, then select the answer that comes *closest*. THERE ARE NO RIGHT OR WRONG ANSWERS. Select your answers quickly and do not spend too much time analyzing your answers. You may change any answer(s) at any time before completing this form. If you do change an answer, please erase the previous mark(s) entirely."

1. I drive when I am angry or upset. (NE)
2. I lose my temper when driving. (NE)
3. I consider the actions of other drivers to be inappropriate or "stupid." (NE)
4. I flash my headlights when I am annoyed by another driver. (AD)
5. I make rude gestures (e.g., giving "the finger," yelling curse words) toward drivers who annoy me. (AD)
6. I verbally insult drivers who annoy me. (AD)
7. I deliberately use my car/truck to block drivers who tailgate me. (AD)
8. If another driver *seriously* threatens my safety, I would defend myself. (O)
9. I would tailgate a driver who annoys me. (AD)
10. I "drag race" other drivers at stop lights to get out front. (RD)
11. I will illegally pass a car/truck that is going *too* slowly. (RD)
12. I feel it is my right to strike back in some way, if I feel another driver has been aggressive toward me. (AD)
13. When I get stuck in a traffic jam, I get *very* irritated. (NE)
14. I will race a slow moving train to a railroad crossing. (RD)
15. I will weave in and out of slower traffic. (RD)
16. I will drive if I am only *mildly* intoxicated or buzzed. (RD)
17. When someone cuts me off, I feel I should punish him/her. (AD)
18. I get impatient and/or upset when I fall behind schedule when I am driving. (NE)
19. Passengers in my car/truck tell me to calm down. (NE)
20. I get irritated when a car/truck in front of me slows down for no reason. (NE)

21. I will cross double yellow lines to see if I can pass a slow moving car/truck. (RD)
22. I feel it is my right to get where I need to go as quickly as possible. (RD)
23. I am an aggressive driver. (O)
24. I feel that *passive* drivers should learn how to drive or stay home. (NE)
25. I keep some type of weapon in my car/truck. (O)
26. I will drive in the shoulder lane or median to get around a traffic jam. (RD)
27. When passing a car/truck on a 2-lane road, I will barely miss on-coming cars. (RD)
28. I will drive when I am drunk. (RD)
29. I feel that I may lose my temper if I have to confront another driver. (NE)
30. I consider myself to be a risk-taker. (RD)
31. I feel that most traffic "laws" could be considered as suggestions. (RD)

APPENDIX E

DRIVING BEHAVIOR QUESTIONNAIRE

Appendix 1. List of items and its changes from the originals.

Reason et al. (1990) wording	Parker et al. (1995) wording	Final item	Reason for the changes
Attempt to drive away from traffic lights in third gear	Attempt to drive away from traffic lights in third gear	Attempt to leave a parking space in the wrong gear	Revised for clarity (most people drive an automatic transmission)
Check your speedometer and discover that you are unknowingly traveling faster than the legal limit		Check your speedometer and discover that you are traveling faster than the posted speed limit	Changed wording slightly for clarity
Lock yourself out of your car with the keys still inside			Omitted because not related to driving safety.
Become impatient with a slow driver in the outer lane and overtake on the inside	Become impatient with a slow driver in the outer lane and overtake on the inside		Omitted for repetition
Drive as fast along country roads at night on dipped lights as on full beam		Drive as fast along country roads at night on low beams as you would on high beams	Revised wording for North America (NA) context
Attempt to drive away without first having switched on the ignition			Omitted for repetition
Drive especially close or 'flash' the car in front as a signal for that driver to go faster or get out of your way	Drive especially close to the car in front as a signal for that driver to go faster or get out of your way	Drive especially close to or 'flash' the car in front of you to try and get them to go faster or get out of your way	Altered the original wording for clarity
Forget where you left your car in a multi-level car park	Forget where you left your car in a car park	Forget where you parked your car	Revised for NA context and clarity
Distracted or preoccupied, realize belatedly that the vehicle ahead has slowed, and have to slam on the brakes to avoid a collision		Realize that the vehicle ahead has slowed, and have to slam on the brakes to avoid a collision because you were distracted or preoccupied	Changed original wording for clarity
Intend to switch on the windscreen wipers, but switch on the lights instead, or *vise versa*	Switch on one thing, such as the headlights, when you meant to turn on something else, such as the wipers	Switch on one thing, such as the headlights, when you meant to turn on something else, such as the wipers	Wording from Parker et al. (1995)
Turn left onto a main road into the path of an oncoming vehicle that you hadn't seen, or whose speed you had misjudged		Turn left into the path of an oncoming vehicle that you hadn't seen	Revised wording to avoid repetition of other items
Misjudge your gap in a car park and nearly (or actually) hit adjoining vehicle		Misjudge the space available in a parking lot and nearly (or actually) hit another vehicle	Revised wording for NA context
'Wake up' to realize that you have no clear recollection of the road along which you have just traveled	Realize you have no clear recollection of the road along which you have just been traveling	Realize you have no clear recollection of the road along which you have just been traveling	Wording from Parker et al. (1995)
Miss your exit on a motorway and have to make a lengthy detour		Miss your exit on a highway and have to make a detour	Revised wording for NA context
Forget which gear you are currently in and have to check with your hand			Omit because few drivers have manual transmission
Stuck behind a slow-moving vehicle on a two-lane highway, you are driven by frustration to try to overtake in risky circumstances		Try to pass in risky circumstances when stuck behind a slow-moving vehicle on a two-lane highway	Revised wording for brevity and clarity
Intending to drive to destination A, you 'wake up' to find yourself en route to B, where the latter is the more usual journey	Intending to drive to destination A, you 'wake up' to find yourself en route to B, perhaps because the latter is your more usual destination	Intending to drive to destination A, you realize that you are actually en route to destination B, perhaps because destination B is your more usual destination	Revised for clarity
Take a chance and cross on lights that have turned red		Take a chance and run a red light	Revised wording for NA context
Angered by another driver's behavior, you give chase with the intention of giving him/her a piece of your mind	Angered by another driver's behavior, you give chase with the intention of giving him/her a piece of your mind	Feel angered by another driver's behavior and chase after him/her with the intention of giving him/her a piece of your mind	Revised wording for clarity
Try to overtake without first checking your mirror, and then get hooted at by the car behind which has already begun it's overtaking maneuver			Omitted for repetition
Deliberately disregard the speed limits late at night or very early in the morning	Disregard the speed limits late at night or early in the morning	Deliberately disregard the speed limit late at night or very early in the morning	Original wording
Forget when your road tax/insurance expires and discover that you are driving illegally			Omitted because it does not happen often
Lost in thought, you forget that your lights are on full beam until 'flashed' by other motorists		Forget that you have your high beams on until 'flashed' by other motorists	Revised for NA context and clarity
On turning left, nearly hit a cyclist who has come up on your inside	On turning left, nearly hit a cyclist who has come up on your inside	When turning right, nearly hit a cyclist who has come up beside you	Revised wording for NA context
In a queue of vehicles turning left on to a main road, pay such close attention to the traffic approaching from the right that you nearly hit the car in front	Queuing to turn left onto a main road, you pay such close attention to the main stream of traffic that you nearly hit the car in front	In a line of cars turning left onto a main road, pay such close attention to the main stream of traffic that you nearly hit the car in front	Reworded for clarity

(continued on next page)

Appendix 1 (*continued*)

Reason et al. (1990) wording	Parker et al. (1995) wording	Final item	Reason for the changes
Drive back from a party, restaurant, or pub, even though you realize that you may be over the legal blood-alcohol limit	Drive even though you realize that you may be over the legal blood-alcohol limit	Drive even though you realize that you may be over the legal blood-alcohol limit	Parker et al. (1995) wording
Have an aversion to a particular class of road user, and indicate your hostility by whatever means you can	Have an aversion to a particular class of road user, and indicate your hostility by whatever means you can		Omitted after pilot testing
Lost in thought or distracted, you fail to notice someone waiting at a zebra crossing, or a pelican crossing light that has just turned red		Fail to notice someone waiting at a crosswalk	Reworded to accommodate NA context and for clarity
Park on a double-yellow line and risk a fine			Omit for NA context
Misjudge speed of oncoming vehicle when overtaking	Underestimate the speed of an oncoming vehicle when overtaking	Underestimate the speed of an oncoming vehicle when passing on a two-lane highway	Changed wording for clarity
Hit something when reversing that you had not previously seen	Hit something reversing that you had not previously seen	Hit something when backing up that you did not see	Changed wording for clarity
Fail to notice someone stepping out from behind a bus or parked vehicle until it is nearly too late		Fail to notice someone stepping out from behind a bus or parked vehicle until it is nearly too late	Original wording
Plan your route badly, so that you meet traffic congestion you could have avoided			Omitted because irrelevant to driving safety
Overtake a single line of stationary or slow-moving vehicles, only to discover that they were queuing to get through a one-lane gap or roadwork lights			Omitted because irrelevant to driving safety
Overtake a slow-moving vehicle on the inside lane or hard shoulder of a motor-way			Omitted after pilot testing
Cut the corner on a right-hand turn and have to swerve violently to avoid an oncoming vehicle			Omitted after pilot testing
Get into the wrong lane at a roundabout or approaching a road junction	Get into the wrong lane at a roundabout or approaching a junction	Get into the wrong lane when approaching an intersection or roundabout	Revised for clarity
Fail to read the signs correctly, and exit a roundabout on the wrong road	Misread the signs and exit a roundabout on the wrong road		Omitted because roundabouts are infrequent in NA and redundant with respect to other items
Fail to give way when a bus is signaling its intention to pull out		Fail to yield right-of-way to a bus that is signaling its intention to pull out	Revised wording for clarity
Ignore 'give way' signs, and narrowly avoid colliding with traffic having the right of way	Miss 'give way' signs, and narrowly avoid colliding with traffic having the right of way	Ignore a yield sign and almost collide with traffic having the right-of-way	Revised wording for clarity and NA context
Fail to check your mirror before pulling out, changing lanes, turning, etc.	Fail to check your rearview mirror before pulling out, changing lanes, etc.	Fail to check your mirrors before pulling out, changing lanes, turning, etc.	Original wording (Reason et al., 1990)
Attempt to overtake a vehicle that you hadn't noticed was signaling its intention to turn right	Attempt to overtake someone that you hadn't noticed to be signaling a right turn	On a two-lane road, attempt to pass a vehicle that you hadn't noticed was signaling its intention to turn left	Reworded for clarity and NA context
Deliberately drive the wrong way down a deserted one-way street		Drive the wrong direction down a deserted one-way street	Revised wording to make a S/L/M – would be very rare if deliberate
Disregard red lights when driving late at night along empty roads		Disregard red lights or stop signs when driving late at night along empty roads	Added wording to make more comprehensive
Drive with only 'half-an-eye' on the road while looking at a map, changing a cassette or radio channel, etc.		Drive while looking at a map or GPS device, changing the radio station, etc.	Revised wording for clarity and NA context
Fail to notice pedestrians crossing when turning into a side-street from a main road	Fail to notice pedestrians are crossing when turning into a side-street from a main road	Fail to notice pedestrians crossing when turning into a side-street from a main road	Original wording (Reason et al., 1990)
Get involved in unofficial 'races' with other drivers	Get involved in unofficial 'races' with other drivers	Get involved in unofficial 'races' with other drivers	Original wording (Reason et al., 1990)
'Race' oncoming vehicles for a one-car gap on a narrow or obstructed road			Omitted because it is confusing and unclear
Brake too quickly on a slippery road and/or steer the wrong way in a skid	Brake too quickly on a slippery road and/or steer the wrong way in a skid	Brake too hard on a slippery road or steer the wrong way in a skid	Revised wording for clarity
Misjudge your crossing interval when turning right and narrowly miss collision		Misjudge the distance between oncoming vehicles when turning left and narrowly miss a collision	Revised wording for clarity and NA context
	Cross a junction knowing that the traffic lights have already turned against you		Omit for repetition

APPENDIX F

DIMENSIONS OF DRIVER STRESS

Table 5. Factor structure and items loading on each factor: study II.

Items	Loading
'Driving Aggression': Contribution to Total Variance: 14·1%	
Driving usually makes me feel aggressive	0·60
I tend to overtake other vehicles whenever possible	0·57
When irritated I drive aggressively	0·48
When I try but fail to overtake I am usually frustrated	0·48
Driving a car gives me a sense of power	0·46
I think it is worthwhile taking risks on the road	0·42
'Dislike of driving and related anxiety': Contribution to Total Variance: 6·9%	
I am worried to drive in bad weather	0·58
I am always ready to react to other drivers' unexpected manoeuvres	0·56
Driving usually does not make me happy	0·53
In general I do not enjoy driving	0·52
Driving usually makes me feel frustrated	0·48
I feel confident in my ability to avoid an accident	0·48
I am more anxious then usual in heavy traffic	0·48
I am more tense on new than familiar roads	0·47
I am usually patient during the rush hour	0·42
'Driving Alertness': Contribution to Total Variance: 6·4%	
I am on the alert on a difficult road	0·81
I increase concentration on a difficult road	0·74
Slow moving vehicles are a traffic hazard	0·55
I am always ready to react to other drivers' unexpected manoeuvres	0·42
An accident is always possible because of other drivers' poor judgement	0·41
'Irritation when Overtaken': Contribution to Total Variance: 4·8%	
I feel bothered when overtaken at a junction	0·64
I feel angry when overtaken at a junction	0·62
I feel anxious when overtaken at a junction	0·58
'Overtaking Tension': Contribution to Total Variance: 3·5%	
I do not feel indifferent when overtaking another vehicle	0·64
I feel satisfied when overtaking another vehicle	0·62
I feel tense when overtaking another vehicle	0·46
'General Driver Stress': Contribution to Total Variance: 15·7%	
I am annoyed to drive behind slow moving vehicles	0·70
When I try but fail to overtake I am usually bothered	0·66
When I try but fail to overtake I am usually frustrated	0·66
I am usually patient during the rush hour	0·53
When irritated I drive aggressively	0·52
Annoyed when traffic lights change to red when I approach them	0·52
I do not feel indifferent when overtaking another vehicle	0·50
In general I mind being overtaken	0·49
Driving usually makes me feel aggressive	0·48
Driving usually makes me feel frustrated.	0·48
I am more tense on new than familiar roads	0·47
I lose my temper when another driver does something silly	0·46
I feel tense when overtaking another vehicle	0·43
Driving a car gives me a sense of power	0·43
I feel bothered when overtaken at a junction	0·43
I feel satisfied when overtaking another vehicle	0·40