2015

Examining the Relationship Between Driving Styles of Teen Drivers and Their Parents

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EXAMINING THE RELATIONSHIP BETWEEN DRIVING STYLES OF TEEN DRIVERS AND THEIR PARENTS

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A THESIS

Submitted to the graduate faculty of The University of Alabama at Birmingham
in partial fulfillment of the requirements for the degree of Master of Arts

BIRMINGHAM, ALABAMA

2015

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LIFESPAN DEVELOPMENTAL PSYCHOLOGY PROGRAM

ABSTRACT

Teenage drivers, ages 16 to 19, account for about 16.8% of motor vehicle crashes (MVCs) in the United States, even though teenagers only represent about 4.4% of the United States population. Several factors increase teenagers' risk for MVCs including: lack of driving experience, poor ability to identify and anticipate hazards, lack of sensitivity to road complexity and conditions, and increased willingness to take risks. Research has also suggested the importance of parental influences on risky teenage driving. This study examined the effects of parental driving styles, behaviors, and history on teenagers' driving style using self-reported measures. Overall, it was hypothesized that parental driving factors (driving style, driving behavior, and driving history) would predict teenagers' driving style. Further, it was hypothesized that parental reckless and careless driving style would be associated with teenage risky driving style and parental history of poor driving history (e.g., higher number of tickets and crashes) would be associated with these same negative outcomes in teenagers. Findings revealed no associations among parents and teenagers driving styles, driving behaviors, and driving history. Results found that the greater the amount of time a parent spends helping teenagers to drive, the lower teenagers endorsed anxious driving style. Implications and future research directions were discussed.

Keywords: Driving style, Driving behaviors, Driving history, Parental influence, Teenage driving safety

ACKNOWLEDGMENTS

This work was sponsored, in part, by a grant from the Southeastern Transportation Research, Innovation, Development and Education (STRIDE) Center and matching funds were provided by the Alabama Department of Transportation (ALDOT) and Florida Department of Transportation (FDOT). The use of the Multidimensional Driving Style Inventory was made possible by Dr. Orit Taubman-Ben-Ari. This study was made possible through the hard work and dedication of the research assistants of the Translational Research for Injury Prevention Laboratory and The Study of Healthy Aging & Applied Research Programs Lab. Additional thanks to the UAB Edward R. Roybal Center for Translational Research on Aging and Mobility.

I wish to acknowledge and thank the many people who contributed to this thesis. I would like to thank my thesis advisor, Dr. Despina Stavrinos, for her help, guidance, and advice that she has provided throughout this process; though the good times and bad times, she was always there to give me encouragement. I would also like to thank Dr. Fred Biasini, Dr. Kristi Guest, and Dr. Lesley Ross for serving on my committee and providing advice on various aspects of analysis and design.

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INTRODUCTION

A disproportionate number of teenage drivers, aged 16 to 19 years old, are involved in motor vehicle crashes (MVCs) every year, with seven teen deaths per day attributed to motor vehicle incidents (Centers for Disease Control and Prevention [CDC], 2012). Teenage drivers are at the greatest risk for being involved in a MVC as compared to other age groups, with an elevated risk of being involved in a MVC within the first six months after licensure (Centers for Disease Control and Prevention [CDC], 2012; Klauer et al., 2011). Consequently, while roughly 9.5 million, or 4.4%, of the nearly 212 million licensed drivers in the United States were classified as teenage drivers in 2011, teenage drivers accounted for 16.8% of drivers who are involved in fatal crashes and 8% of driver fatalities (Federal Highway Administration [FHWA], 2013; Insurance Institute for Highway Safety [ILHS], 2013). Further emphasizing the major public health burden and importance of teenage driving are the economic costs associated with MVCs of this at-risk group, which were estimated to be $26 billion dollars in medical losses (Centers for Disease Control and Prevention [CDC], 2012).

Risk Factors Associated With Teenager MVC Risk

Numerous studies have identified various factors that may account for the increased risk of MVCs in teenage drivers (Shope & Bingham, 2008). Teenage drivers' lack of skill (e.g., poor training), combined with a lack of driving experience and poor ability to identify and anticipate hazards may, for example, increase the risk of being involved in a MVC (Shope & Bingham, 2008). Teenage drivers also lack sensitivity to road complexity

and conditions (Laapotti et al., 2006; Underwood, 2007) and have an increased willingness to take risks, such as speeding (Aarts & van Schagen, 2006; Jonah, Thiessen, & Au-Yeung, 2001; McKenna, Horswill, & Alexander, 2006). With experience, driving becomes a subconscious task, which may decrease those risk factors in teenage drivers (Crundall, Underwood, & Chapman, 1999).

Inexperience is a common MVC risk factor for teenage drivers. As a result of their inexperience, teenage drivers often have difficulty in identifying hazardous situations or determining the severity of the danger posed by a hazardous situation (Simons-Morton et al., 2011). The inability to detect hazardous situations may place teenage drivers at an increased risk for fatal MVCs. For example, teenage drivers may not understand the hazard of wet, slippery roadways and the increased risk of hydroplaning which may increase the likelihood of MVCs (Simon, 2010). As drivers gain experience with increased exposure to driving, they may become more effective at recognizing and anticipating hazardous situations which results in a decreased risk of involvement in a MVC (Crundall et al., 1999).

Teenage drivers also engage in a number of risky behaviors that are less frequently seen in more experienced groups (Centers for Disease Control and Prevention [CDC], 2012). Some of the most commonly reported risky driving behaviors among teenagers (e.g., driving under the influence of alcohol, driving at a high speed, driving while using a cell phone, and driving with multiple passengers in the vehicle) may increase the risk of a MVC by 50% (Goodwin, Foss, Harrell, & O'Brien, 2012; Olsen, Shults, & Eaton, 2013; Simons-Morton et al., 2011). Risky behaviors could be influenced by family expectations, such as conditions or restrictions placed on the teenager’s

driving, and peer expectations, such as not wearing a seat belt (Braithwaite & Lythcott, 1989; Mathews, Zollinger, Przybylski, & Bull, 2001).

Common demographic factors, such as age and gender, also increase risk for a MVC. The younger a driver, the more likely that driver is to become involved in a MVC per mile driven (Insurance Institute for Highway Safety [ILHS], 2013). Male teenage drivers were three times more likely to be involved in a fatal crash than their female counterparts; moreover, male teenage drivers' deaths (12.3%) were triple the rate of their female teenage driver counterparts (4.4%) in 2012 (Centers for Disease Control and Prevention [CDC], 2012; Insurance Institute for Highway Safety [ILHS], 2013). Teenage drivers were three times more likely to be invoved in a fatal MVC than drivers who were over the age of 20 (Centers for Disease Control and Prevention [CDC], 2012). The risk of a MVC is higher among 16 to 19 year olds than any other age group, with an elevated risk of a MVC in the first six months after licensure (Centers for Disease Control and Prevention [CDC], 2012; Klauer et al., 2011). With each additional year of licensure, the rate of death per 100,000 people involved in a MVC declines, but does not reach the lowest death rates until after thirty years of age. The highest rate of deaths per 100,000 people in 2012 were drivers aged 19 (9.8%) with the deaths of 18 year olds (8.0%) following close behind (Insurance Institute for Highway Safety [ILHS], 2013).

As noted above, the rates of MVCs and deaths associated with teenage drivers remain elevated among teenage drivers even several years after first licensure (Anderson & Smith, 2003), indicating that gaining driving experience does not fully explain the relationship between teenage drivers and MVC rates. This has prompted many researchers to consider other factors or influences that might play a role in teenage

driver's increased risk for MVCs. The role of parent driving has been considered as an additional factor in several studies and the role of parent driving will be the focus of the proposed study. In particular, the current study was among the first to examine multiple aspects of driving (i.e., driving styles, driving behaviors, and driving history) compared across parent-child dyads.

Operational Definitions

Driving Definitions. There is a significant overlap between the two constructs of driving style and driving behavior and current studies in transportation safety have used the two concepts interchangeably or have used both concepts without overtly defining them (Elander, West, & French, 1993; French, West, Elander, & Wilding, 1993; Nyberg, 2007). Leonard Evans (1991) separated driving skill-driving style into driving performance and driving behavior, thus creating a dichotomy (Evans, 1991). It is not always clear as to how a researcher's findings should be classified. For example, if a person typically drives recklessly (i.e., their driving *behavior*), then they may have been in or were involved in more crashes than another driver (i.e., their driving *performance*).

Elander et al. (1993) argued that incidents were related to both driving style and driving skill. They defined driving style as "concerning the way individuals choose to drive or driving habits that have become established over a period of years" (Elander et al., 1993). This definition is ambiguous since it gives two different definitions for the construct of driving style: (1) the way individuals choose to drive and (2) the way individuals' driving habits become established over time. The first definition implies that an individual is conscious of how they drive; whereas the second definition implies that there is a level of sub-consciousness in how an individual drives. Both of these

definitions give way to the understanding that driving is both a conscious effort as well as a sub-conscious effort and influenced by attitudes and beliefs regarding driving as well as a driver's customary driving mode, including speed, headway (i.e., tailgating), and habitual level of attentiveness and assertiveness. Driving skill, on the other hand, is referred to as the ability of drivers to control the vehicles through their own knowledge, skill, perceptual, and cognitive abilities while responding to various traffic situations.

Driving Style and Driving Behavior. Recently, a more stable operational definition for both driving behavior and driving style was established by Taubman-Ben-Ari, Mikulincer, and Gillath (2004). Driving style is often measured by the way individuals choose to drive or their customary driving mode, including speed, headway (i.e., the distance to the vehicle in front of the driver's vehicle), and habitual level of attentiveness and assertiveness. Driving behaviors, on the other hand, are typically measured by self-reported, objectively reported, or observed behaviors that may impact driving, including attentional or memory slips and lapses (e.g., adjusting the mirror before pulling out of the drive way), mistakes (e.g., underestimating oncoming traffic while passing vehicle on a two-lane highway), or violations (e.g., driving over the speed limit).

Driving History. The style of driving and behaviors that may impact driving, therefore, may result in negative driving history (i.e., a MVC or ticket). Driving history is often measured by self-report approaches or objectively measured variables, such as crash and/or incident police reports, remembrance of number of speeding tickets or number of MVCs. For the purpose of this study, we considered driving style, driving behaviors, and driving history as separate constructs.

Parental Influence

The influence of parental driving styles, behaviors, and history on their teenage children's driving styles, behaviors, and history was examined several decades ago. Among the first to study the parent-teenage relationship within the context of driving was Carlson and Klein (1970) who conducted an experiment to determine the influence paternal driving history had on young male drivers aged 18 to 20. Specifically, Carlson and Klein examined son's and their father's driving violation records, which provided two measures of driver history: (1) the frequency of the driver's non-crash connected moving violations (i.e., violations not related to a crash) and (2) the seriousness of the non-crash connected moving violations. Results suggested a significant relationship: the more driving violations committed by the father, the more driving violations reflected on the son's driving record (Carlson & Klein, 1970).

Following a 30 year hiatus, a renewal of interest in parental driving influences on teenage drivers occurred. Ferguson, Williams, Chapline, Reinfurt, and De Leonardis (2001) suggested that parents' driving history, which included moving violations such as speeding, reckless driving, alcohol involvement, failure to yield, driving without a license, and crashes was related to young drivers' moving violations and crashes. The number of moving violations and crashes were obtained via the driver's history record which generally provided information for the past five years. Specifically, young drivers, aged 18 to 21, whose parents had three or more crashes on their record were more likely to have had a crash than children whose parents had fewer crashes. In addition, young drivers were also more likely to have a violation if their parents had three or more

violations on their record. In other words, parents that had violations or crashes were more likely to have children with violations or crashes (Ferguson et al., 2001).

A similar pattern of teenagers' self-reported driving behaviors and driving styles among parents, in general, and their teenagers was found across international studies. In Brazil, Bianchi and Summala (2004) indicated that the more driving errors and violations that parents, in general, accrued, the more driving errors and violations their children committed, implying that parents' driving behaviors was strongly related to teenagers' driving errors and violations (Bianchi & Summala, 2004). In Israel, Taubman-Ben-Ari, Mikulincer, and Gillath (2005) suggested that driving styles may be passed down from generation to generation since parents' anxious, reckless, and careful driving styles were associated with their adult teenagers' driving styles (Taubman-Ben-Ari et al., 2005).

Further studies revealed additional parental influence on teenage driving risk, specifically related to parental restriction and supervision of teenage drivers. Hartos, Eitel, and Simons-Morton (2002) indicated that low parental restrictions on teenage drivers, as reported by teenagers (i.e., specific driving rules including where to drive, who could ride in the vehicle, when to drive, no drinking and driving, and no aggressive driving), increased the likelihood of teenage risky driving behaviors. Similarly, research conducted by Beck, Shattuck, and Raleigh (2001) suggested that low parental restriction and less access to vehicle increased the likelihood of identifying high risk teenage drivers.

Parental gender differences in driving styles, behaviors, and history may also play a role in the formation of teenager's driving styles, behaviors, and history. Bianchi and Summala (2004) indicated parental gender differences within violations, with fathers

reporting more violations than mothers (Bianchi & Summala, 2004). Taubman-Ben-Ari et al. (2005) revealed gender differences in driving styles, with fathers reporting lower anxious driving styles than mothers, sons, or daughters. Fathers also reported higher reckless and careless and angry and hostile driving styles than mothers (Taubman-Ben-Ari et al., 2005).

Theoretical Background.

Social learning theory. Two theories may offer additional support and conceptual framework for understanding how driving styles, behaviors, and history are passed from parents to teenage drivers. Bandura's social learning theory (1977) suggested that parents shape their teenagers' behavior by modeling. Specifically, a person acquires new behaviors through direct experience or by observing the behavior of others (Bandura, 1971). A recent national survey commissioned by Ford found 55% of teenagers and more than 75% of tweens, aged 9 to 12, were heavily influenced by their parents' driving (Ford Motor Company, 2011). Eighty percent of both teenagers and tweens stated that they saw their parents engaging in risky driving behaviors. It is plausible to discern that these past recollections of their parents' driving styles, behaviors, and history may influence or alter teenagers driving styles, behaviors, and history (Ford Motor Company, 2011).

Various studies have also supported Bandura's theory with regard to shaping teenage driving behaviors and/or styles, displaying a clear association between parenting driving behaviors and/or styles and their teenagers' (Bianchi & Summala, 2004; Miller & Taubman-Ben-Ari, 2010; Taubman-Ben-Ari & Katz-Ben-Ami, 2012; Taubman-Ben-Ari et al., 2005). Taubman-Ben-Ari and Katz-Ben-Ami (2012) provided evidence that young drivers, aged 17 to 21, who perceived an increase in their parent's involvement in the

process of learning to drive, such as providing encouraging and empowering feedback for safe driving, monitoring their driving, and setting clear limits on breaking traffic laws, perceived their parents to be safe driver role models; consequently, young drivers reported taking risks less frequently, driving more carefully, and being committed to driving more safely when they saw their parents in a positive light. Miller and Taubman-Ben-Ari (2010) found that the more anxious or reckless the parent's driving style, the more likely that their children displayed the same style. Likewise, if the father showed a more careful driving style, then his children were more likely to display a careful style, which is further evidence that children may model their parents' driving style.

Family systems theory. Another theory that may offer an explanation for how parental driving influence is passed on to teenagers is Bowen's family systems theory (Bowen, 1978). Bowen's theory (1978) states that processes, including perceptions, attitudes, values, emotions, and beliefs, are transferred from generation to generation. Therefore, the attitudes, values, and beliefs about driving could be transferred from parent to teenager while the teenager is learning how to drive (Bowen, 1978). Another study by Miller and Taubman-Ben-Ari (2010), suggested that driving styles were transmitted from one generation to another, as their results showed a significant correlation between the teenagers' driving style and the parents' driving style one year after the teenager got his/her license. This suggested transference of belief between generations about the safeness of driving.

Bandura's social learning theory and Brown's family systems theory present differing, yet complementary views on how teenage driving style, behavior, and history are shaped by the family dynamic, primarily through means of direct observation

(Bandura, 1971) or active teaching (Bowen, 1978). As a result, various measurement approaches have been developed to assess driving styles, behaviors, and history.

Driving Factors

With an increased interest in parental influence on teenagers' driving, multiple methods have been developed to measure driving styles, behaviors, and history. Several self-reported measures of driving behaviors have been constructed in the last decade, measuring concepts ranging from driving stress (Gulian, Glendon, Matthews, Davies, & Debney, 1988), driving behaviors related to accident involvement or risky driving behavior (French et al., 1993), attitudes towards driving violations (West & Hall, 1997), frequency with which a person committed various types of errors and violations while driving (Reason, Manstead, Stradling, Baxter, & Campbell, 1990), driving factors ranging from aggression, law breaking and risk taking (Furnham & Saipe, 1993), anxious driving behavior (Clapp et al., 2011), use of vengeance in common driving situations (Wiesenthal, Hennessy, & Gibson, 2000), to the way a person typically drives or their driving style (Taubman-Ben-Ari et al., 2004). This diversity of measurements and the associated driving aspects reflect the complex nature of how researchers measure driving styles, behaviors, and history. Of particular interest to this study were the way a person typically drives or their driving style (Taubman-Ben-Ari et al., 2004) and the frequency with which a person committed various types of errors and violations while driving or their driving behaviors (Reason et al., 1990).

Driving style. To measure driving style, Taubman-Ben-Ari et al. (2004) created the Multidimensional Driving Style Inventory (MDSI) which accounts for a broader scope of driving in general and not just specific driving behaviors. The MDSI is a

self-reported scale that distinguishes four domains of driving styles: (1) reckless and careless, (2) angry and hostile, (3) anxious and (4) patient and careful (Taubman-Ben-Ari et al., 2004). Reckless and careless, angry and hostile, and anxious driving styles are considered to be negative driving styles since the characteristics associated with these driving styles may lead to increased risk for MVCs. On the other hand, patient and careful driving styles are deemed as positive driving styles which are associated with decreased risk of involvement in MVCs (AAA Foundation for Traffic Safety, 2013; Centers for Disease Control and Prevention [CDC], 2012; Dula, Adams, Miesner, & Leonard, 2010).

The reckless and careless domain refers to seeking of thrills and sensations while driving and deliberate violations of normal, safe driving norms. It characterizes drivers who drive at high speeds and take risks while driving, leading to increased risk for MVCs. For example, in 2011, speeding was a contributing factor in 9,944 fatal motor vehicle deaths or 31% of all fatal crashes (National Highway Traffic Safety Administration [NHTSA], 2013). The angry and hostile domain indicates a tendency to act aggressively on the road, curse, blow the horn, or "flash" other drivers (i.e., rapidly turning high light beams on and off) (Taubman-Ben-Ari et al., 2004). It characterizes drivers who express irritation, rage, and hostile attitudes and acts while driving, which impacts driving safety. Research suggested that aggressive actions may have accounted for half of the fatal MVCs from 2003 to 2007 (American Automoblie Assoication [AAA], 2009). The anxious domain of driving style reflects the feelings of alertness and tension as well as ineffective engagement in relaxing activities while driving (Taubman-Ben-Ari et al., 2004). Research has shown that people with higher levels of anxiety were

more likely to be involved in dangerous driving behaviors leading to more crashes and engaging in more driving under the influence than those drivers with low and /or medium anxiety (Dula et al., 2010). The driving domain of the patient and careful driver refers to keeping to the traffic rules, planning ahead, and being attentive, patient, polite, and calm while driving, which reduces the amount of accidents the driver reported being involved in (Taubman-Ben-Ari et al., 2004).

By creating the MDSI, Taubman-Ben-Ari et al. (2004) established a single measurement that measures both concepts of driving style and driving behavior, which provides a more comprehensive look into driving style by incorporating four distinct driving styles on a continuum.. The MDSI can be used cross culturally, as indicated by its previous use in studies targeting drivers from Australia (Kleisen, 2011), Argentina (Kleisen, 2011; Poo, Taubman-Ben-Ari, Ledesma, & Diaz-Lazaro, 2013), and Israel (Taubman-Ben-Ari et al., 2004). The proposed study was among the first to consider its use in a U.S. driver population.

Driving behaviors. To measure driving behaviors, the Manchester Driving Behaviour Questionnaire or Driving Behavior Questionnaire (DBQ) (Reason et al., 1990) was developed as a self-reported questionnaire that allows a driver to make a judgment of their driving behavior. The original DBQ, created by Reason et al. (1990), consisted of 50 items, which covered three domains of aberrant driving behavior: (1) slips and lapses, (2) mistakes (errors), and (3) violations. Associated risk categories were assigned to each item: (1) low, (2) intermediate, and (3) high. Slips and lapses consisted of attention and memory failures resulting in embarrassment but unlikely to impact driving safety risk. Mistakes were failures of planned actions to achieve their intended consequences,

resulting in some possibility of risk to others in general (intermediate risk). Driving violations were "deliberate deviations from those practices believed necessary to maintain the safe operation of a potentially hazardous system" and consisted of both unintended violations and deliberate violations (Reason et al., 1990). Driving violations, especially deliberate violations, resulted in high safety risk or definite safety risk to oneself and others, such as increased speeding while driving (Schwebel, Severson, Ball, & Rizzo, 2006).

Numerous versions of the DBQ have been created over the past 20 years and have been translated into multiple languages (Bianchi & Summala, 2004; Niezgoda, Kamiński, Kruszewski, & Tarnowski, 2013; Varmazyar, Mortazavi, Hajizadeh, & Arghami, 2013). While not all the versions contain the same number of items, all versions generally contain the error and violation domains of driving behavior. Previous research revealed that driving lapses were not associated with crash involvement, thus some versions of the DBQ have dropped this domain. Even with this difference, the DBQ has been widely used as a predictor of self-reported road MVCs (Bianchi & Summala, 2004; Niezgoda et al., 2013; Varmazyar et al., 2013).

Driving history. To measure driving history, two key approaches have been developed. The first approach has been to obtain self-reported measurements of the number of MVCs and the number of driving violation tickets. The second approach has been to obtain a more objective measure of driving history (i.e., crash and driving records) to measure MVCs and driving violation tickets.

Numerous studies have used either crash and/or driving records or self-reported measurements to measure driving history. W. Chen, Cooper, and Pinili (1995) used

driving records identifying the type of violation/crash and found that being involved in prior violations or crashes increased future accident and crash rates; with prior at-fault crashes being a better predictor of future at-fault crashes (W. Chen et al., 1995). Conversely, Begg, Langley, and Williams (1999) used self-reports of any MVC in the past three years, an injury MVC (i.e., anyone involved in crash in which medical attention was sought), or a non-injury MVC (i.e., crash in which medical attention was not sought) and found that previous crash involvement increased the risk of being involved in an injury MVC specifically for males (Begg et al., 1999).

While crash and driving records are more objective, under reporting of MVCs are not uncommon. According to a meta-analysis of 13 countries completed by Elvik and Mysen (1999), the mean reporting level of MVC varied substantially across all countries, with 95 percentage of MVC fatalities being reported in the United States. However, the percentage of MVC drops significantly for property damage only MVCs (i.e., 25%) (Elvik & Mysen, 1999). Self-reported measures suffer from response bias (i.e., social desirability) of the participant or under reporting of MVCs and tickets, with drivers potentially forgetting approximately one-third of MVCs each year regardless of age (Maycock, Lockwood, & Lester, 1991). Even with these difficulties in both approaches to measuring MVCs and driving violation tickets, self-reported MVCs and driving violation tickets have been widely used as a predictor of risky driving behavior.

Objectives

This study sought to be among the first to directly compare multiple driving factors (i.e., driving style, driving behaviors, and driving history) in parent-teenage dyads. There are many reasons why teenagers get into MVCs; however, there has been

limited research on the effects of parental driving factors influences on teenage driving style and on the comparison of numerous driving factors. No published studies have examined this relationship within the United States using the Multidimensional Driving Style Inventory created by Taubman-Ben-Ari et al. (2004). While a number of studies have looked at parental influence on teenage driving by examining teenage driving style, behaviors, and history through surveys and interviews, the majority of studies used only parent-based or teenager-based responses on a single driving factor (i.e., driving style, driving behavior, or driving history) to generate their results.

Hartos et al. (2002) studied parenting practices and teenagers' risky behavior. However, all reports were self-reported by the teenager (Hartos et al., 2002). In another study, Beck et al. (2001) interviewed both parents and their children about parental teaching, parental supervision, parental driving rules and restrictions, unrestricted teenage access to a vehicle, and whether the teenage had ever engaged in a series of risky driving behaviors. Unlike the previous study, Beck et al. (2001) received responses from both parents and their children; however, all questions were related to the parent's monitoring of their teenage driver and about the parental driving (Beck et al., 2001). Even when the studies gathered information on both the parents and their children, information was limited to crash records (Carlson & Klein, 1970; Ferguson et al., 2001) or self-reported scores on the Driving Behavior Questionnaire (Bianchi & Summala, 2004) and it accounted for only one driving factor.

To address these gaps and limitations in the literature on parent-teenage driving relationships, this study investigated the relationship between parents' and teenagers' driving styles using self-report information collected from parent-teenage dyads. This

study examined the relationship between parents and their teenagers' responses on the MDSI (Taubman-Ben-Ari et al., 2004), DBQ (Reason et al., 1990), and driving history, such as the number of moving violation tickets and crashes. The study also sought to investigate which specific parental driving factors significantly predict teenage driving styles. There were 2 specific aims:

AIM 1: To examine the association between teenager's driving factors, which consist of driving styles as measured by the MDSI [1) reckless and careless, 2) angry and hostile, 3) anxious and 4) patient and careful], driving behaviors as measured by the DBQ [1) errors and 2) violations)], and driving history as measured by the Driving Habits and MVC/Tickets Questionnaire (number of MVCs and violations), and parental driving factors (driving style, driving behaviors, and driving history). Pearson correlations were conducted to investigate the association between parents and teenagers' continuous driving factors. Chi-square tests of associations were conducted to investigate the association between parents and teenagers' categorical driving factors.

Hypothesis 1a. It was hypothesized that angry, risky, anxious, and careful driving styles of teenagers will be significantly associated with these respective driving styles in parents.

Hypothesis 1b. It was hypothesized that more driving errors and violations in teenagers will be significantly correlated with more driving errors and violations in parents.

Hypothesis 1c. It was hypothesized that more moving violation tickets and crashes in teenagers will be significantly correlated with more moving violation tickets and crashes in parents.

AIM 2: To investigate the influence of parental driving factors on teenager's driving style over and above teenagers' own driving factors (driving style, driving behavior, and driving history). A series of hierarchical multiple regressions using the enter method were used to determine which parental factors influence teenager's driving styles over and above teenager's driving factors (see Figure 1).

Hypothesis 2a. It was hypothesized that reckless driving parents, as indicated by higher endorsement of reckless and careless driving style, more driving violations and errors, and higher number of moving violation tickets and crashes, will influence teenager's reckless and careless driving style over and above teenager's driving factors.

Hypothesis 2b. It is hypothesized that angry and aggressive driving parents, as indicated by higher endorsement of angry and hostile driving style, more driving violations and errors, higher number of moving violation tickets and crashes, will influence teenager's angry and hostile driving style over and above teenager's driving factors.

Hypothesis 2c. It is hypothesized that anxious parental driving factors, as indicated by higher anxious driving style, more driving violations and errors, and higher number of moving violation tickets and crashes, will influence teenager's anxious driving style over and above teenager's driving factors.

Hypothesis 2d. It is hypothesized that careful parent driving, as indicated by higher patient and careful driving style, fewer driving violations and errors, and lower number of moving violation tickets and crashes, will influence teenager's patient and careful driving style over and above teenager's driving factors.

The aims of this study were addressed through data analysis from a larger study (Senior and Adolescent Naturalistic Driving Study [SANDS]) which examined the patterns of driving mobility, safety, and behavior in younger (16 to 19 year olds) and older drivers (65 and older) through self-reported and naturalistic driving approaches.

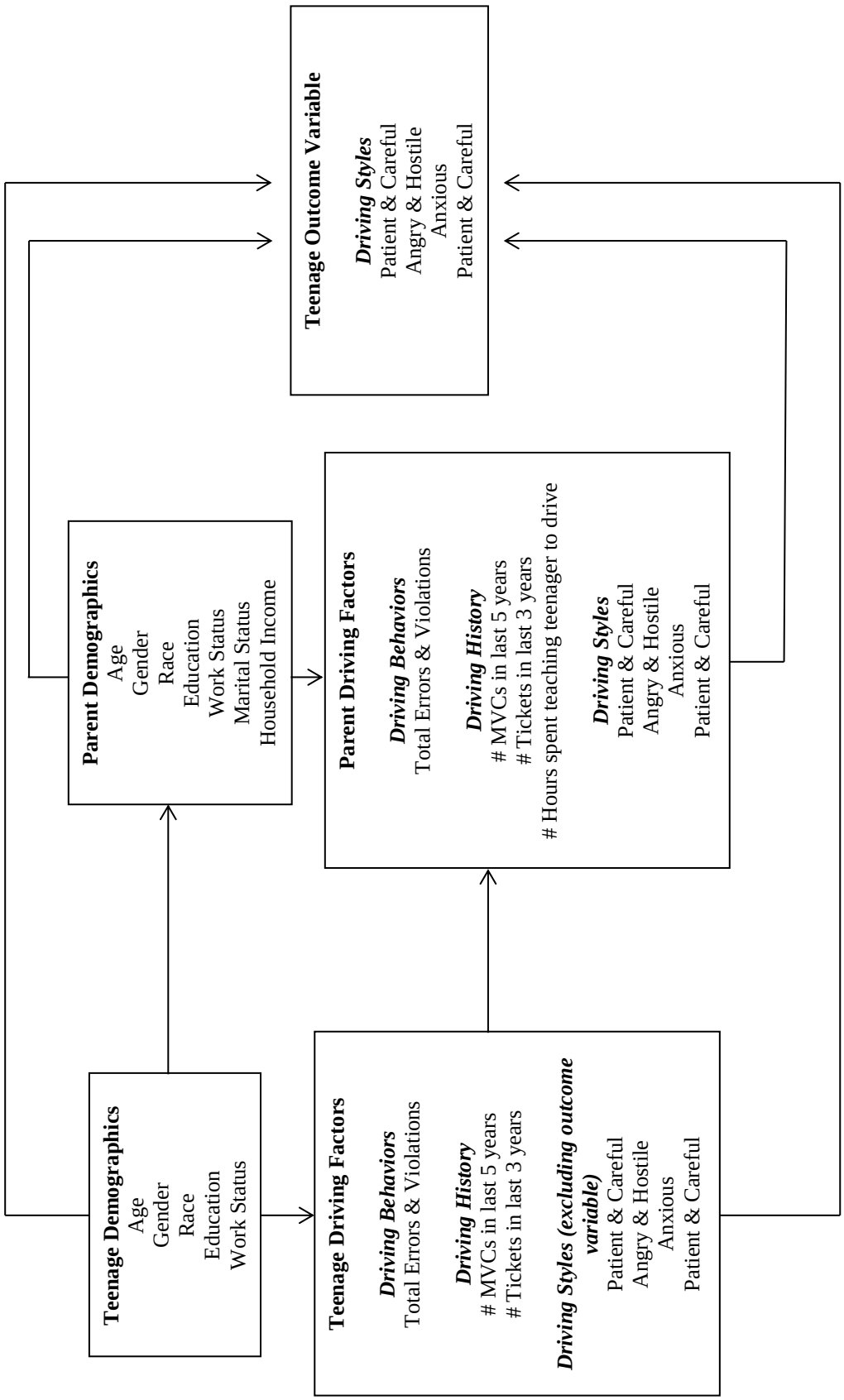

Figure 1. Teen and Parental Factors Influencing Teen Driving Styles

METHOD

Participants

Forty-four parent-teenager dyads, consisting of either a son or daughter teenage driver (16 – 19 years old) and their parents (35 – 59 years old), completed the telephone and baseline phase of SANDS at the University of Alabama at Birmingham. Teenagers and their parents were recruited from the Birmingham area and surrounding cities/ communities using advertisements on social networking websites, flyers, and letters.

Inclusion criteria for teenagers included possession of a valid driver's license, being the owner of a vehicle and primary driver of that vehicle (whom has liability insurance) which was expected to be reliable for at least six months, owning a cell phone with text messaging capability, and having driven, on average, at least three times per week. Inclusion criteria for parents included possession of a valid driver's license, being the owner of a vehicle, having driven, on average, at least three times per week, and having taught their teenager to drive. Teenagers were screened for eligibility, and if eligibility criteria were met, the parent-teenager dyad was scheduled for an appointment.

Overall, ten dyads were excluded from the study for various reasons. Six father-teenager (son or daughter) dyads were excluded from the study due to the low paternal sample size. One mother-son dyad was excluded from the study due to parental withdrawal from study and thus incomplete data for the majority of the measures. One mother-son dyad and one mother-daughter dyad were excluded from the study due to parental non-involvement with teaching the teenager how to drive. One mother-daughter

dyad was excluded from the study due to parental non-valid driver's license. The resulting final sample size included 34 parent-teenager dyads, consisting of either a son or daughter teenage driver (16 – 19 years old) and their mother (35 – 56 years old). All parent-teenage drivers were related biologically.

Teenagers' age at telephone screening ranged from 16 to 19 years (M_{age} = 17.12, *SD* = 1.09), with more females (*n* = 21; M_{age} = 17.00, *SD* = 1.14) than males (*n* = 13; M_{age} = 17.31, *SD* = 1.03) with the mean educational level of 10.71 years (*SD* = 1.45). Approximately 29.40% (*n* = 10) of teenagers were of minority status (African American, Asian, Bi-racial, or Other) and approximately 44.10% (*n* = 15) of teenagers were employed at the time of enrollment.

Mothers' age at baseline ranged from 37 to 56 years (M_{age} = 47.21, *SD* = 4.73), with a mean educational level of 15.88 years (*SD* = 1.98). Approximately 26.47% (*n* = 9) of mothers were of minority status (African American or Asian) and 82.35% (*n* = 28) of mothers were employed at the time of baseline. The overall general descriptive characteristics of the sample are presented in Table 1. Overall means and standard deviations of driving variables of interest are presented in Table 2.

Table 1

Sample Demographic Characteristics (N = 68)

	Teenagers (*n* = 34)		Parents (*n* = 34)		
Demographics	*n (%)*	Mean *(SD)*	*n (%)*	Mean *(SD)*	*p*
Age (years) [a]		17.12 (1.09)		47.21 (4.73)	**<0.001**
16	13 (38.20)				
17	9 (26.50)				
18	7 (20.60)				
19	5 (14.70)				
Gender [b]					**<0.001**
Female	21 (61.80)		34 (100.00)		
Race [b]					*n.s.*
Minority	10 (29.40)		9 (26.50)		
African American	6 (17.60)		7 (20.60)		
Asian	2 (5.90)		2 (5.90)		
Other	2 (5.90)				
Education (years) [a]		10.71 (1.45)		15.88 (1.98)	**<0.001**
Work Status (yes) [b]	15 (44.10)		28 (82.40)		**<0.001**
Household Income[†]					
$30,000-$69,999			6 (17.60)		
$70,000-$99,999			8 (23.50)		
$100,000-$149,999			12 (35.30)		
More than $150,000			8 (23.50)		
Marital Status[†]					
Single, Divorced, or Separated			3 (8.80)		
Married			29 (85.30)		
Widowed			2 (5.90)		
Parent-Teenager Dyad[†]					
Mother/Son			13 (38.20)		
Mother/Daughter			21 (61.80)		

Note. [a] t-test significant difference between groups on continuous variables. [b] Chi- square significant difference between groups on categorical variables. Racial minority included African American, Asian, and Other. [†] Parent only variable.

Table 2
Mean (SD) of Sample's Driving Characteristics (N = 68)

	Teenagers (n = 34)		Parents (n = 34)		
Driving Characteristics	*N (%)*	Mean *(SD)*	*N (%)*	Mean *(SD)*	*p*
Driving Style					
Reckless and Careless (α = 0.728)		2.33 (0.73)		2.07 (0.44)	*n.s.*
Angry and Hostile (α = 0.572) [a]		2.01 (0.72)		1.59 (0.48)	**0.007**
Anxious (α = 0.684)		2.16 (0.52)		1.94 (0.41)	*n.s.*
Patient and Careful (α = 0.680)		4.70 (0.59)		4.78 (0.73)	*n.s.*
Driving Behaviors					
Total Errors and Violations (α = 0.725) [a]		11.15 (6.04)		8.29 (4.35)	**0.029**
Driving History					
MVC in past 5 years (0 MVCs)	22 (64.70)		23 (67.60)		*n.s.*
Tickets in past 3 years (0 Tickets)	24 (70.60)		25 (73.50)		*n.s.*
Involved in teaching teenager to drive[†]					
Mothers			34 (100.00)		
Fathers			25 (73.50)		
Driver's Education Teachers			19 (55.90)		
# of teenagers completed driver's education courses[†]	27 (79.40)				
Public School	23 (67.60)				
Private Instruction	2 (5.90)				
Other	2 (5.90)				
# of hours mothers spent helping teenager learn to drive[†]					
0 hours			0 (0.00)		
1 to 24 hours			6 (17.60)		
25 to 49 hours			10 (24.40)		
50 or more hours			18 (52.90)		

Note. [a] t-test significant difference between groups on continuous variables; [†] Parent only variable.

Procedures

This study was an expansion of a larger study, entitled SANDS, from which data was collected from January 2014 to July 2014. Prospective participants were mailed a University of Alabama at Birmingham (UAB) Institutional Review Board (IRB) approved consent form within 24 hours of scheduling their appointment as well as a set of questionnaires that were to be completed and returned when arriving at the first (baseline) appointment. Reminder calls were made to the participant the day before their appointment to ensure continued interest in participation.

Upon arrival at the first (baseline) appointment, participants provided staff with the signed IRB consent forms. For participants whose age rendered them minors by state law (16 – 18 year olds), a parent was required to be present at the time of their teenager's baseline appointment to provide written IRB consent, in addition to the teenage participant's assent. This was accomplished by signing appropriate documents at the time of the appointment in the presence of a research assistant.

Assessments were administered by a team of trained undergraduate and graduate research assistants using standardized protocols. One trained assistant led the data collection for each participant: teenage driver or parent. Teenage drivers took part in six parts during the larger study: (1) telephone screening, (2) mailed questionnaires, (3) baseline appointment, (4) take home questionnaires, (5) naturalistic data acquisition, and (6) post-test appointment (which occurred in a second and final appointment at UAB). Parents took part in one task during the larger study: (1) a series of tasks and questionnaires during their teenager's first (baseline) appointment. Parent-teenage dyads

completed their respective tasks and questionnaires in separate private rooms in our laboratory.

For the purpose of this study, only the procedures and measures relevant to this study are discussed in further detail below.

Teenagers' Procedure.

Telephone screening. Prospective participants called the number listed in the advertisement and underwent an extensive eligibility screening process. The telephone screening entailed questions about demographics and included the Driving History Questionnaire and Driving Habits and MVC/Tickets Questionnaire. The telephone screening took approximately 45 minutes to complete.

Mailed Questionnaires. After the telephone screening, teenage drivers were mailed a packet of questionnaires upon enrollment in the larger study. This packet was completed at home and returned at the first (baseline) appointment. After obtaining informed consent at the baseline appointment, the research assistant escorted the participant to a private room to review the questionnaires for missing data and to clarify any questions the participant may have had about any of the measures. The mailed questionnaire battery included the Driving Behavior Questionnaire (DBQ) (Reason et al., 1990), the Multidimensional Driving Style Inventory (MDSI) (Taubman-Ben-Ari et al., 2004), and the Learning to Drive Questionnaire - Teenage (LDQ) (Huang, Kao, Curry, & Durbin, 2012). The complete set of mailed questionnaires took approximately one hour to complete.

Parents' Procedure.

Baseline Appointment. After obtaining informed consent at the baseline appointment, parents were escorted to a private room to complete a series of questionnaires. Parents were given the option of completing the questionnaires and tasks individually via pen and paper or with the assistance of a research assistant. The questionnaires were divided into two parts: questions about themselves (i.e., parent) and questions about their teenager (i.e., teenage driver). The questionnaire about themselves included demographics, Driving History Questionnaire, Driving Habits and MVC/Tickets Questionnaire, DBQ (Reason et al., 1990), the MDSI (Taubman-Ben-Ari et al., 2004), and the Learning to Drive Questionnaire – Parent (LDQ) (Huang et al., 2012). Parents took approximately two hours to complete their portion of the study.

Measures

Demographics. Teenage drivers reported their age, gender, race, highest level of education completed, and driving status (e.g., current driver with valid driving license), through a detailed telephone interview. Having a valid driver's license was validly documented in person. In addition to the all items listed above, parents reported family household income, marital status, and relationship to teenage (i.e., mother or father) during their baseline appointment. Gender and race were dichotomous variables. Females were coded as zero (0) and males were coded as one (1). Racial minorities were coded as zero (0) and whites were coded as one (1). This study used teenager demographics as covariates and parent demographics as predictors. Driving status (i.e., current driver with valid driving license) was used as an inclusion criterion for the study.

Multidimensional Driving Style Inventory. Driving style was evaluated with the MDSI. The MDSI (Taubman-Ben-Ari et al., 2004) is a 44 item measure that assessed driving style of parents and teenagers. Each item asked the participant to indicate to what extent the statement fit his/her feelings, thoughts, and behaviors while driving and was measured on a six-point scale (1 = not at all to 6 = very much). Items were further divided into four-driving styles structure based on previous research (Taubman-Ben-Ari et al., 2004, 2005). The four driving style structure included: (1) reckless and careless (e.g., I usually enjoy the excitement of dangerous driving), (2) angry and hostile (e.g., I often swear at other drivers), (3) anxious (e.g., I feel nervous while driving) and (4) patient and careful (e.g., I tend to drive cautiously). In previous studies, the Cronbach's alpha reliability coefficients for the MDSI factors ranged from 0.72 to 0.79 for mothers and 0.76 to 0.84 for teenage drivers.

In this study, driving style subscales were computed by averaging participant responses to the particular items in each factor, with higher scores indicating higher endorsement of the relevant driving style for the four-factor driving style structure. This study used the teenagers' driving style as the dependent variable and the parental driving styles as a predictor.

Driving Behavior Questionnaire. Driving behavior was evaluated with the DBQ. The DBQ (Reason et al., 1990) is a 19 question questionnaire that examined self-reported risk-related driving. Items were rated by participants using a six-point scale (0 = "never" to 5 = "nearly all the time"). Items from the DBQ were further divided into two categories—errors (e.g., trying to pass someone I didn't notice was signaling to turn right) and violations (e.g., tailgating to "signal" to the driver of the car in front of me to

go faster) —based on whether the risky driving behavior addressed in the question was intentional (i.e., a violation) or a mistake (i.e., an error) (Garner et al., 2012). A total score was computed combining errors and violations, with higher scores indicating higher rates of negative driving behaviors (Fried et al., 2006). Cronbach's alpha value equaled 0.76 and 0.67 for violations and errors, respectively. This study used the combined total score of errors and violations as a predictor.

Learning to Drive Questionnaire. The Learning to Drive Questionnaire (LDQ) (Huang et al., 2012) is a questionnaire which assessed self-reported variables of interest including parental monitoring, parental limits, and parental investment in driving safety. Parental monitoring was assessed by the number of tickets or MVCs the teenage had been involved in. Parental limits were assessed by the amount of driving restrictions placed on the teenager. Parental investment in driving safety was assessed by the number of hours spent learning to drive and who taught the teenager how to drive.

There were two versions of the LDQ, one for teenage drivers and one for parents. The teenage driver LDQ had 37 questions and the parent LDQ had 52 questions. In addition to the questions asked on the teenage driver LDQ, the parent LDQ measured the parent's knowledge of their teenage driver's driving history, such as speeding tickets or MVCs.

In this study, parent LDQ response to the parent investment question of who taught the teenager how to drive was used as an inclusion criterion. Parent response to number of hours spent learning to drive was used as a parental predictor.

Driving Habits and MVC/Tickets Questionnaire. Driving history was measured by 24 questions on the laboratory-created Driving Habits and MVC/Tickets

Questionnaire (Welburn, Garner, Franklin, Fine, & Stavrinos, 2011). Variables of interest included the number of tickets received in the past three years and number of MVCs in the past five years. These variables of interest were recoded into dichotomous variables. Zero represented having received no tickets or not being involved in a MVC within the respective timeframe, whereas, one represented receiving one or more tickets or being involved in one or more MVCs. These recoded variables were used as predictors.

Data Analyses

Preliminary Analyses. All analyses were conducted using SPSS 22.0 for Windows. Prior to conducting correlational and regression analyses, the data were examined via a rigorous data entry process. The data entry process consisted of three phases: (1) scoring, (2) data entry, and (3) data cleaning. For the scoring and data entry phase, once the initial scoring/data entry was completed, a research assistant double checked the results of data entry. Five percent of data points were found to have an error in initial data entry which was subsequently corrected prior to data analysis. The data cleaning phase consisted of checking for impossible variable values, missing data, and outliers (i.e., data points of absolute value 3.29 *SDs* from the mean).

Descriptive statistics on all measures were inspected for normality. A variety of transformations (square root and logarithmic) were performed on influential outliers, which were only found for the marital status variable (data points $\geq$ -3.29 or $\leq$ 3.29 SDs from the mean) and distributional properties were re-examined. While the transformed variables distributional properties improved, the ability to interpret the data decreased as all outliers were (1) true data points and (2) only located on either the teenagers' rating of

the variable or the parents' rating of the variable; thus, the original, raw data values were used in these analyses (Orr, Sackett, & Dubois, 1991).

A series of independent sample t-tests and unequal variance t-tests were conducted to examine whether group differences (parent vs teenager) existed between demographic variables (e.g., age, education, race, and work status) and on several driving factors (e.g., driving style, driving behaviors, and driving history). Pearson and point biserial correlations were conducted between demographic variables to examine potential covariates. Upon further inspection, a series of Analyses of Covariance (ANCOVAs) were conducted to inspect whether group differences existed on several of the driving factors (e.g., driving style and driving behavior). Age served as the covariate in the analyses.

Primary Analyses. The primary data analysis proceeded in the following manner:

Specific AIM 1: Examine the association between teenagers' driving factors, which consist of driving styles as measured by the MDSI [1) reckless and careless, 2) angry and hostile, 3) anxious and 4) patient and careful], driving behaviors as measured by the DBQ [1) errors and 2) violations)], and driving history as measured by the Driving Habits and MVC/Tickets Questionnaire (number of MVCs and violations), and parental driving factors (driving style, driving behaviors, and driving history). We predicted that teenagers' driving styles, driving behaviors, and driving history would be significantly correlated with their parents' driving style, driving behaviors, and driving history. Aim 1 hypotheses were tested using Pearson correlations for continuous variables and Pearson chi-square test of associations were conducted for

categorical variables to examine differences in driving style, driving behavior, and driving history between the two groups (parents vs teenagers).

Specific AIM 2: To investigate the influence of parental driving factors on teenager's driving style over and above teenagers' own driving factors (driving style, driving behavior, and driving history), while controlling for teenager demographics and teenager driving factors. Prior to conducting a series of hierarchical multiple regressions, Pearson and point biserial correlations of all possible predictor variables (e.g., parental driving styles, driving behavior, and driving history) with the dependent variables (e.g., teenager's reckless and careless driving style, angry and hostile driving style, anxious driving style, and patient and careful driving style) were examined. Predictors significantly correlated to any of the dependent variables were retained in the subsequent hierarchical multiple regressions.

A series of hierarchical multiple regressions using the enter method were used to determine which parental factors influenced teenagers' driving styles over and above teenagers' driving factors. Teenagers' driving styles (e.g., reckless and careless, angry and hostile, anxious, and patient and careful) served as the dependent variable in each model. This method determined if adding each category of factors increased the amount of variance explained by the block. If more variance was explained by the subsequent block, the factor influences teenagers' driving style over and above the previous factors. Four separate hierarchical multiple regressions were ran for each subscale representing a different driving style. Three blocks were included in each of the hierarchical multiple regression. The first block contained the covariates. The second block contained teenagers' predictors and the third block contained parental predictors. If the parental

predictors explained more variance than the previous block, the individual parental predictor influenced teenagers' driving style over and above teenagers' driving style. We predicted that reckless parent driving, angry and aggressive parent driving, anxious parents driving, and careful parent driving would predict teenagers' reckless and careless, angry and hostile, anxious, and patient and careful driving styles.

Secondary Analyses. Secondary analyses were conducted to examine the differences between parent and teenager driving styles using a series of independent t-tests and unequal variance t-tests.

RESULTS

Preliminary Analyses

Chi-square tests for association were conducted between groups on categorical demographic variables revealing associations between gender, χ^2 (1, N = 68) = 21.124, p < 0.001, and work status, χ^2 (1, N = 68) = 11.096, p < 0.001 between groups, but no association between race of the two groups. Findings revealed that parents were all females (100% of parents were female while only 61.80% of teenagers were female) and tended to be employed (82.40% of parents were employed while 44.10% of teenagers were employed).

Independent sample t-tests were conducted to examine differences between groups on continuous demographic variables, including age and education and revealed differences between the two groups. Upon inspection, unequal population variance was detected for the demographic variable of age, thus an unequal variance t-test was performed. Findings revealed parents were older (M = 47.21, SD = 4.73) than teenagers (M = 17.12, SD = 1.09), t (36.527) = 26.961, p < 0.001, and parents (M = 15.88, SD = 1.98) were more educated than teenagers (M = 10.71, SD = 1.45), t (66) = 2.056, p < 0.001.

Chi-square tests of association were conducted to examine differences between groups on categorical driving variables, including number of MVCs in past five years and number of tickets received in past three years and revealed no associations between the two groups (Table 3).

Table 3
Chi-square tests of association on Categorical Driving Variables

		Teenagers	Parents	χ^2	φ
Driving History					
MVC in past 5 years					
	YES	12	11		
	NO	22	23		
				0.066	-0.031
Tickets in past 3 years					
	YES	10	9		
	NO	24	25		
				0.073	-0.033

Note. φ = Phi; *n.s.* = not significant; MVC and Tickets = dichotomous variables with 0 = none and 1 = 1 or more.

To further understand this relationship between age, education, gender, and work status, Pearson correlations (for continuous variables) and point biserial correlations (for categorical variables) were conducted and revealed significant, positive correlations between age and education; age and work status; and education and work status, r = 0.819, r = 0.358, and r = 0.348 respectively. A significant, negative correlation was revealed between age and gender and between gender and education, r = -0.468 and r = -0.384 respectively. As education, gender, and work status were significantly correlated with age and in conjunction with inspection of skewness and kurtosis for the variables of age, education, gender, and work status, age was retained as a covariate in all subsequent analyses.

A series of Analyses of Covariance (ANCOVAs) examined differences between the groups (parent vs teenager) on driving variables of interest (age served as the covariate) and revealed no significant differences between the two groups (Table 4).

Table 4
Between Group Comparisons on Continuous Driving Variables with Age as Covariate

	Teenagers	Parents	*F*	*η2*
Driving Style				
Reckless and Careless	2.33 (0.73)	2.07 (0.44)	0.714	0.011
Angry and Hostile	2.01 (0.72)	1.59 (0.48)	0.003	0.000
Anxious	2.16 (0.52)	1.94 (0.41)	0.125	0.002
Patient and Careful	4.70 (0.59)	4.78 (0.73)	1.609	0.024
Driving Behaviors				
Total Errors and Violations	11.15 (6.04)	8.29 (4.35)	0.063	0.001

Note. η2 = partial eta square.

Primary Analyses

Specific AIM 1: Examine the association between teenagers' driving factors, which consist of driving styles as measured by the MDSI [1) reckless and careless, 2) angry and hostile, 3) anxious and 4) patient and careful], driving behaviors as measured by the DBQ [1) errors and 2) violations)], and driving history as measured by the Driving Habits and MVC/Tickets Questionnaire (number of MVCs and violations), and parental driving factors (driving style, driving behaviors, and driving history). After determining the continuous and categorical variables of interest, the linear relationship was assessed between the parent and teenager's driving style and driving behaviors. Visual inspection showed the relationships to be linear in nature and normally distributed. Several outliers were detected; yet upon inspection of the transformations, distributional properties weakened, thus original, raw data points were used in these analyses. Pearson and point biserial correlations were conducted to examine associations between parents and teenagers' continuous driving factors. Pearson chi-square tests of associations were conducted for categorical driving factors.

Hypothesis 1a. A Pearson correlation was conducted in order to examine the associations between reckless and careless, angry and hostile, and patient and careful driving styles of teenagers and their respective driving styles in parents and revealed no significant correlations between driving styles of teenagers and parents (Table 5).

Table 5

Intercorrelation Matrix for Driving Styles

			Parent			
			1	2	3	4
Teenager	1	Reckless & Careless	**-0.064**	-0.253	-0.066	-0.053
	2	Angry & Hostile	-0.032	**-0.059**	-0.109	-0.135
	3	Anxious	-0.141	-0.258	**-0.103**	0.080
	4	Patient & Careful	0.126	0.342*	0.389*	**0.000**

Note. *p < 0.05; **p < 0.01; ***p < 0.001.

Hypothesis 1b. Pearson correlations were conducted to examine the associations between teenagers' driving errors and violations and parents' driving errors and violations and revealed no associations between parent and teenagers' driving errors and violations (Table 6).

Table 6

Intercorrelation Matrix for Driving Errors and Violations

			Parent		
			1	2	3
Teenager	1	Errors	**0.075**	0.119	0.119
	2	Violations	0.097	**0.210**	0.188
	3	Total Errors and Violations	0.111	0.178	**0.178**

Note. *p < 0.05; **p < 0.01; ***p < 0.001.

Hypothesis 1c. Pearson chi-square tests of associations were conducted to examine the associations between teenagers' and parents' moving violations tickets and motor vehicle crashes and revealed no associations (Table 3).

Specific AIM 2: To investigate the influence of parental driving factors on teenagers' driving style over and above teenagers' own driving factors (driving style, driving behavior, and driving history). Pearson and point biserial correlations for all variables (for continuous and categorical variables, respectively) were examined (Table 7-9). Strong correlations ($r > 0.70$, $p < 0.01$) were revealed between race of parent and teenager and marital status of parent and household income of parent, $r = 0.93$ and $r = -0.77$ respectively. To account for multicollinearity between these variables, it was determined that as the dependent variable was teenager's driving style for the hierarchical multiple regression analyses, only teenager race were used in further analyses. Furthermore, upon inspection of the distribution of data points for the variables of marital status of parent and household income of parent, household income was retained as the variable of further analyses. Household income was chosen in part because the distribution of income was greater across parents than marital status of parents, as approximately 85% of parents were married.

Table 7

Correlation Table for Teenage Variables

	Teenage Variables	1	2	3	4	5	6	7	8	9	10	11
1	Age	1										
2	Gender	0.14	1									
3	Race	**-0.41***	-0.02	1								
4	Work Status	-0.04	0.03	0.05	1							
5	Reckless & Careless Driving Style	0.29	0.20	0.07	0.17	1						
6	Angry & Hostile Driving Style	0.19	0.07	0.25	0.14	**0.40***	1					
7	Anxious Driving Style	0.13	**-0.41***	0.22	0.04	0.25	0.10	1				
8	Patient & Careful Driving Style	-0.19	-0.06	-0.17	-0.33	**-0.63****	-0.26	-0.14	1			
9	Total Errors & Violations	**0.37***	-0.02	0.05	-0.01	**0.73****	0.23	**0.43***	**-0.55****	1		
10	MVCs in last 5 years	0.26	-0.20	-0.06	0.21	0.26	0.28	**0.40***	-0.24	0.22	1	
11	Tickets in last 3 years	**0.35***	**0.42***	-0.01	-0.05	0.24	0.19	0.05	-0.10	0.15	0.06	1

Note. MVC and Tickets = dichotomous variables with 0 = none and 1 = 1 or more. ***$p < 0.001$; **$p < 0.01$; *$p < 0.05$.

Table 8

Correlation Table for Parent Variables

Parent Variables		1	2	3	4	5	6	7	8	9	10	11	12	13
1	Age	1												
2	Race	0.03	1											
3	Marital Status	**0.36***	0.11	1										
4	Household Income	-0.31	0.05	**-0.77****	1									
5	Work Status	-0.23	0.25	-0.11	0.05	1								
6	Reckless & Careless Driving Style	**-0.42***	0.09	-0.32	0.31	0.12	1							
7	Angry & Hostile Driving Style	-0.22	0.13	-0.21	0.25	0.22	**0.52****	1						
8	Anxious Driving Style	-0.21	-0.21	-0.29	0.25	-0.08	0.08	0.30	1					
9	Patient & Careful Driving Style	0.26	-0.08	0.16	-0.27	-0.24	**-0.49****	**-0.37***	0.20	1				
10	Total Errors & Violations	-0.17	0.27	-0.09	0.10	0.07	0.22	**0.41***	0.24	-0.06	1			
11	MVCs in last 5 years	-0.26	0.13	-0.15	0.20	0.16	0.23	-0.23	**-0.41***	-0.15	-0.00	1		
12	Tickets in last 3 years	0.13	-0.24	-0.11	0.11	-0.15	0.12	0.04	-0.04	0.15	0.16	0.16	1	
13	# hours spent helping your teenager learn to drive	-0.12	-0.25	0.11	-0.02	0.01	0.07	0.07	0.06	-0.12	-0.11	-0.16	-0.19	1

Note. MVC and Tickets = dichotomous variables with 0 = none and 1 = 1 or more; # of Hours = categorical variable with 3 = more than 50 hours, 2 = between 25-49 hours, 1 = between 1-24 hours, and 0 = no hours. ***$p < 0.001$; **$p < 0.01$; *$p < 0.05$.

Table 9
Correlation Table for Teenage and Parent Variables

		Teenage Variables										
	Variables	Age	Gender	Race	Work Status	Reckless & Careless Driving Style	Angry & Hostile Driving Style	Anxious Driving Style	Patient & Careful Driving Style	Total Violations & Errors	MVCs in last 5 years	Tickets in last 3 years
Parent Variables	Age	0.21	-0.03	0.06	0.32	0.23	0.16	0.17	-0.17	0.15	**0.50****	0.01
	Race	-0.31	-0.08	**0.93****	0.00	0.09	0.18	0.19	-0.27	0.09	-0.11	-0.05
	Marital Status	0.21	0.15	0.13	0.33	0.21	**0.57****	-0.12	-0.27	0.11	**0.41***	0.11
	Household Income	-0.18	0.00	0.02	**-0.53****	-0.19	**-0.35***	-0.01	0.24	-0.18	**-0.52****	0.06
	Work Status	-0.24	0.05	0.21	-0.05	0.07	-0.14	-0.13	0.03	-0.20	0.02	-0.04
	Reckless & Careless Driving Style	-0.29	0.04	0.16	-0.14	-0.06	-0.03	-0.14	0.13	-0.07	-0.28	0.27
	Angry & Hostile Driving Style	-0.32	0.01	0.21	-0.27	-0.25	-0.06	-0.26	**0.34***	**-0.35***	-0.30	-0.13
	Anxious Driving Style	0.00	-0.02	-0.17	-0.26	-0.07	-0.11	-0.10	**0.39***	-0.09	-0.14	0.00
	Patient & Careful Driving Style	0.09	-0.22	-0.12	0.14	-0.05	-0.13	0.08	0.00	0.15	0.17	-0.22
	Total Errors & Violations	0.05	0.09	0.26	-0.21	0.07	0.01	-0.13	0.06	0.18	-0.29	0.06
	MVCs in last 5 years	-0.02	-0.03	0.03	-0.23	0.10	0.04	0.26	-0.09	0.17	-0.12	0.24
	Tickets in last 3 years	-0.19	0.08	-0.20	0.00	0.21	-0.12	-0.03	-0.05	0.22	-0.02	-0.24
	# hours spent helping your teenager learn to drive	0.20	**0.35***	-0.29	0.21	-0.29	-0.08	**-0.63****	0.09	**-0.47****	-0.26	0.04

Note. MVC and Tickets = dichotomous variables with 0 = none and 1 = 1 or more; # of Hours = categorical variable with 3 = more than 50 hours, 2 = between 25-49 hours, 1 = between 1-24 hours, and 0 = no hours. ****p* < 0.001; ***p* < 0.01; **p* < 0.05.

Pearson correlations for all potential predictors were examined (Table 10). Only significant correlations were retained in the final hierarchical regression analyses. While parental driving style was not significantly correlated with teenage driving style, theoretical consideration for parental driving style influencing teenage driving style prompted the inclusion of parental driving style into the final hierarchical regression analyses (Miller & Taubman-Ben-Ari, 2010). Several predictors were marginally correlated ($p < 0.10$) but were not included into the final regression analysis.

The following predictors were retained for further inspection of teenagers' reckless and careless driving style: teenagers' total driving errors and violations ($r = 0.73$, $p < 0.001$) and teenagers' patient and careful driving style ($r = -0.63$, $p < 0.001$). Other significant ($p < 0.05$) predictors of teenagers' reckless and careless driving style with moderate correlation included: teenagers' angry and hostile driving ($r = 0.39$) and age of teenager ($r = 0.29$).

Further inspection of the following predictors of teenagers' angry and hostile driving style included teenagers' reckless and careless driving style ($r = 0.39$, $p < 0.05$) and parental report of household income ($r = -0.35$, $p < 0.05$).

The following predictors were retained for inspection of teenagers' anxious driving style, which included parental involvement in the number of hours spent helping their teenager learn how to drive ($r = -0.63$, $p < 0.001$). Other significant ($p < 0.05$) predictors of teenagers' anxious driving style included gender of teenager (with females exhibiting higher levels of anxious driving styles) ($r = -0.41$), teenagers' report of total driving errors and violations ($r = -0.40$), and teenagers' report of getting into a MVC in past five years ($r = 0.40$).

Finally, further inspection of the following predictors of teenagers' patient and careful driving style included teenagers' reckless and careless driving style (r = -0.63, p < 0.001) and teenagers' report of the combination of driving errors and violations (r = -0.55, p < 0.001). Parental anxious driving style (0.39), parental angry and hostile driving style (r = 0.34) and teenagers' work status (-0.33) were also significant (p <0.05) predictors of teenagers' patient and careful driving style.

Table 10

Correlation Matrix of All Potential Predictors and the Outcome Variables

		Teenager Outcome Variables			
		Reckless & Careless Driving Style	Angry & Hostile Driving Style	Anxious Driving Style	Patient & Careful Driving Style
Teenager Potential Predictors	Age	**0.29***	0.19	0.13	-0.19
	Gender	0.21	0.07	**-0.41****	-0.06
	Race	0.07	0.25┼	0.23	-0.17
	Work Status	0.17	0.14	0.04	**-0.33***
	Reckless & Careless Driving Style	---	**0.40****	0.25	**-0.63*****
	Angry & Hostile Driving Style	**0.40****	---	0.10	-0.26┼
	Anxious Driving Style	0.25┼	0.10	---	
	Patient & Careful Driving Style	**-0.63*****	-0.26┼	-0.14	---
	Total Errors & Violations	**0.73*****	0.23┼	**-0.40****	**-0.55*****
	MVC in past 5 years	0.26┼	0.28┼	**0.40****	-0.24┼
	Tickets in past 3 years	0.24┼	0.19	0.17	-0.10
Parent Potential Predictors	Age	0.23┼	0.16	0.19	-0.17
	House Hold Income	-0.19	**-0.35***	-0.13	0.24┼
	Work Status	0.07	-0.14	-0.14	0.03
	Reckless & Careless Driving Style	-0.06	-0.03	-0.14	0.13
	Angry & Hostile Driving Style	-0.25┼	-0.06	-0.26┼	**0.34***
	Anxious Driving Style	-0.07	-0.11	-0.10	**0.39***
	Patient & Careful Driving Style	-0.05	-0.14	0.08	0.00
	Total Errors & Violations	0.07	0.01	-0.13	0.06
	MVC in past 5 years	0.10	0.04	0.26┼	-0.10
	Tickets in past 3 years	0.21	-0.12	-0.03	-0.05
	# of hours spent helping teenager learn to drive	-0.29┼	-0.08	**-0.63*****	0.09

Note. ┼$p < 0.10$;*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Upon determining predictors for the series of hierarchical regression analyses, the independence of residuals, as assessed by Durbin Watson for all regression analyses, were inspected and were within the acceptable range of 1.5 to 2.5, with a value of 2 indicating no correlations between variables. Visual inspection of studentized residuals against the unstandardized predicted values, as well as all partial regression plots, for all regression analyses showed a linear relationship or an approximately linear relationship. Further visual inspection revealed equal spread of residuals across all values of the predicted dependent variables. Predictors were not highly correlated between one another and the tolerance and VIF values were well below the levels of concern for multicollinearity. Neither outliers nor influential data points were found and the distributions of residuals were approximately normally distributed for all regression analyses.

Hypothesis 2a. A three block hierarchical linear regression analysis was used to determine the factors that influenced teenagers' reckless and careless driving style over and above the teenagers' own driving factors. Results of the hierarchical regression analysis are shown in Table 11. In the first block, covariates, including age of teenagers and parents, were simultaneously entered; in the second block, teenagers' total driving errors and violations, teenagers' angry and hostile driving style, and teenagers' patient and careful driving style were entered. In the third and final block, parental reckless and careless driving style was entered.

Covariates, entered in the first block, were not significant predictors of teenagers' reckless and driving style, F (2, 31) = 2.051, p = 0.146 and only accounted for 11.7% of the variation in teenager's reckless and careless driving style. When the teenage

predictors were added in the second block, the prediction model explained an additional 53.40% of the variation in teenagers' reckless and careless driving style and this change in R^2 was statistically significant, F (3, 28) = 14.245, p = 0.001. The prediction model was statistically significant, F (5, 28) = 10.419, p = 0.001, R^2 = 0.650, Adjusted R^2 = 0.588. In the second block, teenage report of greater total driving errors and violations predicted higher teenagers' reckless and careless driving style. Conversely, teenage reporting of lower patient and careful driving style predicted higher teenage reckless and careless driving style.

For the last and final block, while the model increased in predictive power, F (6, 27) = 8.463, p = 0.001, R^2 = 0.653, Adjusted R^2 = 0.576, the change in R^2 was not statistically significant, F (1, 27) = 0.190, p = *n.s.* With the inclusion of the parent variable, the prediction model explained an additional 0.2% of the variation within teenagers' reckless and careless driving. No parent demographic variables were predictive of teenagers' reckless and careless driving style.

Generally, with all other variables in the analysis statistically controlled, teenagers who reported higher levels of total driving errors and violations endorsed higher reckless and careless driving styles. Teenagers who reported lower patient and careful driving style endorsed higher reckless and careless driving style. Parental variables were not predictive of teenagers' reckless and careless driving style.

Table 11

Hierarchical Multiple Regression Predicting Teenager's Reckless and Careless Driving Style

	Teenager's Reckless and Careless Driving Style					
	Model 1 - Covariates		Model 2 - Teenager's Predictors		Model 3 – Parent's Predictors	
Variable	B	β	B	β	B	β
Constant	-1.900		2.396		1.930	
Age_T	0.171	0.256	-0.004	-0.006	0.006	0.009
Age_P	0.028	0.179	0.012	0.075	0.015	0.097
Angry and Hostile Driving Style_T			0.198	0.195	0.194	0.191
Patient and Careful Driving Style_T			-0.351*	-0.28	-0.358*	-0.285
Total Errors and Violations_T			0.063***	0.521	0.062***	0.514
Reckless and Careless Driving Style_P					0.095	0.057
R^2 Statistics and Goodness-of-fit						
R^2	0.117		0.650		0.653	
F	2.051		10.419***		8.463***	
$\triangle R^2$	0.060		0.588		0.576	
$\triangle F$	2.051		14.245***		0.190	
AIC	-20.585		-46.094		-44.332	
BIC	-16.006		-36.936		-33.648	

Note. N = 34. T indicated teenager predictor. P indicated parent predictor. *p < 0.05; **p < 0.01; ***p < 0.001.

Hypothesis 2b. A three block hierarchical linear regression analysis was used to predict the factors that influenced teenagers' angry and hostile driving style over and above the teenagers' own driving factors. Results of the hierarchical regression analysis are shown in Table 12. In the first block, covariates, including age of teenagers and parents, were simultaneously entered; in the second block, teenagers' reckless and careless driving style was entered. In the third and final block, parental report of household income and parental angry and hostile driving style were entered simultaneously as the primary variables of interest.

Covariates, entered in the first block, were not significant predictors of teenagers' angry and hostile style, F (2, 31) = 0.839, p = *n.s.*, and only accounted for 5.1% of the variation in teenagers' angry and hostile driving style. When the teenage predictors were added into the second block, the prediction model explained an additional 11.7% of the variation in teenagers' angry and hostile driving style and this change in R^2 was statistically significant, F (1, 30) = 4.232, p = 0.048. The prediction model was not significant, F (3, 30) = 2.028, p = *n.s.*, R^2 = 0.169, Adjusted R^2 = 0.085. In the second block, teenage report of higher reckless and careless driving styles predicted higher teenagers' angry and hostile driving style.

For the last and final block, the model decreased in predictive power, F (5, 28) = 1.881, p = *n.s.*, R^2 = 0.251, Adjusted R^2 = 0.118, and the change in R^2 was not statistically significant, F (2, 28) = 1.549, p = *n.s.* With the inclusion of two parent variables, the prediction model explained an additional 8.3% of the variation within teenagers' angry and hostile driving. No teenager or parent variables were predictive of teenagers' angry and hostile driving style.

Generally, with all other variables in the analysis statistically controlled, neither teenage nor parental variables were predictive of teenagers' angry and hostile driving style.

Table 12

Hierarchical Multiple Regression Predicting Teenager's Angry and Hostile Driving Style

	Teenager's Angry and Hostile Driving Style					
	Model 1 - Covariates		Model 2 - Teenager's Predictors		Model 3 – Parent's Predictors	
Variable	B	*β*	B	*β*	B	*β*
Constant	-0.741		-0.057		0.948	
Age_T	0.108	0.163	0.046	0.070	0.048	0.073
Age_P	0.019	0.126	0.009	0.061	0.000	-0.002
Reckless and Careless Driving Style_T			0.360*	0.364	0.351	0.355
Household Income_P					-0.089	-0.300
Angry and Hostile Driving Style_P					0.193	0.128
R^2 Statistics and Goodness-of-fit						
R^2	0.051		0.169		0.251	
F	0.839		2.028		1.881	
$\triangle R^2$	-0.010		0.085		0.118	
$\triangle F$	0.839		4.232		1.549	
AIC	-18.970		-21.457		-21.024	
BIC	-14.391		-15.352		-11.866	

Note. $N = 34$. T indicated teenager predictor. P indicated parent predictor. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Hypothesis 2c. A three block hierarchical linear regression analysis was used to predict the factors that influenced teenagers' anxious driving style over and above the teenagers' own driving factors. Results of the hierarchical regression analysis are shown in Table 13. In the first block, covariates, including age of teenagers and parents, were simultaneously entered; in the second block, teenagers' gender, teenagers' total driving errors and violations, and teenagers' report of getting into a MVC in past five years were entered. In the third and final block, parental involvement in the number of hours spent helping their teenager learn how to drive and parental anxious driving style were entered simultaneously as the primary variables of interest.

Covariates, entered in the first block, were not significant predictors of teenagers' anxious driving style, F (2, 31) = 0.631, p = *n.s.*, and only accounted for 3.9% of the variation in teenagers' anxious driving style. When the teenager predictors were added in the second block, the prediction model explained an additional 36.4% of the variation in teenagers' anxious driving style and this change in R^2 was statistically significant, F (3, 28) = 5.698, p = 0.004. The prediction model was also statistically significant, F (5, 28) = 3.786, p = 0.010, R^2 = 0.403, Adjusted R^2 = 0.297. In the second block, teenage report of higher levels of total driving errors and violations predicted higher teenagers' anxious driving style. Males predicted lower teenagers' anxious driving style.

In the last and final block, when the parental factors were added, the prediction model explained an additional 13.8% of the variation in teenagers' anxious driving style. The model increased in predictive power and was statistically significant, F (7, 26) = 4.389, p = 0.002, R^2 = 0.542, Adjusted R^2 = 0.418. In the third block, the more time a

parent spent helping their teenager learn to drive, the lower the teenagers' anxious driving style.

Generally, with all other variables in the analysis statistically controlled, the more time a parent spent helping their teenager learn to drive, the lower the teenagers' anxious driving style. Teenage factors were not predictive of teenagers' patient and careful driving style.

Table 13

Hierarchical Multiple Regression Predicting Teenager's Anxious Driving Style

	Teenager's Anxious Driving Style					
	Model 1 - Covariates		Model 2 - Teenager's Predictors		Model 3 - Parent ‘s Predictors	
Variable	B	*β*	B	*β*	B	*β*
Constant	0.545		2.142		1.611	
Age_T	0.049	0.102	-0.010	-0.022	0.101	0.211
Age_P	0.016	0.149	-0.003	-0.026	-0.005	-0.046
Male_T			-0.367*	-0.346	-0.238	-0.225
Total Errors and Violations_T			0.033*	0.381	0.006	0.073
MVC in past 5 years_T			0.282	0.261	0.171	0.159
Anxious Driving Style_P					-0.075	-0.059
# of hours spent helping teenager learn to drive_P					-0.352**	-0.521
R^2 Statistics and Goodness-of-fit						
R^2	0.039		0.403		0.542	
F	0.631		3.786**		4.389**	
ΔR^2	-0.023		0.297		0.418	
ΔF	0.631		5.698**		3.921*	
AIC	-40.526		-50.728		-55.691	
BIC	-35.947		-41.569		-43.480	

Note. N = 34. T indicated teenager predictor. P indicated parent predictor. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Hypothesis 2d. A three block hierarchical linear regression analysis was used to predict the factors that influenced teenagers' patient and careful driving style over and above the teenagers' own driving factors. Results of the hierarchical regression analysis are shown in Table 14. In the first block, covariates, including age of teenagers and parents, were simultaneously entered; in the second block, teenagers' total driving errors and violations, teenagers' work status, and teenagers' reckless and careless driving style were entered. In the third and final block, parental angry and hostile driving style, parental anxious driving style, and parental patient and careful driving style were entered simultaneously as the primary variables of interest.

Covariates, entered in the first block, were not significant predictors of teenagers' patient and careful driving style, F (2, 31) = 0.903, p = *n.s.*, and only accounted for 5.5% of the variation in teenagers' patient and careful driving style. When the teenage predictors were added in the second block, the prediction model explained an additional 42.8% of the variation in teenagers' patient and careful driving style and this change in R^2 was statistically significant, F (3, 28) = 7.733, p = 0.001. The prediction model was also statistically significant, F (5, 28) = 5.236, p = 0.002, R^2 = 0.483, Adjusted R^2 = 0.391. No teenage variables were predictive of teenagers' angry and hostile driving style.

In the last and final block, when the parental factors were added, the prediction model explained an additional 8.7% of the variation in teenagers' patient and careful driving style. The model decreased in predictive power but was still statistically significant, F (8, 25) = 4.139, p = 0.003, R^2 = 0.5701, Adjusted R^2 = 0.432. In the third block, teenagers' report of lower reckless and careless driving style was predictive of

higher patient and careful driving style. No parent variables were predictive of teenagers' patient and careful driving style.

Generally, with all other variables in the analysis statistically controlled, teenagers who reported lower levels of reckless and careless driving style endorsed higher patient and careful driving style. Parental factors were not predictive of teenager's patient and careful driving style.

Table 14

Hierarchical Multiple Regression Predicting Teenager's Patient and Careful Driving Style

	Teenager's Patient and Careful Driving Style					
	Model 1 - Covariates		Model 2 - Teenager's Predictors		Model 3 - Parent Predictors	
Variable	B	*β*	B	*β*	B	*β*
Constant	6.997		5.557		4.639	
Age_T	-0.088	-0.166	0.000	0.000	-0.008	-0.014
Age_P	-0.017	-0.134	0.007	0.054	0.014	0.115
Work Status_T			-0.327	-0.283	-0.224	-0.194
Reckless and Careless Driving_T			-0.310	-0.388	-0.367*	-0.460
Total Errors and Violations_T			-0.027	-0.281	-0.018	-0.188
Angry and Hostile Driving Style_P					0.013	0.011
Anxious Driving Style_P					0.459	0.323
Patient and Careful Driving Style_P					-0.048	-0.060
R^2 Statistics and Goodness-of-fit						
R^2	0.055		0.483		0.570	
F	0.903		5.236**		4.139**	
ΔR^2	-0.006		0.391		0.432	
ΔF	0.903		7.733		1.676	
AIC	-33.641		-48.161		-48.393	
BIC	-29.062		-39.002		-34.655	

Note. $N = 34$. T indicated teenager predictor. P indicated parent predictor. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Secondary Analyses

When examining parental driving styles, driving behaviors, and driving history on teenager's driving style, only the parental amount of time spent helping teach teenagers to drive was predictive of teenager's anxious driving style. Furthermore, the intercorrelations between parent and teenager's driving styles revealed no associations (Table 5). This appeared to be in contrast to previous research which has indicated an association among reckless and careless driving style, anxious driving styles, and patient and careful driving style between parents and teenagers (Miller & Taubman-Ben-Ari, 2010). Perhaps the lack of association and subsequent analyses was in part because of differences among the gender of the parent and the teenager. Previous literature indicated that the transmission of driving style for daughters was not gender specific (e.g., from father to daughter and mother to daughter), but transmission of driving style for sons was gender specific (e.g., from father to son). However, teenagers do not necessarily adopt their parent's driving style to the same extent. Notably, daughters reported higher levels of reckless/careless driving style than mothers. Sons also reported higher levels of reckless/careless driving style, along with higher levels of angry/hostile driving style, when compared to other family members (Miller & Taubman-Ben-Ari, 2010; Taubman-Ben-Ari et al., 2005).

To account for this lack of association and possible difference in driving styles between parents and teenagers, a series of independent t-tests was conducted to examine the differences between mother and teenager, mother and male teenagers, mothers and female teenagers, and male and female teenage driving style. Unequal population variance occurred between various dyad pairs, thus an unequal variance t-test was

performed. To account for inflation of familywise type I error, a Holm-Bonferroni correction was applied to subsequent results. For the purpose of simplifying the data analyses, the terms sons and daughters will be applied to male and female teenagers for the following section. Descriptive characteristics for all dyads are presented in Table 15. Overall means and standard deviations of driving styles of all dyads are presented in Table 16.

When comparing mother and teenager driving styles, daughters (M = 1.97, SD = 0.68) reported significantly higher levels of angry and hostile driving styles than mothers (M = 1.59, SD = 0.50), t (40) = 2.059, p = 0.046. Daughters (M = 2.32, SD = 0.56) reported significantly higher levels of anxious driving styles than mothers (M = 1.95, SD = 0.43), t (40) = 2.458, p = 0.018. Sons (M = 2.08, SD = 0.81) reported marginally higher levels of angry and hostile driving styles than mothers (M = 1.60, SD = 0.45), t (18.928) = 1.858, p = 0.079. Teenagers (M = 2.02, SD = 0.72) reported significantly higher levels of angry and hostile driving styles than their mothers (M = 1.59, SD = 0.48), t (57.314) = 2.812, p = 0.007. Teenagers (M = 2.16, SD = 0.52) reported marginally significantly higher levels of anxious diving styles than their mothers (M = 1.94, SD = 0.41), t (66) = 1.928, p = 0.058. Teenagers (M = 2.33, SD = 0.73) reported marginally significantly higher levels of reckless and careless driving styles than their mothers (M = 2.07, SD = 0.44), t (53.898) = 1.805, p = 0.077. No differences were found between the driving styles of mothers of sons and mothers of daughters. Daughters (M = 2.32, SD = 0.56) reported significantly higher levels of anxious driving styles than sons (M = 1.89, SD = 0.33), t (31.971) = 2.835, p = 0.008. When the Holm-Bonferroni correction was applied, no significant differences were found between mother and teenager, mother and male

teenagers, mothers and female teenagers, male and female teenage driving style, and mothers of sons and mothers of daughters driving styles (see Figure 2).

Table 15

Means (SD) for Independent t-tests for Mother-Teenager Dyads (N = 34) Driving Styles

	Mother-Daughter Dyads		Mother-Son Dyads		Mother Teenager Dyad		Mother-Mother		Daughter-Son	
	Mother (*n* = 21)	Daughter (*n* = 21)	Mother (*n* = 13)	Son (*n* = 13)	Mother (*n* = 34)	Teenager (*n* = 34)	Mother of Sons (*n* = 13)	Mother of Daughters (*n* = 21)	Daughters of Mothers (*n* = 21)	Sons of Mothers (*n* = 13)
Age (years)	47.00 (4.80)	17.31 (1.03)	47.33 (4.80)	17.00 (1.14)	47.21 (4.73)	17.12 (1.09)	47.00 (4.80)	47.33 (4.80)	17.31 (1.03)	17.00 (1.14)
Education (years)	16.07 (2.02)	10.85 (1.34)	15.76 (2.00)	10.62 (1.53)	15.88 (1.98)	10.71 (1.45)	16.08 (2.02)	15.76 (2.00)	10.85 (1.34)	10.62 (1.53)
Race: White (%)	69.20%	69.20%	76.20%	71.40%	73.50%	70.60%	69.20%	76.20%	69.20%	17.40%

Table 16

Independent t-tests Between Mother-Teenage Dyads Driving Styles

	Mothers			Daughters			Uncorrected	Holm-Bonferroni
	n	*M*	*SD*	*n*	*M*	*SD*	*t*	*t*
Reckless and Reckless Driving Style [a]	21	2.05	0.39	21	2.21	0.70	0.915	0.915
Angry and Hostile Driving Style	21	1.59	0.50	21	1.97	0.68	2.059*	2.059
Anxious Driving Style	21	1.95	0.43	21	2.32	0.56	2.458*	2.458
Patient and Careful Driving Style	21	4.90	0.75	21	4.73	0.56	-0.878	-0.878
	Mothers			Sons				
	n	*M*	*SD*	*n*	*M*	*SD*	*t*	*t*
Reckless and Reckless Driving Style	13	2.08	0.52	13	2.52	0.77	1.675	1.675
Angry and Hostile Driving Style [a]	13	1.60	0.45	13	2.08	0.81	1.858†	1.858
Anxious Driving Style	13	1.93	0.40	13	1.89	0.33	-0.236	-0.236
Patient and Careful Driving Style	13	4.57	0.67	13	4.66	0.66	0.328	0.328
	Mother			Teenagers				
	n	*M*	*SD*	*n*	*M*	*SD*	*t*	*t*
Reckless and Reckless Driving Style [a]	34	2.07	0.44	34	2.33	0.73	1.805†	1.805
Angry and Hostile Driving Style [a]	34	1.59	0.48	34	2.01	0.72	2.812**	2.812
Anxious Driving Style	34	1.94	0.41	34	2.16	0.52	1.928†	1.928
Patient and Careful Driving Style	34	4.78	0.73	34	4.70	0.59	-0.482	-0.482
	Mothers of Sons			Mothers of Daughters				
	n	*M*	*SD*	*n*	*M*	*SD*	*t*	*t*
Reckless and Reckless Driving Style	13	2.08	0.52	21	2.05	0.39	0.205	0.205
Angry and Hostile Driving Style	13	1.60	0.45	21	1.59	0.50	0.056	0.056
Anxious Driving Style	13	1.93	0.40	21	1.95	0.43	-0.141	-0.141
Patient and Careful Driving Style	13	4.57	0.67	21	4.90	0.75	-1.305	-1.305
	Sons of Mothers			Daughters of Mothers				
	n	*M*	*SD*	*n*	*M*	*SD*		
Reckless and Reckless Driving Style	13	2.52	0.77	21	2.21	0.70	-1.182	-1.182
Angry and Hostile Driving Style	13	2.08	0.81	21	1.97	0.68	-0.409	-0.409
Anxious Driving Style [a]	13	1.89	0.33	21	2.32	0.56	2.835**	2.835
Patient and Careful Driving Style	13	4.66	0.66	21	4.73	0.56	0.331	0.331

Note. [a] Unequal variance t-test. $^{**}p < 0.01$; $^{*}p < 0.05$; $^{\dagger}p < 0.10$.

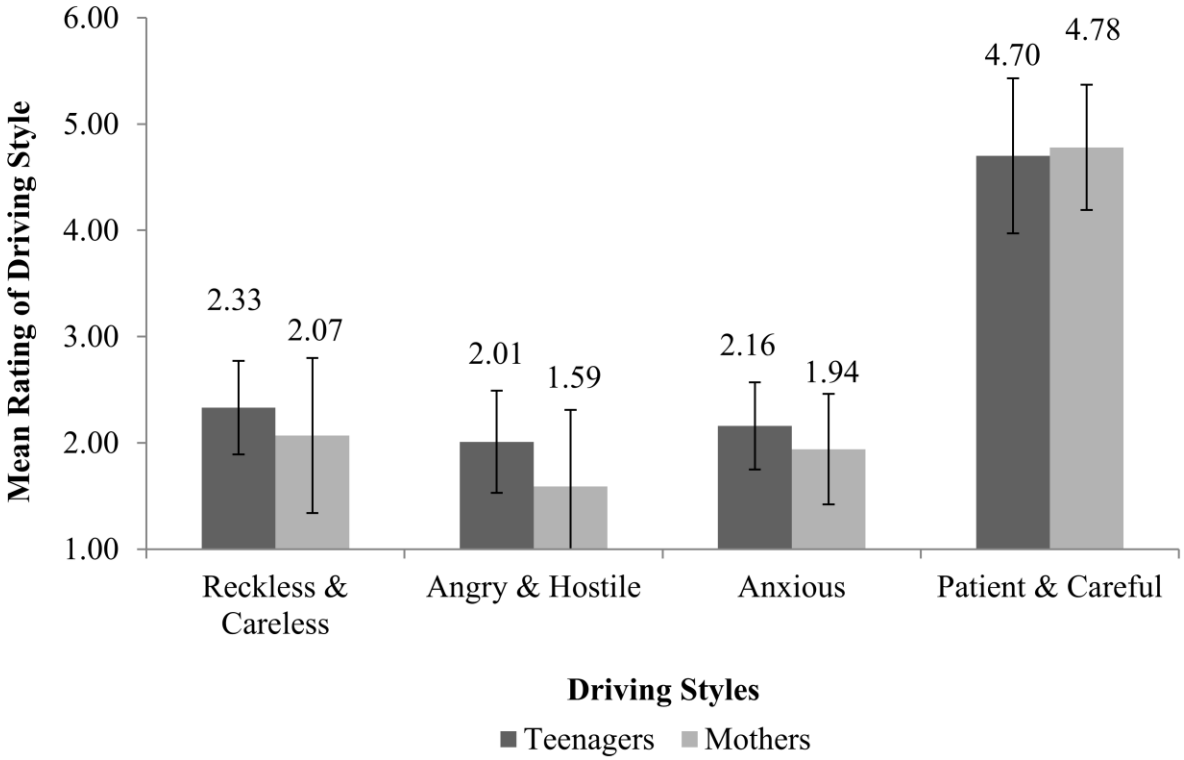

Figure 2. Mean Differences Between Driving Styles of Mothers-Teenage Dyads

DISCUSSION

The purpose of this study was to directly compare multiple driving factors (i.e., driving style, driving behavior, and driving history) in parent-teenage dyads as our understanding of how multiple driving factors influence teenage driving factors is limited. Previous studies have explored the effects of parental driving behavior and styles on teenage driving behaviors and styles respectively (Bianchi & Summala, 2004; Taubman-Ben-Ari et al., 2005). The results from this study suggested that one parental driving factor was associated with teenage driving factors. This study was intended to evaluate the associations of multiple driving factors between parents and teenagers in a population of United States drivers and determine specific parental driving predictors of teenage driving styles.

Primary Analyses

We tested whether parental driving factors predicted teenage driving styles. Results confirmed, in part, that which we expected to occur; the more time a parent spends helping teenagers learn to drive, the lower teenagers endorse anxious driving style. These results were consistent with previous research examining time commitment of parents spent teaching teenagers how to drive and driving styles, which found that increased time commitment to teach teenagers how to drive resulted in a decrease of reckless and careless and angry and hostile driving styles (Taubman-Ben-Ari & Katz-Ben-Ami, 2012). Parental involvement in teaching teenagers to drive was the only parental driving factor that was predictive of teenage driving styles, which is surprising,

because while numerous studies have stated that parents influence their teenage driver's driving styles and behaviors, our findings revealed little to no influence by parents on teenage driving styles (Simons-Morton & Ouimet, 2006; Simons-Morton & Winston, 2006).

This may be, in part, due to parent's lack of knowledge and understanding as to what is necessary to help guide teenagers to be safe drivers and what kind of instruction and experiences are needed for certain types of drivers. Research has shown that increased supervised driving practice has been shown to decrease the odds of teenagers getting into a fatal crash or into an MVC (L. H. Chen, Baker, & Li, 2006; Jacobsohn, Garcia-Espana, Durbin, Erkoboni, & Winston, 2012; Lyon, Pan, & Li, 2012). In a survey, however, while 77% of parents knew that that there was a specific number of required supervised practiced driving hours, only 1/3 of parents correctly reported it (O'Brien, Foss, Goodwin, & Masten, 2013). Several interventions have been created to address improving parent's knowledge and have demonstrated improved parental supervisory behaviors (Curry, Peek-Asa, Hamann, & Mirman, 2015). Specifically, those interventions that incorporated an in-vehicle data recorder system into teenager's vehicle, had an active parental engagement with teenagers to help teach teenagers to drive component, and had a strong theoretical approach, show the most potential in improving parental supervisory behaviors, in addition to, reducing teenagers' risky driving behaviors and increasing teenage driving skill (Curry et al., 2015).

Results suggested that parents' driving factors appeared not to be predictive of teenage driving factors, except for the amount of hours a parent helps teach the teenager to drive. Rather it appears as though other teenage driving factors were the primary

predictors of teenage driving styles. More teenage driving negative behaviors (i.e., total driving errors and violations) were indicative of more endorsement of reckless and careless driving style. Endorsement of lower patient and careful driving style was predictive of higher reckless and careless driving style. Endorsement of lower reckless and careless driving style was predictive of higher patient and careful driving style. No teenage predictor was found for teenager's anxious driving style. Given that this was among the first attempts at exploring multiple driving factors within one analysis, additional research, particularly with larger sample sizes than the present study, would be beneficial.

Results of correlations between parent and teenager's driving styles and behaviors revealed no associations. These findings of no associations were contradictory to previous research that shows clear associations between driving styles and behaviors between parents and teenagers (Bianchi & Summala, 2004; Taubman-Ben-Ari et al., 2005). A similar pattern of no associations occurred when comparing the amount of MVCs and moving violation tickets between parents and teenage drivers, in contrast to previous research (Carlson & Klein, 1970; Ferguson et al., 2001).

Perhaps the inclusion of both parent and teenage self-report data into this analysis changed the associations between parent and teenage driving factors, as the majority of pervious research only used parent-based or teenager-based responses on a single driving factor (i.e., driving style, driving behavior, or driving history) to generate their results (Beck et al., 2001; Hartos et al., 2002). Additionally, previous research may have suffered from publication bias where researchers tend to selectively report only significant findings (Francis, 2012). Further, as this was among the first to use the

Multidimensional Driving Style Inventory (MDSI) (Taubman-Ben-Ari et al., 2004) in a United States population, the four factor structure was adapted without modification. Future studies should compute a factor solution that would be most suitable to the United States population.

It is also important to note that for all analyses, father-teenager pairs were excluded due to their small sample size within the overall sample. Previous studies have shown that the more driving violations obtained by fathers, the more driving violations obtained by sons (Carlson & Klein, 1970). Furthermore, when mothers were asked who helped teach the teenager how to drive, 73.5% of mothers reported that fathers helped teach the teenager how to drive, in addition to themselves. One limitation of the study is that we failed to collect information about who typically drove the vehicle if traveling with family, who drove teenagers to school, extracurricular activities, etc., and the level of involvement of fathers in helping teach teenagers how to drive. As fathers may play a role in teenager's driving styles, driving behaviors, and driving history, further research should try to over sample father-teenager dyads to examine this relationship closer.

Secondary Analyses

Perhaps the lack of association and subsequent analyses was in part due to differences among the gender of the parent and the teenager (Miller & Taubman-Ben-Ari, 2010; Taubman-Ben-Ari et al., 2005). Differences in gender of both the parent and the teenager were found. The findings found that teenagers, regardless of gender, reported higher levels of angry and hostile driving styles than mothers. When gender of teenager was taken into account, more differences emerged, with daughters reporting higher angry and hostile and anxious driving styles than mothers. This difference in angry and hostile

driving style may be indicative of a growing problem of a rise of aggressive driving within the general population (American Automoblie Assoication [AAA], 2009).

However, when gender of teenager was compared, daughters reported higher anxious driving style than sons. Non-significant findings suggested that mothers and sons may be quite similar with regard to driving style. This is interesting, as previous literature has shown that the transmission of driving style for sons to be gender specific (i.e., from father to sons) (Taubman-Ben-Ari et al., 2005). Our results indicate that mothers may shape sons' driving style more than was previously thought.

When the Holm-Bonferroni correction was applied, differences in gender of both the parent and the teenager were not found. The findings indicated that mothers and teenagers driving styles are similar; however, given the prior results of no associations between mothers' driving styles and teenagers' driving styles, these results should be used with caution. Additional research in this topic area is warranted, to better clarify the differences among gender and driving styles among both parents and teenagers.

Strengths of the Study

The study featured a couple of notable strengths. First, this is among the first studies to examine multiple driving factors (i.e., driving styles, driving behaviors, and driving history) as potential predictors for teenage driving style. Second, this study gathered both parent and teenage reports on their own driving styles, driving behaviors, and driving history. Previous studies have only used teenager's self-report on parenting practice and their own risky driving behavior (Hartos et al., 2002), or if researchers received responses from both parents and their children, information was limited to crash records (Carlson & Klein, 1970; Ferguson et al., 2001) or self-reported scores on the

Driving Behavior Questionnaire (Bianchi & Summala, 2004) and the studies only accounted for one driving factor, unlike our study where we accounted for multiple driving factors.

Limitations of the Study

Several limitations are present within our study. One limitation already discussed was the sample size and lack of diversity in parents' gender within the sample. The small number of fathers in the sample, in addition to, 73.5% of mothers reporting that teenager's father or stepfather help teach the teenager how to drive, in addition to themselves, indicates that fathers may play a larger role in the formation of teenagers' driving style, driving behavior, and driving history in the general population than was seen within our sample. We also failed to collect information about who typically drove the vehicle if traveling with family, who drove teenagers to school, extracurricular activities, etc., and father's participants in the number of hours they spent helping teach teenagers learn to drive which may further provide better insight into the formation of teenager's driving factors. Second, the results may be subject to recruitment bias as the larger study recruited teenage participants that were (a) the primary drivers of their own vehicle and (b) willing to have cameras installed in their vehicles for two weeks. Third, the MDSI (Taubman-Ben-Ari et al., 2004) was adapted without any modifications. Thus, the internal consistency for the Angry and Hostile Driving Style was poor, given the Cronbach's alpha of 0.572. As mentioned above, further research should compute a factor solution via principle component analysis to create a unique factor solution that may work better with a United States population.

Fourth, all measures used within this study were self-reported from parents and teenagers, thus no objective measure of teenage driving performance was used. Previous research showed that participants tended to engage in socially desirable responding, resulting in giving favorable self-descriptions of driving history (Lajunen, Corry, Summala, & Hartley, 1997). However, as mentioned previously, objective measures of teenage driving performance that could be potentially gathered from driving records, are also flawed, in that the driving record may under-report the actual number of MVCs, as drivers may simply choose not to report the MVC(s) (Arthur & Graziano, 1996). Future research should gather both self-report and objective measures to measure driving styles, driving behaviors, and driving history.

Lastly, according to VanVoorhis and Morgan (2007), the ratio goal of the sample size to the number of predictors should be close to 20:1; however, a more realistic ratio goal may be a 10:1 ratio (Rosenthal, 2011; VanVoorhis & Morgan, 2007). This would indicate that for the size of this population, a maximum of three predictors was an appropriate number for the hierarchical regression analyses that were conducted. Further power analyses were conducted using G Power, indicating that the maximum number of participants with eight predictors for a preferred power of 80% to detect a medium effect size of 0.15 was 109 participants. For all primary analyses, the number of predictors within the model exceeded the amount. Given that this was among the first studies to examine multiple driving factors, there was no precedence for which predictors would be predictive of teenager's driving styles. Theoretical consideration indicated seven driving variables (i.e., four driving styles, one driving behavior, and two driving history) had strong associations between parents and teenagers. To try to account for this

overabundance of driving variables, only significant variables that were correlated with the driving style outcome were retained for the final hierarchical regression model.

Future Directions

This study is among the first to investigate multiple driving factors of both parents and teenagers. However, future studies should adjust for lack of paternal participation within the sample by over sampling fathers to make the sample more generalizable to the population. In addition, personality may be an underlying mechanism that should be taken into account when looking at the relationship between teenage drivers and their parents, as personality, especially extraversion, neuroticism, sensation seeking, and impulsivity, has been shown to be a risk factor for teenage risky driving behaviors (Arnett, Offer, & Fine, 1997; Constantinou, Panayiotou, Konstantinou, Loutsiou-Ladd, & Kapardis, 2011; Dahlen, Martin, Ragan, & Kuhlman, 2005; Dahlen & White, 2006; Fine, 1963; Matthews, Dorn, & Glendon, 1991).

While this study focused on the relationship between teenage drivers and parents, numerous other factors may be an underlying influence upon teenage driving, such as peer influence or social influence (Allen & Brown, 2008). Typically, previous research has studied these relationships between parents and teenage driving, peer and teenage driving, and social influence and teenage driving separately; yet as driving is multidimensional and may be influenced by numerous sources, future studies should attempt to determine the level of influence posed by each source (i.e., parents, peers, and social).

Future research should also gather both self-report and objective measures to measure driving styles, driving behaviors, and driving history. Furthermore, while current

research on teenage driving with objective measures is becoming more popular with naturalistic data acquisition devices, only within the last decade has driving history been examined from a longitudinal perspective in over 2,800 drivers across the lifespan in a study know as the second Strategic Highway Research Program (SHRP 2) (Hallmark et al., 2013). For example, Hallmark et al. (2013) followed licensed drivers across the lifespan, including teenagers, longitudinally for an average of 18 months and showed that teenagers driving history was compromised as compared to middle age drives. Future work may attempt to collect self-reported measures numerous times throughout data collection and not just at baseline as in SHRP 2, thus extending findings by studying the longitudinal relations between not only driving history, but also driving styles and driving behaviors, and teenager driving ability. Given differences in driving styles of teenagers, it is plausible that teenagers with higher reckless and careless and angry and hostile driving style will grow up to be risky teen drivers. Early interventions may be crucial for reducing high teenage MVC mortality rates and ensuring safer future drivers.

Simulator driving interventions may provide an excellent apparatus for training teenagers how to drive safely on the roadway. The benefits of using simulated driving to reduce MVC risk are numerous. First, simulated driving offers a safe environment to drive in a vehicle that closely resembles actual traffic conditions, without being in danger of getting into a MVC. Second, simulated driving offers the ability to deliver numerous training trails across a variety of traffic conditions and road types. Finally, simulated driving offers the ability to review specific details in errors or violations of driving with the teenager within seconds of the error or violation occurring.

Conclusion

The increased risk of MVCs for teenage drivers is a major public health issue. Only increased time spent teaching teenagers to drive by the parents predicted a reduction of teenager's anxious driving style. Thus, these results suggested that teenager's own risky driving factors predict their own driving style better than parental driving factors. This highlights the need for further research on possible interventions targeting teenage driving factors.

REFERENCES

AAA Foundation for Traffic Safety. (2013). *2012 traffic safety culture index*. Washington DC: AAA Foundation for Traffic Safety. Retrieved from AAA Foundation for Traffic Safety website: https://www.aaafoundation.org/sites/default/files/2012TrafficSafetyCultureIndex.pdf.

Aarts, L., & van Schagen, I. (2006). Driving speed and the risk of road crashes: A review. *Accident Analysis & Prevention, 38*(2), 215-224. doi: 10.1016/j.aap.2005.07.004

Allen, J. P., & Brown, B. B. (2008). Adolescents, peers, and motor vehicles: The perfect storm? *American Journal of Preventive Medicine, 35*(3), 289-293. doi: 10.1016/j.amepre.2008.06.017

American Automoblie Assoication [AAA]. (2009). *Aggressive driving: Research update*. Washington DC: AAA Foundation for Traffic Safety. Retrieved from AAA Foundation for Traffic Safety website: https://www.aaafoundation.org/sites/default/files/AggressiveDrivingResearchUpdate2009.pdf.

Anderson, R. N., & Smith, B. L. (2003). *Deaths: Leading causes for 2001*. Washington DC: National Vital Statistics Reports. Retrieved from Center for Disease Control and Prevention website: http://www.cdc.gov/nchs/data/nvsr/nvsr52/nvsr52_09.pdf.

Arnett, J. J., Offer, D., & Fine, M. A. (1997). Reckless driving in adolescence: "State" and "trait" factors. *Accident Analysis & Prevention, 29*(1), 57-63. doi: 10.1016/S0001-4575(97)87007-8

Arthur, W., & Graziano, W. G. (1996). The five-factor model, conscientiousness, and driving accident involvement. *Journal of Personality, 64*(3), 593-618. doi: 10.1111/1467-6494.ep9703132897

Bandura, A. (1971). *Social learning theory*. New York, NY: General Learning Press.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*(2), 191-215. doi: 10.1037/0033-295X.84.2.191

Beck, K. H., Shattuck, T., & Raleigh, R. (2001). A comparison of teen perceptions and parental reports of influence on driving risk. *American Journal of Health Behavior, 25*(4), 376-387. doi: 10.5993/AJHB.25.4.3

Begg, D. J., Langley, J. D., & Williams, S. M. (1999). A longitudinal study of lifestyle factors as predictors of injuries and crashes among young adults. *Accident Analysis & Prevention, 31*(1-2), 1-11. doi: 10.1016/S0001-4575(98)00039-6

Bianchi, A., & Summala, H. (2004). The "genetics" of driving behavior: Parents' driving style predicts their children's driving style. *Accident Analysis & Prevention, 36*(4), 655-659. doi: 10.1016/s0001-4575(03)00087-3

Bowen, M. (1978). *Family treatment in clinical practice*. New York, NY: Rowman & Littlefield Publishers, Inc.

Braithwaite, R. L., & Lythcott, N. (1989). Community empowerment as a strategy for health promotion for black and other minority populations. *Journal of the American Medical Association, 261*(2), 282-283. doi: 10.1001/jama.1989.03420020136047

Carlson, W. L., & Klein, D. (1970). Familial versus institutional socialization of the young traffic offender. *Journal of Safety Research, 2*(1), 13-25.

Centers for Disease Control and Prevention [CDC]. (2012). Teen drivers: Get the facts. Retrieved July, 2014, from Center for Disease Control and Prevention website: http://www.cdc.gov/Motorvehiclesafety/teen_drivers/teendrivers_factsheet.html

Chen, L. H., Baker, S. P., & Li, G. (2006). Graduated driver licensing programs and fatal crashes of 16-year-old drivers: A national evaluation. *Pediatrics, 118*(1), 56-62. doi: 10.1542/peds.2005-2281

Chen, W., Cooper, P., & Pinili, M. (1995). Driver accident risk in relation to the penalty point system in British Columbia. *Journal of Safety Research, 26*(1), 9-18. doi: 10.1016/0022-4375(94)00023-9

Clapp, J. D., Olsen, S. A., Beck, J. G., Palyo, S. A., Grant, D. M., Gudmundsdottir, B., & Marques, L. (2011). The driving behavior survey: Scale construction and validation. *Journal of Anxiety Disorders, 25*(1), 96-106. doi: 10.1016/j.janxdis.2010.08.008

Constantinou, E., Panayiotou, G., Konstantinou, N., Loutsiou-Ladd, A., & Kapardis, A. (2011). Risky and aggressive driving in young adults: Personality matters. *Accident Analysis & Prevention, 43*(4), 1323-1331. doi: 10.1016/j.aap.2011.02.002

Crundall, D., Underwood, G., & Chapman, P. (1999). Driving experience and the functional field of view. *Perception, 28*(9), 1075-1087. doi: 10.1068/p2894

Curry, A. E., Peek-Asa, C., Hamann, C. J., & Mirman, J. H. (2015). Effectiveness of parent-focused interventions to increase teen driver safety: A critical review. *Journal of Adolescent Health, 57*(1 Suppl), S6-S14. doi: 10.1016/j.jadohealth.2015.01.003

Dahlen, E. R., Martin, R. C., Ragan, K., & Kuhlman, M. M. (2005). Driving anger, sensation seeking, impulsiveness, and boredom proneness in the prediction of unsafe driving. *Accident Analysis & Prevention, 37*(2), 8. doi: 10.1016/j.aap.2004.10.006

Dahlen, E. R., & White, R. P. (2006). The big five factors, sensation seeking, and driving anger in the prediction of unsafe driving. *Personality and Individual Differences, 41*(5), 903-915. doi: 10.1016/j.paid.2006.03.016

Dula, C. S., Adams, C. L., Miesner, M. T., & Leonard, R. T. (2010). Examining relationship between anxiety and dangerous driving. *Accident Analysis & Prevention, 42*(2), 2050-2056. doi: 10.1016/j.aap.2010.06.016

Elander, J., West, R., & French, D. (1993). Behavioral correlates of individual differences in road-traffic crash risk: An examination method and findings. *Psychological Bulletin, 113*(2), 279-294. doi: 10.1037/0033-2909.113.2.279

Elvik, R., & Mysen, A. B. (1999). Incomplete accident reporting: Meta-analysis of studies made in 13 countries. *Transportation Research Record: Journal of the Transportation Research Board, 1665*(1), 133-140. doi: 10.3141/1665-18

Evans, L. (1991). *Traffic safety and the driver*. New York, NY: Van Nostrand Reinhold.

Federal Highway Administration [FHWA]. (2013). Distribution of licensed drivers - 2011 by sex and percentage in each age group and relation to population. Retrieved July, 2014, from Federal Highway Administration website: http://www.fhwa.dot.gov/policyinformation/statistics/2011/dl20.cfm

Ferguson, S. A., Williams, A. F., Chapline, J. F., Reinfurt, D. W., & De Leonardis, D. M. (2001). Relationship of parent driving records to the driving records of their children. *Accident Analysis & Prevention, 33*(2), 229-234. doi: 10.1016/S0001-4575(00)00036-1

Fine, B. J. (1963). Introversion-extraversion and motor vehicle driver behavior. *Perceptual and Motor Skills, 12*, 95-100. doi: 10.2466/pms.1963.16.1.95

Ford Motor Company. (2011). *2011 Ford safe driving survey*. Retrieved from Ford Motor Company website: http://www.at.ford.com/SiteCollectionImages/2011_NA/Article%20Images/April/Safe_Driving_Survey.pdf.

Francis, G. (2012). Publication bias and the failure of replication in experimental psychology. *Psychonomic Bulletin & Review, 19*(6), 975-991. doi: 10.3758/s13423-012-0322-y

French, D. J., West, R. J., Elander, J., & Wilding, J. M. (1993). Decision-making style, driving style, and self-reported involvement in road traffic accidents. *Ergonomics, 36*, 627-644. doi: 10.1080/00140139308967925

Fried, R., Petty, C. R., Surman, C. B., Reimer, B., Aleardi, M., Martin, J. M., . . . Biederman, J. (2006). Characterizing impaired driving in adults with attention-deficit/hyperactivity disorder: A controlled study. *Journal of Clinical Psychiatry, 67*(4), 567-574. doi: 10.4088/JCP.v67n0407

Furnham, A., & Saipe, J. (1993). Personality correlates of convicted drivers. *Personality and Individual Differences, 14*(2), 329-336. doi: 10.1016/0191-8869(93)90131-L

Garner, A. A., Gentry, A., Welburn, S. C., Fine, P. R., Franklin, C. A., & Stavrinos, D. (2012). Symptom dimensions of disruptive behavior disorders in adolescent drivers. *Journal of Attention Disorders, 18*(6), 496-503. doi: 10.1177/1087054711431699

Goodwin, A. H., Foss, R. D., Harrell, S. S., & O'Brien, N. P. (2012). *Distracted driving among newly licensed teen drivers*. Washington DC: AAA Foundation for Traffic Safety. Retrieved from AAA Foundation for Traffic Safety website: http://www.distraction.gov/downloads/pdfs/distracted-driving-among-newly-licensed-teen-drivers.pdf.

Gulian, E., Glendon, A. I., Matthews, G., Davies, D. R., & Debney, L. M. (1988). Exploration of driver stress using self-reported data. In T. Rothengatter & R. de Bruin (Eds.), *Road User Behavior: Theroy and Research* (pp. 342-347). Wolfeboro, NH: Van Gorcum.

Hallmark, S., McGehee, D., Bauer, K. M., Hutton, J. M., Davis, G. A., Hourdos, J., . . . Dozza, M. (2013). *Initial analyses from the SHRP 2 naturalistic driving study: addressing driver performance and behavior in traffic safety*. Washington DC: Transportation Research Board. Retrieved from Transportation Research Board website: http://onlinepubs.trb.org/onlinepubs/shrp2/SHRP2_S08.pdf.

Hartos, J., Eitel, P., & Simons-Morton, B. (2002). Parenting practices and adolescent risky driving: A three-month prospective study. *Health Education & Behavior, 29*(2), 194-206. doi: 10.1177/10901980222194129

Huang, P., Kao, T., Curry, A. E., & Durbin, D. R. (2012). Factors associated with driving in teens with autism spectrum disorders. *Journal of Developmental & Behavioral Pediatrics, 33*(1), 70-74. doi: 10.1097/DBP.0b013e31823a43b7

Insurance Institute for Highway Safety [ILHS]. (2013). Teenagers. Retrieved February 2014, from Insurance Institute for Highway Safety website: http://www.iihs.org/iihs/topics/t/teenagers/fatalityfacts/teenagers

Jacobsohn, L., Garcia-Espana, J. F., Durbin, D. R., Erkoboni, D., & Winston, F. K. (2012). Adult-supervised practice driving for adolescent learners: The current state and directions for interventions. *Journal of Safety Research, 43*(1), 21-28. doi: 10.1016/j.jsr.2011.10.008

Jonah, B. A., Thiessen, R., & Au-Yeung, E. (2001). Sensation seeking, risky driving and behavioral adaptation. *Accident Analysis & Prevention, 33*(5), 679-684. doi: 10.1016/S0001-4575(00)00085-3

Klauer, S. G., Simons-Morton, B., Lee, S. E., Ouimet, M. C., Howard, E. H., & Dingus, T. A. (2011). Novice drivers-exposure to known risk factors during the first 18 months of licensure: The effect of vehicle ownership. *Traffic Injury Prevention, 12*(2), 159-168. doi: 10.1080/15389588.2010.549531

Kleisen, L. (2011). *The relationship between thinking and driving styles and their contribution to young driver road safety* (Management Dissertation), University of Canberra.

Laapotti, S., Keskinen, E., Hatakka, M., Hernetkoski, K., Katila, A., Peraaho, M., & Salo, I. (2006). Driving circumstances and accidents among novice drivers. *Traffic Injury Prevention, 7*(3), 232-237. doi: 10.1080/15389580600668537

Lajunen, T., Corry, A., Summala, H., & Hartley, L. (1997). Impression management and self-deception in traffic behaviour inventories. *Personality and Individual Differences, 22*(3), 341-353. doi: 10.1016/S0191-8869(96)00221-8

Lyon, J. D., Pan, R., & Li, J. (2012). National evaluation of the effect of graduated driver licensing laws on teenager fatality and injury crashes. *Journal of Safety Research, 43*(1), 29-37. doi: 10.1016/j.jsr.2011.10.007

Mathews, J., Zollinger, T., Przybylski, M., & Bull, M. (2001). The association between risk-taking behavior and the use of safety devices in adolescents. *Annual Processings of the Association for the Advancement of Automotive Medicine, 45*, 23-36.

Matthews, G., Dorn, L., & Glendon, A. I. (1991). Personality correlates of driver stress. *Personality and Individual Differences, 12*(6), 535-549. doi: 10.1016/0191-8869(91)90248-A

Maycock, G., Lockwood, C. R., & Lester, J. (1991). The accident liability of car drivers. Crowthrone, UK: Transport and Road Research Laboratory.

McKenna, F. P., Horswill, M. S., & Alexander, J. L. (2006). Does anticipation training affect drivers' risk taking? *Journal of Experimental Psychology: Applied, 12*(1), 1-10. doi: 10.1037/1076-898X.12.1.1

Miller, G., & Taubman-Ben-Ari, O. (2010). Driving styles among young novice drivers--The contribution of parental driving styles and personal characteristics. *Accident Analysis & Prevention, 42*(2), 558-570. doi: 10.1016/j.aap.2009.09.024

National Highway Traffic Safety Administration [NHTSA]. (2013). *Traffic safety facts: 2011 data - Speeding*. (DOT HS 811 751). Washington DC: National Center for Statistics and Analysis. Retrieved from National Highway Traffic Safety Administration website: http://www-nrd.nhtsa.dot.gov/Pubs/811751.pdf.

Niezgoda, M., Kamiński, T., Kruszewski, M., & Tarnowski, A. (2013). Self-reported drivers' behaviour: An application of DBQ in Poland. *Journal of KONES Powertrain and Transport, 20*(1), 233-238.

Nyberg, A. (2007). *The potential of driver education to reduce traffic crashes involving young drivers.* (Medical Doctoral Dissertation), Linkoping University.

O'Brien, N. P., Foss, R. D., Goodwin, A. H., & Masten, S. V. (2013). Supervised hours requirements in graduated driver licensing: Effectiveness and parental awareness. *Accident Analysis & Prevention, 50*, 330-335. doi: 10.1016/j.aap.2012.05.007

Olsen, E. O., Shults, R. A., & Eaton, D. K. (2013). Texting while driving and other risky motor vehicle behaviors among US high school students. *Pediatrics, 131*(6), e1708-e1715. doi: 10.1542/peds.2012-3462

Orr, J. M., Sackett, P. R., & Dubois, C. L. Z. (1991). Outlier detection and treatment in I/O psychology: A survey of researcher beliefs and an empirical illustration. *Personnel Psychology, 44*(3), 473-486. doi: 10.1111/j.1744-6570.1991.tb02401.x

Poo, F. M., Taubman-Ben-Ari, O., Ledesma, R. D., & Diaz-Lazaro, C. M. (2013). Reliability and validity of a spanish-language version of the multidimensional driving style inventory. *Transportation Research Part F: Traffic Psychology and Behaviour, 17*, 75-87. doi: 10.1016/j.trf.2012.10.003

Reason, J. T., Manstead, A., Stradling, S., Baxter, J., & Campbell, K. (1990). Errors and violations on the roads: A real distinction? *Ergonomics, 33*(10-11), 1315-1332. doi: 10.1080/00140139008925335

Rosenthal, J. A. (2011). *Statistics and data interpretation for social work*. New York, NY: Springer Publishing Company.

Schwebel, D. C., Severson, J., Ball, K. K., & Rizzo, M. (2006). Individual difference factors in risky driving: The roles of anger/hostility, conscientiousness, and sensation-seeking. *Accident Analysis & Prevention, 38*(4), 801-810. doi: 10.1016/j.aap.2006.02.004

Shope, J. T., & Bingham, C. R. (2008). Teen driving: Motor-vehicle crashes and factors that contribute. *American Journal of Preventive Medicine, 35*(3rd Supp), S261-S271. doi: 10.1016/j.amepre.2008.06.022

Simon, L. (2010). *Teen Behind the Wheel: Your Kid - Surviving the Dangers*: Xlibris Corporation.

Simons-Morton, B. G., & Ouimet, M. C. (2006). Parent involvement in novice teen driving: A review of the literature. *Injury Prevention, 12 Suppl 1*, i30-i37. doi: 10.1136/ip.2006.011569

Simons-Morton, B. G., Ouimet, M. C., Zhang, Z., Klauer, S. E., Lee, S. E., Wang, J., . . . Dingus, T. A. (2011). The effect of passengers and risk-taking friends on risky driving and crashes/near crashes among novice teenagers. *Journal of Adolescent Health, 49*(6), 587-593. doi: 10.1016/j.jadohealth.2011.02.009

Simons-Morton, B. G., & Winston, F. K. (2006). Translational research in child and adolescent transportation safety. *Evaluation & the Health Professions, 29*(1), 33-64. doi: 10.1177/0163278705284442

Taubman-Ben-Ari, O., & Katz-Ben-Ami, L. (2012). The contribution of family climate for road safety and social environment to the reported driving behavior of young drivers. *Accident Analysis & Prevention, 47*(1), 1-10. doi: 10.1016/j.aap.2012.01.003

Taubman-Ben-Ari, O., Mikulincer, M., & Gillath, O. (2004). The multidimensional driving style inventory—scale construct and validation. *Accident Analysis & Prevention, 36*(3), 323-332. doi: 10.1016/S0001-4575(03)00010-1

Taubman-Ben-Ari, O., Mikulincer, M., & Gillath, O. (2005). From parents to children—similarity in parents and offspring driving styles. *Transportation Research Part F: Psychology and Behaviour, 8*(1), 19-29. doi: 10.1016/j.trf.2004.11.001

Underwood, G. (2007). Visual attention and the transition from novice to advanced driver. *Ergonomics, 50*(8), 1235-1249. doi: 10.1080/00140130701318707

VanVoorhis, C. R. W., & Morgan, B. L. (2007). Understanding power and rules of thumb for determining sample sizes. *Tutorials in Quantitative Methods for Psychology, 3*(2), 43-50.

Varmazyar, S., Mortazavi, S. B., Hajizadeh, E., & Arghami, S. (2013). The relationship between driving aberrant behavior and self-reported accidents involvement amongst professional bus drivers in the public transportation company. *Health Scope*, *2*, 110-115.

Welburn, S. C., Garner, A. A., Franklin, C. A., Fine, P. R., & Stavrinos, D. (2011). *Psychometric validity of the Questionnaire Assessing Distracted Driving (QUADD).* Poster presented at the 2011 University of Alabama at Birmingham Expo for Undergraduate Research, Birmingham, AL. [First place prize for student poster competition].

West, R., & Hall, J. (1997). The role of personality and attitudes in traffic accident risk. *Applied Psychology: An International Review, 46*(3), 253-264. doi: 10.1111/j.1464-0597.1997.tb01229.x

Wiesenthal, D. L., Hennessy, D., & Gibson, P. M. (2000). The driving vengeance questionnaire (DVQ): The development of a scale to measure deviant drivers' attitudes. *Violence and Victims, 15*(2), 115-136.

APPENDIX A

INSTITUTIONAL REVIEW BOARD APPROVAL

THE UNIVERSITY OF ALABAMA AT BIRMINGHAM

Institutional Review Board for Human Use

Form 4: IRB Approval Form
Identification and Certification of Research
Projects Involving Human Subjects

UAB's Institutional Review Boards for Human Use (IRBs) have an approved Federalwide Assurance with the Office for Human Research Protections (OHRP). The Assurance number is FWA00005960 and it expires on January 24, 2017. The UAB IRBs are also in compliance with 21 CFR Parts 50 and 56.

Principal Investigator:	WITTIG, SHANNON
Co-Investigator(s):	
Protocol Number:	**X140820007**
Protocol Title:	*Examining the Relationship Between Driving Styles of Teen Drivers and Their Parents*

The IRB reviewed and approved the above named project on 9-16-14. The review was conducted in accordance with UAB's Assurance of Compliance approved by the Department of Health and Human Services. This Project will be subject to Annual continuing review as provided in that Assurance.

This project received EXPEDITED review.

IRB Approval Date: 9-16-14

Date IRB Approval Issued: 9-16-14

IRB Approval No Longer Valid On: 9-16-15

HIPAA Waiver Approved?: N/A

Partial HIPAA Waiver Approved?: N/A

Marion Dass

Member - Institutional Review Board for Human Use (IRB)

Investigators please note:

The IRB approved consent form used in the study must contain the IRB approval date and expiration date.

IRB approval is given for one year unless otherwise noted. For projects subject to annual review research activities may not continue past the one year anniversary of the IRB approval date.

Any modifications in the study methodology, protocol and/or consent form must be submitted for review and approval to the IRB prior to implementation.

Adverse Events and/or unanticipated risks to subjects or others at UAB or other participating institutions must be reported promptly to the IRB.

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