Accident Analysis and Prevention 43 (2011) 923–931

Contents lists available at ScienceDirect

Accident Analysis and Prevention

journal homepage: www.elsevier.com/locate/aap

Age and gender differences in risky driving: The roles of positive affect and risk perception

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ARTICLE INFO

Article history:
Received 20 December 2008
Received in revised form 31 October 2010
Accepted 24 November 2010

Keywords:
Emotion
Risk perception
Teen drivers
Risky driving

ABSTRACT

A phone survey of 504 teen (age 16–20) and 409 adult (age 25–45) drivers in the US state of Alabama was conducted to examine the relationships among risk perception, positive affect and risky driving. Male drivers reported engaging in risky driving behaviors more frequently than female drivers and teen drivers reported engaging in risky driving behaviors more frequently than adult drivers. Positive affect (liking for risky driving behaviors) and perceived risk mediated the relationships of age and gender with risky driving. Affect and risk perception were independent predictors of risky driving behavior. Interactions of positive affect and perceived risk with gender and age showed that positive affect more strongly predicted risky driving for teen and male drivers than for adult and female drivers. These findings are interpreted in the context of dual process models of behavioral decision making. Future research into interventions designed to moderate the positive affect surrounding driving may have promise for reducing risky driving behavior.

> "Whilst I am driving, I am nearly always happy. Driving towards virtually anywhere makes me excited, expectant: full of hope." (Pearce, 2000, p. 163)

1. Introduction

Motor vehicle crashes are a significant threat to young drivers worldwide (Peden et al., 2004). In the United States, vehicle crashes are the leading cause of death for individuals 15–20 years old (NHTSA, 2009). Teen drivers were involved in nearly 12% of all fatal crashes in 2008, although teen drivers represent less than 7% of licensed drivers (NHTSA, 2009; licensed driver percent based on 2007 data, the latest data available; NHTSA, 2008). In spite of decreases in fatalities for young drivers since 1995 (Ferguson et al., 2007; NHTSA, 2009), further efforts to understand and reduce risky driving are warranted.

Although the extent to which teen crashes are attributable to inexperience or risk-taking has been debated (McKnight and McKnight, 2003; Senserrick, 2006), clearly teen crashes are characterized by features consistent with risk-taking behavior, such as speeding, following too closely, and driving too fast for conditions (Preusser et al., 1998; Reason et al., 1990; Rhodes et al., 2005). Several cognitive processes have been linked to risky driving behavior in young drivers (Teese and Bradley, 2008), including underestimating the extent to which they are at risk of serious consequences while driving (Delhomme et al., 2009; Matthews and Moran, 1986; Taubman-Ben Ari et al., 2004; but see Steinberg, 2008 for an alternate view) and overestimating their driving skill and their ability to recognize hazards (Harré et al., 2005; Horswill et al., 2004).

Gender differences have also been found in risky driving behavior (Harré et al., 2000, 1996; Oltedal and Rundmo, 2006). The fatality rate for male drivers is more than triple that for female drivers (NHTSA, 2009). Male drivers appear to take more risks than females, especially during adolescence (Vavrik, 1997). Male drivers in fatal crashes are more likely to have been speeding than female drivers in fatal crashes (NHTSA, 2007), have been found to drive significantly faster in towns, report more intention to drink and drive, and report engaging in other unsafe behaviors more often than female drivers of the same age (Harré et al., 1996).

Because of these observed patterns of risky driving for male as compared with female drivers, and for teen as compared with adult drivers, the purpose of the present research is to examine the cognitive and affective mediators of decision making in the context of driving risk. A more complete understanding of how drivers who are prone to risky behavior think and feel about driving should help to provide insights for behavior change.

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doi:10.1016/j.aap.2010.11.015

1.1. Risk perception

Theoretical models that have been commonly applied to decision making about health risk behavior, such as the health belief model (Rosenstock, 1974) and the theories of reasoned action and planned behavior (Ajzen, 1991; Ajzen and Fishbein, 1980), assume that decision making about risk behaviors occurs through rational processes such as evaluating the risks and benefits of a given action. If decision making was purely a rational process, interventions which inform drivers of the risks inherent in driving, such as driver's education, should be sufficient to encourage safer driving. In fact, research has failed to find a significant improvement in crash rates as a function of traditional driver's education programs (Hirsch, 2003; Mayhew, 2007; Mayhew and Simpson, 2002; Senserrick et al., 2009). Thus, it is important to move beyond models of rational decision making in understanding driving risk.

1.2. Dual-process models of decision making

Recent work in behavioral decision making has focused on the implications of dual-process models of decision making (e.g., Chaiken and Trope, 1999; Smith and DeCoster, 2000). Dual-process models posit two systems of information processing. One system is rational, deliberative, and analytic and represents decisions that are based on logical analysis of the available information. In contrast, the other system is experiential and intuitive, and represents decision making based on affect. The emotional reactions to events and stimuli that form the basis for decisions have been the focus of research on experiential models of decision making (e.g., Damasio, 1994; Epstein, 1994; Finucane et al., 2000; Zajonc, 1980). Dual process models have been applied to health risk behaviors such as alcohol consumption (Moss and Albery, 2009) and cigarette smoking (Slovic, 2001), but have not been used extensively in the area of traffic safety. Yet, because affective modes of decision making are often relied on when there is significant time pressure to make a decision (Slovic and Peters, 2006; Smith and DeCoster, 2000), a focus on affect in risky driving seems particularly warranted, given that driving decisions are often made in response to rapidly changing situations and stimuli.

1.3. Positive affect

The driving of an automobile is an intensely emotional construct in contemporary American society. Driving is characterized by positive emotions associated with the pleasures of driving (Sheller, 2004). These positive emotions have been enhanced by emotional marketing of automobiles that emphasizes vehicle performance and the fun of driving (Britt, 2003; Ferguson et al., 2003), and by media portrayals of risky driving (Roberts, 1989). Recent research has shown that positive emotional functions of driving such as blowing off steam and having fun with friends are related to risky driving (Møller and Gregersen, 2008). Yet many of the investigations of dual process models have focused on negative affect, especially fear and anxiety (see review by Loewenstein et al., 2001). Because of the extent to which driving is positively valenced in our society, a focus on the role of positive affect may contribute to a fuller understanding of risky driving behavior.

When considered in light of research showing that, compared with adults, adolescent drivers often perceive driving behaviors to be less risky (Harré et al., 2000) dual process explanations may shed light on adolescents' proclivity for engaging in more risky driving than older drivers. Indeed, recent research suggests that, because of developmental differences between adolescents and adults, adolescents may rely more on an experiential decision making style (Reyna and Farley, 2006). Positive affect for driving may be especially strong for teen drivers: for most adolescents, having a license to drive independently represents a developmental milestone on the journey to becoming an adult (Winston and Senserrick, 2006), and thus is likely to be associated with strong positive affect. Anecdotal reports from focus groups we have conducted with teen drivers (Author, unpublished data) indicate that teen drivers express a great deal of positive affect when talking about driving.

Positive affect also appears to play a role in gender differences in driving behavior: a study of attitudes toward driving indicated that young men are often more interested in driving and enjoy driving more than young women (Harré et al., 1996). In the fast-paced decision-making required in real-life driving situations, experiential decision making is likely to dominate, and thus positive affect may play a strong role in the behavioral outcome of driving decisions. The greater positive affect experienced by male drivers than female drivers may help explain their higher likelihood of engaging in risky driving behaviors.

The purpose of the current study was to examine age and gender differences in risky driving, and to determine whether these differences can be attributed to differences in how positive affect and risk perception contribute to risky driving behavior. In light of this, the following hypotheses were tested in this research.

Hypothesis 1. Male drivers report greater positive affect for risky driving behavior than female drivers.

Hypothesis 2. Female drivers report perceiving greater risk in risky driving behavior than male drivers.

Hypothesis 3. Positive affect and perceived risk mediate the relationship between sex and risky driving behavior.

Hypothesis 4. Teen drivers report greater positive affect for risky driving behavior than adult drivers.

Hypothesis 5. Adult drivers report perceiving greater risk in risky driving behavior than teen drivers.

Hypothesis 6. Positive affect and perceived risk mediate the relationship between age and risky driving behavior.

In addition, it is important to understand the roles of perceived risk and positive affect in driving behavior. Most dual process models posit that affective and cognitive judgments are not mutually exclusive and can influence each other (e.g., Loewenstein et al., 2001). Some research has suggested that judgments of risk are dependent upon affective judgments (e.g., the affect heuristic, Slovic and Peters, 2006). In these perspectives, affective reactions happen quickly and then form the context for interpreting risk information. Although this is a process that likely occurs over time, and may be most relevant when learning about novel stimuli (Peters and Slovic, 2000), the implications for existing affective and cognitive beliefs is that they should combine to affect driving decisions. That is, if beliefs about the riskiness of an action are dependent on one's feelings about the action, these two beliefs should jointly predict behavior. The present research explored the nature of the relationship between risk perceptions and positive affect with respect to risky driving behavior, specifically whether, in risky driving contexts, positive affect and risk perception function separately or in a combined judgment when predicting behavior. The following research question was posed:

RQ1: Do positive affect and risk perception combine to predict driving behavior, or are the effects of affect and risk independent?

The present work further explored whether riskier drivers are differentially affected by affective or risk judgments than less risky drivers. Understanding whether drivers most prone to risk are more strongly affected by affective or cognitive judgments could help in

Table 1
Race and sex composition of teen and adult samples.

	Teens % (n = 504)	Adults % (n = 409)
White	86	79
African-American	10	17
Female	54	63

Note: In each sample 4% of respondents indicated a race other than white or African-American.

developing targeted message to these risky drivers. The following research question was posed:

RQ2: Do positive affect and risk perception differentially predict risky driving for men and women, or for teens and adults?

2. Method

2.1. Participants

Teen drivers age 16–20 (n = 504) and adult drivers age 25–45 (n = 409) were recruited in a statewide phone survey. The age range for the teens was selected because of research indicating that brain development in the prefrontal cortex, where a majority of reasoning and decision making is thought to occur (e.g., Damasio, 1994), is typically not completed until sometime in one's 20s, and twenty year-olds are still statistically at greater crash risk than adult drivers. Because of the rapid increase in driving experience during the teen years, we conducted analyses to compare novice teen drivers (age 16 and 17) with older teen drivers (age 18 through 20). These analyses revealed few differences and did not alter the main findings in the research, so we report the findings for the teen group as a whole.

The adult age range was selected to sample adults to early middle-age. This range was selected because research shows that risky driving associated with youth appears to level off by the mid-twenties (Begg and Langely, 2001). Older adults are both more risk averse and have cognitive changes that may affect driving skill. Because it is not known when these changes begin for older drivers, the decision was made to cut the age of the adult sample at 45. The intent was specifically not to sample older adults, as that would skew the adult sample toward risk-averse drivers.

Due to the difficulty of reaching teen drivers through random digit dial techniques (RDD), 87% of the teen sample was obtained from a targeted sample of households likely to contain teenage children, whereas 100% of the adult sample was obtained through RDD techniques. Preliminary analyses revealed few differences between the two subsamples of teens, and thus the results for the sample as a whole are presented. Demographics for the two samples are presented in Table 1. The difference in the demographic composition of the teen and adult samples was a concern. To rule out any effect of those differences on our conclusions, we conducted all analyses with weights applied to the teen sample to model the race and sex distribution in the adult sample. No differences were obtained in the findings between the weighted analysis and the unweighted analysis. To simplify the presentation, the unweighted analysis is reported here.

2.2. Survey questions

The survey instrument assessed self-reported frequency of engaging in a range of driving behaviors, liking toward each of the behaviors, and perceived risk of engaging in each of the behaviors. Additional questions addressing safety behaviors and other aspects of driving were asked, but were not related to the present hypotheses and are not discussed further.

The driving behavior questions were based in part on an existing risky driving questionnaire (Musselwhite, 2006) and in part on emerging themes from preliminary focus group data from our prior work. Twelve behaviors formed the main questionnaire (these were: switching lanes frequently to get ahead of other cars, performing fast acceleration and braking, driving faster than the speed limit even if it feels unsafe, driving fast on curves, driving while sleepy, driving after drinking, doing things that can distract you while driving, passengers doing things that can distract you while driving, driving through a red light, braking hard to stop in time, driving during rush hour, and racing with other cars). For each behavior, the respondent indicated on a 5-point scale how frequently they engaged in the behavior when driving from "Never" to "Always." They next indicated their perception of how risky it was to engage in each behavior on a 5-point scale from "Not risky at all" to "Extremely risky." Finally, consistent with research by Alhakami and Slovic (1994), participants indicated their affect toward the target behavior on a 5-point scale from "Dislike a lot" to "Like a lot." The order of the behaviors was randomized within each judgment type, and a different random order of questions was generated by the computer program for each respondent. Finally, demographic data were obtained.

2.3. Procedure

The telephone survey was conducted by the Capstone Poll at The University of Alabama. Responses were recorded anonymously using a computer assisted telephone interviewing program. A random digit dial methodology was used to randomly select households. When a household was reached, the selection of the respondent within the household was determined randomly. Because of the difficulties reaching teens at home by telephone, the complete adult sample was obtained well before the teen sample was complete. Thus, a targeted sample of households likely to contain teenage residents was obtained and used for the remainder of the teen interviews. For interviews conducted with this group, the respondent within the household was always a teen driver, if one was present. When interviewing a respondent under the age of 18, a parent or guardian was asked to provide informed consent prior to speaking to the participant. If permission was received from the parent or guardian, the underage participant then received the informed consent information before being asked for their assent. The interview was conducted only after parental consent and child assent were obtained. All procedures were approved by the Institutional Review Board of the home institution of the authors.

2.4. Analytic strategy

The overall analysis strategy was to use a regression model to address the mediation of the sex and age effects on risky driving by positive affect and perceived risk using the procedures outlined by Baron and Kenny (1986) and adapted by Preacher and Hayes (2008) for multiple mediators. We then applied a normal theory test and bootstrapping (Preacher and Hayes, 2004) to evaluate the indirect, or mediated, effect.

We used Preacher and Hayes' (2008) procedures for these analyses. First, regressions were calculated to evaluate the relationship of age or gender on the hypothesized mediators, in this case, risk perception and positive affect. These initial regressions evaluated the "a" paths in the mediation models shown in Fig. 1, and tested Hypotheses 1 and 2 for gender and Hypotheses 4 and 5 for age. Then, to evaluate Hypotheses 3 and 6, a regression model was evaluated in which risky driving behavior was the dependent variable. The direct effect of the mediators on risky driving was evaluated, corresponding to the "b" paths in Fig. 1. Next the regression evaluated the total effect of the independent variable on the dependent vari-

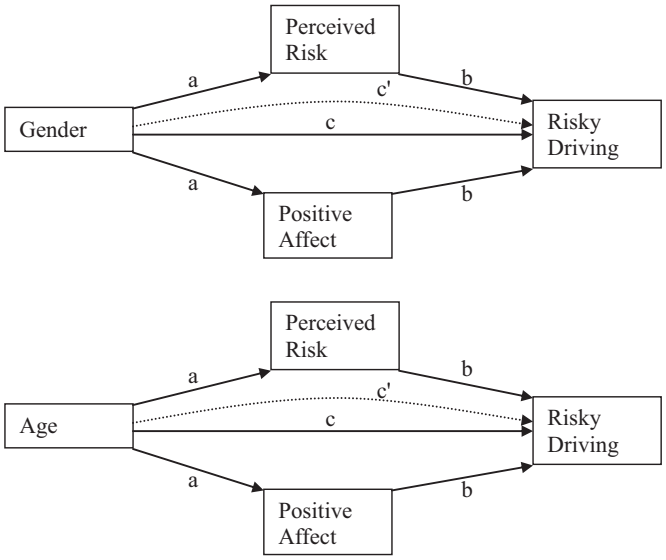

Fig. 1. Depiction of the models tested in the mediation analysis.

able. In this case, this was the relationship of age or sex to risky driving, without accounting for the mediating effects. This corresponded to the "c" paths in the figures. Finally, the direct effect of the independent variable on the dependent variable was evaluated, while controlling for the mediating effects. This was the "c-prime" path in the figures.

Finally, to evaluate the research questions, a final regression model evaluating the independent variable (gender or age), risk and affect, and all interactions was examined. RQ1 was evaluated by examining the interaction of affect and risk on driving behavior. RQ2 was evaluated by examining whether the interactions of gender and age with affect and risk predict behavior.

A preliminary MANOVA of age group by gender was conducted with positive affect, perceived risk and risky driving behavior as the dependent variables. In none of these analyses was there a significant interaction of age group and gender (all p values greater than .12). Thus we were justified in looking at age group and gender as separate predictors of the measured variables. For ease of presentation and interpretation, all analyses examine age and gender effects in separate models.

3. Results

3.1. Scale reliabilities

For each type of rating made – behavior frequency, risk perception, and positive affect – a reliability analysis was conducted to determine whether ratings across the different behaviors could reasonably be combined. The reliabilities were acceptable, with an alpha of .73, .81, and .74 obtained for behavior frequency, risk perception, and positive affect, respectively. Thus, separate means for behavioral frequency, risk perception and positive affect were computed for each participant across the twelve behaviors for each type of rating to represent indices of frequency of risky driving, positive affect toward risky driving, and perceived risk of risky driving. These means were used in the following analysis.

3.2. Gender differences in risky driving

The means for risky driving behavior, perceived risk, and positive affect by gender are presented in Table 2.

Confirming Hypotheses 1 and 2, the analysis revealed a significant relationship between gender and the mediators (a paths). Reports of positive affect were higher for male than female drivers ($b = .15$, $p < .001$), whereas perceived risk was higher for female than male drivers ($b = -.24$, $p < .001$). Evaluating the effects of the moderators on driving behavior (b paths) showed that there was a significant relationship between perceived risk and behavior ($b = -.21$, $p < .001$) and between positive affect and behavior ($b = .38$, $p < .001$) demonstrating that male drivers, compared with female drivers, reported more positive affect and less perceived risk in the sample of behaviors assessed. The total effect of gender on behavior (c path) represents the unmediated relationship between gender and risky driving, which was significant ($b = .08$, $p < .01$), indicating that male drivers reported more risky driving behavior than female drivers.

Hypothesis 3 was evaluated by examining the mediated relationship between gender and driving behavior (c-prime path). In this case, the effect is not significant ($b = .03$, $p > .10$). Following Preacher and Hayes (2008), normal theory tests of the indirect effects (ab paths) were significant ($Z = 5.11$ and $Z = 4.88$ for risk perception and positive affect, respectively). Bootstrapping techniques (Preacher and Hayes, 2008) further confirmed a mediated relationship (95% bias- corrected and -accelerated confidence interval for risk perception: .03–.08; for positive affect: .02–.09; for the total model: .07–.14, on 1,000 bootstrap resamples). Therefore, gender differences in reported risky driving were found to be attributable to gender differences in risk perception and positive affect, which in turn predict reports of risky driving. This analysis is represented graphically in Fig. 2.

3.3. Age differences in risky driving

The means for risky driving behavior, positive affect and perceived risk for teen and adult drivers are presented in Table 3.

The analyses for age effects were parallel to those conducted for gender. Confirming Hypotheses 4 and 5, the analysis revealed a significant relationship between age group and the mediators (a paths). Reports of positive affect were higher for teen than adult drivers ($b = .23$, $p < .001$), whereas perceived risk was higher for adult than teen drivers ($b = -.31$, $p < .001$). Evaluating the effects of the moderators on driving behavior (b paths) showed that there

Table 2
Means and confidence intervals for gender differences in ratings of behavior frequency, perceived risk, and positive affect.

Dependent variable	Gender	Mean (SD)	95% confidence interval	
			Lower bound	Upper bound
Behavior frequency	Male	2.02 (0.44)	1.96	2.05
	Female	1.93 (0.45)	1.89	1.97
Risk perception	Male	3.95 (0.49)	3.93	4.03
	Female	4.19 (0.46)	4.16	4.24
Positive affect	Male	1.74 (0.41)	1.68	1.76
	Female	1.59 (0.43)	1.55	1.62

Note: $n = 385$ for male drivers and 528 for female drivers.

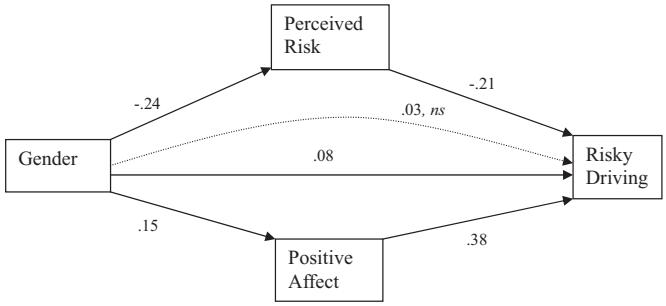

Fig. 2. The mediating role of risk perception and positive affect in the relation between gender and risky driving.

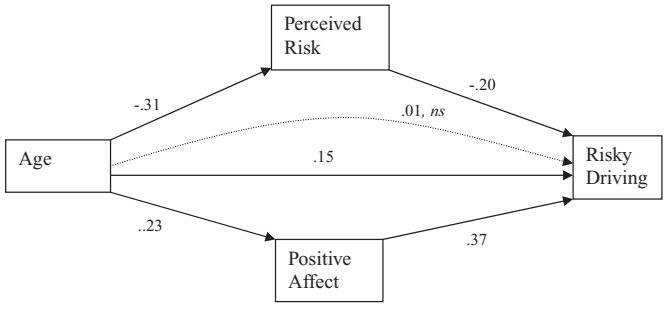

Fig. 3. The mediating role of risk perception and positive affect in the relation between age and risky driving.

was a significant relationship between perceived risk and behavior ($b = -.20$, $p < .001$) and between positive affect and behavior ($b = .37$, $p < .001$) demonstrating that teen drivers, compared with adults, reported more positive affect and less perceived risk in this sample of behaviors. The total effect of age group on behavior (c path) represents the unmediated relationship between age and risky driving, which was significant ($b = .15$, $p < .001$), indicating that teen drivers reported more risky driving behavior than adult drivers.

Hypothesis 6 was evaluated by examining the mediated relationship between age and driving behavior (c-prime path). In this case, the effect is not significant ($b = .007$, $p > .10$). Following Preacher and Hayes (2008), normal theory tests of the indirect effects (ab paths) were significant ($Z = 5.48$ and $Z = 6.57$ for risk perception and positive affect, respectively). Bootstrapping techniques (Preacher and Hayes, 2008) further confirmed a mediated relationship (95% bias-corrected and -accelerated confidence interval for risk perception: .04–.10; for positive affect: .04–.12; for the total model: .11–.18, on 1,000 bootstrap resamples). Therefore, age group differences in reported risky driving were found to be attributable to differences in risk perception and positive affect, which in turn predict reports of risky driving. This analysis is represented graphically in Fig. 3.

Table 4
Regression of risky driving on gender, positive affect and risk perception.

Predictor	*B*	S.E.	β
Gender	−.02	.03	−.02
Positive affect	.13	.02	.29**
Risk perception	−.13	.02	−.28**
Affect × risk	−.01	.01	−.03
Affect × gender	.12	.03	.16**
Risk × gender	.08	.03	.11*
Affect × risk × gender	.01	.02	.02

Note: Gender is coded such that 0 = female, 1 = male. All continuous variables were centered prior to analysis.
* $p < .05$.
** $p < .001$.

Table 5
Regression of risky driving on age, positive affect and risk perception.

Predictor	*B*	S.E.	β
Age group	.02	.03	.02
Positive affect	.15	.03	.34**
Risk perception	−.12	.02	−.28**
Affect × risk	−.02	.01	−.07
Affect × age	.07	.04	.11*
Risk × age	.07	.03	.11*
Affect × risk × age	.04	.02	.07

Note: Age is coded such that 0 = adult, 1 = teen. All continuous variables were centered prior to analysis.
* $p < .05$.
** $p < .001$.

3.4. Affect, risk, and behavior

Regression analyses were conducted to examine research questions 1 and 2. This analysis tested the independent effect of affect and risk perceptions on risky driving behavior (RQ1), as well as the combined effect of affect and risk as predictors of risky driving. To investigate the gender effects, a regression equation was constructed to predict risky driving behavior with the following predictors: gender, risk perception, and positive affect, as well as the 2-way and 3-way interaction terms. A parallel analysis was constructed to examine the effects of age. These regressions are presented in Tables 4 and 5, and indicate that in neither case was the interaction of affect and risk significant, nor was the three way interaction of affect, risk and age or gender significant, indicating that positive affect and perceived risk are independent contributors to driving behavior.

The same regression analyses tested whether affect and risk differentially predict risky driving for teen and adult drivers, or for male and female drivers (RQ2).

3.4.1. Interaction of perceived risk and positive affect with gender

Evaluating RQ2, there were significant two-way interactions of gender with risk perception and positive affect. Fig. 4 shows the interaction effect at one standard deviation below and above the mean for affect and risk, respectively. Risk perception was a

Table 3
Means and confidence intervals for age group differences in ratings of behavior frequency, perceived risk, and positive affect.

Dependent variable	Age group	Mean (SD)	95% confidence interval	
			Lower bound	Upper bound
Behavior frequency	Teen	2.04 (0.44)	2.00	2.08
	Adult	1.88 (0.43)	1.85	1.94
Risk perception	Teen	3.95 (0.46)	3.91	3.98
	Adult	4.26 (0.47)	4.19	4.28
Positive affect	Teen	1.76 (0.40)	1.73	1.80
	Adult	1.53 (0.43)	1.50	1.58

Note: $n = 504$ teen drivers and 409 adult drivers.

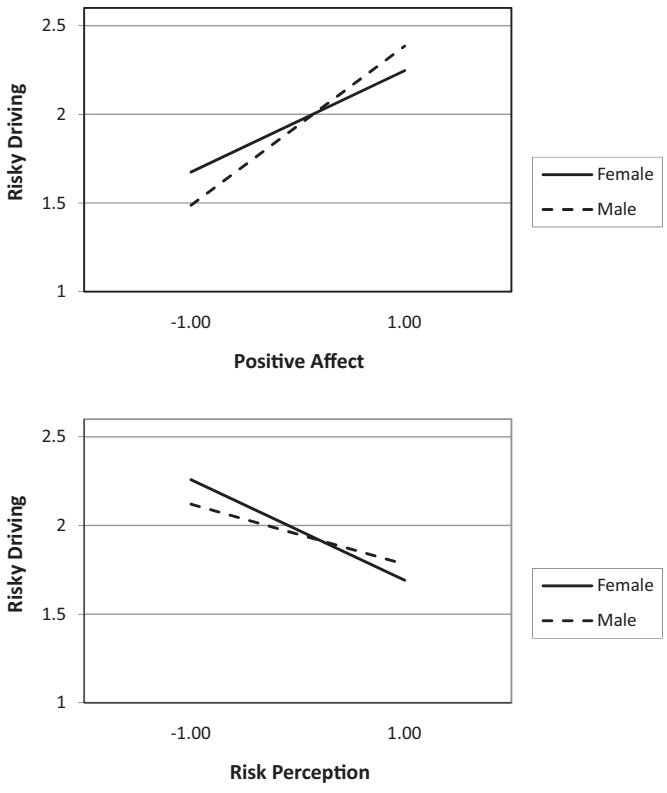

Fig. 4. The interactions of risk perception and positive affect with gender on risky driving behavior.

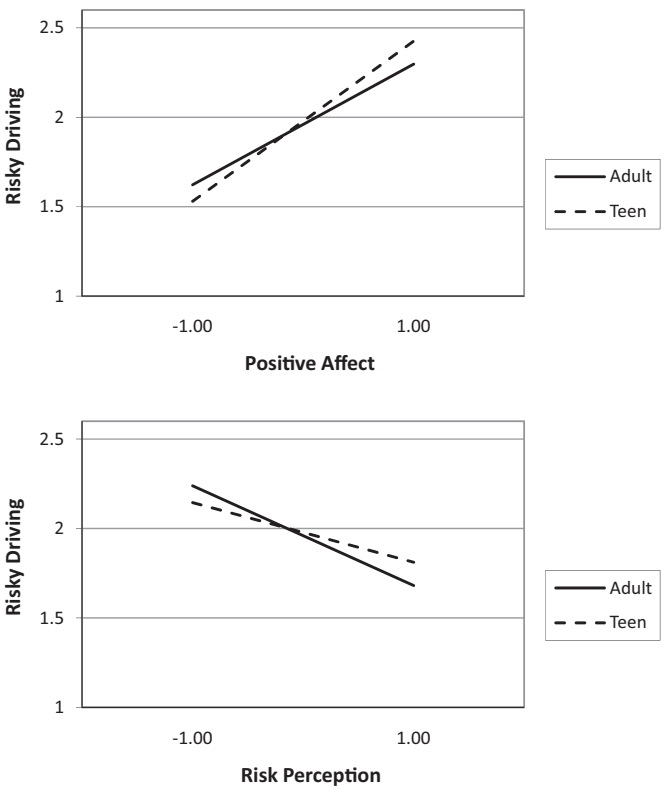

Fig. 5. The interactions of risk perception and positive affect with age group on risky driving behavior.

stronger predictor of risky driving for female than male drivers, whereas positive affect was a stronger predictor of risky driving for male than female drivers.

3.4.2. Interaction of perceived risk and positive affect with age

Evaluating RQ2 for the teen vs. adult drivers, there were significant two-way interactions of age with risk perception and positive affect. Fig. 5 shows the interaction effect at one standard deviation below and above the mean for affect and risk, respectively. Paralleling the gender analysis, risk perception was a stronger predictor of risky driving for adult than teen drivers, whereas positive affect was a stronger predictor of risky driving for teen than adult drivers.

4. Discussion

The goal of the present study was to examine how positive affect toward driving – in this case, reported liking for risky driving behavior, and the perceived riskiness of driving behaviors, may contribute to gender and age differences in risky driving behavior. Our hypotheses were confirmed, indicating that gender and age differences in risky driving behavior can be attributed to differences in perceptions of risk and enjoyment of risky behavior. This is an important finding from the standpoint of prevention efforts: if observed gender and age differences in risky driving are attributable to process variables such as affect and risk perception, efforts to reduce risky driving can focus on the process variables rather than on the characterics of the driver.

4.1. Decision processes in risky driving

These findings are consistent with dual process explanations of decision making (Chaiken and Trope, 1999; Smith and DeCoster, 2000). In this research, reliance on both experiential and rational decision styles was indicated by the roles of positive affect and perceived risk as a mediator of the sex effect on risky driving. Furthermore, the regression analyses demonstrated that affect and risk functioned as independent processes—as predicted by dual process models.

Some of the theoretical models coming out of the dual process perspective have suggested that experiential and rational decision making styles are to some extent interdependent. For example, the affect heuristic proposes that judgments of risk are based, to some extent, on whether the behavior is enjoyable (Finucane et al., 2000; Slovic et al., 2004, 2005; Slovic and Peters, 2006). In a similar vein, the risk as feelings hypothesis (Loewenstein et al., 2001) suggests that the cognitive and affective systems are interdependent. Our data do not address the genesis of affective and cognitive belief structures surrounding driving. However, our data do indicate that at the point of asking drivers about their driving beliefs and driving habits, the affective and cognitive systems appear to function independently. Thus, these findings are more supportive of an interpretation that affective, intuitive processes and reasoned, logical processes are *both* predictive of risky driving behavior.

To examine some of the cognitive processes underlying gender and age differences in risky driving, this study explored judgments of affect and risk perception as they related to driving behavior in teen and male drivers as compared with adult and female drivers. Male drivers and teen drivers were consistently more likely to report both enjoying these risky behaviors and perceiving them as less risky than their female and older counterparts. Examining how positive affect and risk perception relate to driving behavior can provide insight into established behavioral differences between men and women, as well as teens and adults. Our findings advance this work by showing that, among drivers who are more at risk of crashing – that is, younger and male drivers – positive affect appears to be more strongly related to reports of risky driving than for those who are less at risk. These findings are consistent with a growing body of research showing that affect is involved in many areas of

decision making (e.g., Damasio, 1994; Finucane et al., 2000; Slovic et al., 2004, 2005; Slovic and Peters, 2006; Zajonc, 1980).

Our results are consistent with prior research (e.g., Harré et al., 2000) that has found both sex and age differences in driving behaviors. The present research extends these findings by providing support for a psychological mechanism through which these behaviors may persist. The fact that positive affect is a stronger predictor of risky driving than risk ratings for teen and male drivers provides initial support for idea that these at-risk drivers may be particularly reliant on an experiential, affectively based decision style (e.g., Reyna and Farley, 2006) as they drive. Future work to investigate how this type of decision style is contributes to greater risk-taking while driving could shed additional light on the dynamics of risky driving.

Our findings suggest that moderating high-risk drivers' felt positive affect toward driving may be an important step in reducing risky driving. Guidance for this approach may be found in the long history of work on fear appeal messages (see e.g., Witte and Allen, 2000, for a review), which should invoke an emotional state that is antagonistic with pleasure. Recent work has focused on increased negative affect to counter the positive affect associated with risk behavior (Donovan et al., 1999; Lewis et al., 2007; Peters et al., 2006; Slovic and Peters, 2006). It should be noted however, that positive emotions may not be the polar opposite of negative emotion (Caccioppo et al., 1999; Lang et al., 2007; Larson et al., 2001), and thus a moderation of positive affect may not occur simply by presenting negative emotional stimuli. Furthermore, past research has shown that invoking too much negative affect can have deleterious effects (e.g., Janis and Feshbach, 1953; Rippetoe and Rogers, 1987; Witte, 1992; Witte and Allen, 2000). Future work in this area should test various types of affectively laden messages for their effects on both positive and negative emotions experienced by high-risk drivers.

Although positive affect was a stronger predictor of risky driving for higher risk drivers, the present findings also show a role of risk perception in risky driving behavior. Therefore, future research should also examine how to influence drivers' perceptions of risk, and how to make those risk perceptions more predictive of driving behavior. One area that has not received much research attention is how to make drivers consider the risks inherent in their behavior *while* they are driving. Work on the accessibility of mental constructs – how easily such constructs are activated from memory – could be instructive here, as the accessibility of risk-related constructs has been shown to affect risky behavior (Rhodes and Roskos-Ewoldsen, 2009; Shen et al., 2009). Future work in this stream should focus on how to make risk judgments more accessible to drivers while they are driving, by, for example, linking risk judgments to actual driving behavior or to cues in the driving environment.

It is important to note, however, that affect and perception of risk are not the only factors involved in risky driving. Other factors include perceptions of driving ability (e.g., Sarkar and Andreas, 2004), sensation seeking (e.g., Hansen and Breivik, 2001; Zuckerman, 1994), and especially for teen drivers, a lack of driving experience experience (e.g., McKnight and McKnight, 2003). Future work that integrates the current findings with these other streams of research may help develop messages more directly targeted to the riskiest drivers in order to reduce their likelihood of engaging in risky driving behavior.

This work has some limitations. First, because of the nature of telephone surveys and the difficulty of reaching teenagers at home, 87% of our teenage sample was obtained through a targeted sample of households likely to have teenagers. Thus, our teen sample was one of convenience. However, our analysis suggests that any differences in the obtained samples did not affect our conclusions. Nevertheless, future work should attempt to obtain a more representative sample to ensure that these findings are truly representative of teen drivers. An additional limitation of this work is that it is impossible to know whether respondents to the phone survey were able to speak privately; thus, as with all self-reports, the veracity of the responses cannot be determined. This issue may be particularly relevant for the teen respondents because their parents were required to consent to their participation, and thus they may have been present during the interview. Additional studies using other methods of data collection would be desirable to confirm these results.

A limitation of this work is that it was conducted on a cross section of the population at a single point in time. Clearly, beliefs about the risks inherent in driving and the affect associated with driving develop over time, and likely change as a function of driving experience. Future work that examines these issues in a longitudinal design would be beneficial for understanding how these processes develop in young drivers. It should further be cautioned that due to the correlational nature of the analyses, our findings cannot be taken as evidence for causality. It is possible that, for example, some teens have more positive affect toward risky driving before they begin driving, and thus engage in more risky behaviors once they begin driving. It is also possible that engaging in risky behaviors without consequences may increase positive affect toward the behavior. More research will be required to explore this relationship further. Future research investigating actual driving behaviors, whether in a driving simulator or through observations of driving on the road, would be beneficial in understanding more fully how positive affect and risk perceptions influence driving behaviors.

The specific set of behaviors tested in this research was culled from an existing questionnaire (Musselwhite, 2006) to which we added items that have emerged in our work with risky drivers. Our intent was to present to respondents an array of driving behaviors that they were likely to have experienced and that varied in their riskiness. We made no attempt to represent all risky driving behavior, or even the most common or the most dangerous behaviors. Thus, the extent to which the findings reported here are applicable to a wider range of driving behaviors will need to be established in further work.

Finally, our measures of perceived risk and positive affect may not fully represent the processes of experiential and deliberative decision making. These questions were modeled after those used in studies of dual processes in decision making (e.g., Finucane et al., 2000), and serve as indicators of these constructs. Yet, they may not be the most valid measures of the cognitive and affective components of decision making while driving. Further work to refine the measurement of affect and cognitions related to driving, and to more fully understand the interplay between affective and cognitive process in driving is warranted.

5. Conclusions

This work has demonstrated that both positive affect and risk perception are factors in behavioral decision making for drivers. Importantly, positive affect appears to be a stronger contributor to the driving behavior of male and teen drivers than of female and adult drivers. These findings are consistent with emerging views of decision making which indicate that decision making is based often on experiential "gut" feelings rather than rational analysis (Reyna and Farley, 2006). In particular for driving, which is dependent often on making very quick judgments in a dynamic environment, understanding how decisions emerge is important. Helping risky drivers temper the positive emotion related to driving, and helping them to more fully understand the risks of driving, represent promising areas for reducing automobile crashes.

Role of funding source

This work was supported by grant CDC R49CE000191 to the University of Alabama at Birmingham Injury Control Research Center from the Centers for Disease Control. The funding source had no role in the study design, data collection or analysis, or preparation and submission of the manuscript.

Acknowledgements

We are grateful to Debra McCallum and Michael Conaway for their assistance with the survey for this study, and to David Ewoldsen and two anonymous reviewers for their comments on an earlier version of this manuscript.

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