ELSEVIER
www.elsevier.com/locate/jsr

Journal of Safety Research 38 (2007) 59 – 70

www.nsc.org

A challenge to the assumed generalizability of prediction and countermeasure for risky driving: Different factors predict different risky driving behaviors

Ralston Fernandes [a,*], R.F. Soames Job [b], Julie Hatfield [a]

[a] *NSW Injury Risk Management Research Centre, Building G2, Western Campus Drive, Western Campus, University of New South Wales, NSW 2052, Australia*
[b] *Roads and Traffic Authority, PO Box K198, Haymarket, NSW 1238, Australia*

Received 16 June 2006; accepted 25 September 2006
Available online 1 February 2007

Abstract

In road safety, it may be debated whether all risky behaviors are sufficiently similar to be explained by similar factors. The often assumed generalizability of the factors that influence risky driving behaviors has been inadequately tested. Study 1 (N = 116) examined the role of demographic, personality and attitudinal factors in the prediction of a range of risky driving behaviors, for young drivers. Results illustrated that different driving behaviors were predicted by different factors (e.g., speeding was predicted by authority–rebellion, while drink driving was predicted by sensation seeking and optimism bias). Study 2 (N = 127) examined the generalizability of these results to the general driving population. Study 1 results did not generalize. Predictive factors remained behavior-specific, but different predictor-behavior relationships were observed in the community sample. Overall, results suggest that future research and practice should focus on a multi-factor framework for specific risky driving behaviors, rather than assuming generalizability across behaviors and driving populations.

Keywords: Risky driving; Predictive factors; Risk perceptions; Driver attitudes; Driver beliefs

1. Introduction

Road trauma is a major problem worldwide, including in Australia. According to the National Highway Traffic Safety Administration (2005), in 2005 there were 38,253 people killed and approximately 1.86 million people injured as a result of motor-vehicle crashes in the United States. Along with vehicle factors and the environment, human factors are prominent contributing factors in crashes, and, as such, must be thoroughly investigated.

Risky driving has been identified as an important contributor to road crashes (Cameron, 1985; Jonah, 1986; Prabhakar, Lee, & Job, 1996). In his review of the literature, Jonah (1986) illustrated a link between various risky driving behaviors and road trauma. More recently, Iversen (2004) found that people who had been involved in at least one car crash over the last one-year period engaged in more speeding, drink-driving, and reckless driving, as well as lower use of seat belts, over the same period.

Many different factors have been implicated as determinants of risky driving. The following brief review identifies the most prominent possible predictors of risky driving. Given the recent emphasis on motivation as a factor in risky driving (Job, 1999; Prabhakar et al., 1996), several risk-taking attitudes, beliefs, and personality traits are particularly relevant.

1.1. Age

Research has demonstrated significant differences in risky driving behavior between specific driver age groups (Begg & Langley, 2001; Jonah, 1990). In particular, young

* Corresponding author.
E-mail addresses: r.fernandes@unsw.edu.au (R. Fernandes), soames_job@rta.nsw.gov.au (R.F.S. Job), j.hatfield@unsw.edu.au (J. Hatfield).

0022-4375/$ - see front matter © 2007 National Safety Council and Elsevier Ltd. All rights reserved.
doi:10.1016/j.jsr.2006.09.003

drivers are more likely to drive fast, tailgate, engage in risky overtaking, allow too little time to merge, and fail to give way to pedestrians, compared with older drivers (Cameron, 1985; Job, 1999; Jonah, 1986; Prabhakar et al., 1996; Williams, 1998).

1.2. Gender

Males consistently exhibit greater risky driving compared with females (Evans & Wasielewski, 1983; Job, 1990b; Wasielewski, 1984). For example, Harre, Field, and Kirkwood (1996) found that males were significantly more likely than females to report engaging in speeding, drink-driving, and breaking rules associated with being on a restricted license.

1.3. Competitiveness

Competitiveness refers to a trait hypothesized to evaluate engaging in behavior that is viewed as a contest with other people. Blows, Ameratunga, Ivers, Lo, and Norton (2005) showed that drivers who report frequently racing a motor vehicle were 2.4 times more likely to be injured while driving. While competitiveness should logically predict on-road competitive driving (and possibly speeding and tailgating), it is yet to be sufficiently examined as a contributing factor in risky driving.

1.4. Openness, conscientiousness, extraversion, agreeableness, and neuroticism

Arthur and Doverspike (2001) have found that crashes significantly correlated with the five-factor model of personality, however, further research is required to uncover the role of these personality factors in engaging in risky driving behavior.

1.5. Aggression

Recent research suggests that there exists a sub-group of aggressive adolescent drivers who are at significantly high risk of engaging in risky driving behavior (Ulleberg, 2001). Furthermore, in a longitudinal interview study, Begg and Langley (2004) found that aggressive behavior at 18 years of age significantly predicted subsequent self-reported speeding behavior at both 21 and 26 years of age. Trait aggression has also been shown to significantly predict self-reported drink-driving (Begg, Langley, & Stephenson, 2003; Gulliver & Begg, 2004).

1.6. Psychopathy

Psychopathy is a form of antisocial personality characterized by hot-headedness, impulsivity, lack of responsibility, selfishness, lack of empathy, and lack of remorse (Lynam, Whiteside, & Jones, 1999). Research has illustrated the relevance of antisocial personality to deviant behavior (e.g., Kuriychuk, 1992); however, specific research is needed to ascertain the role of psychopathy in risky driving.

1.7. Authority defiance

Rebellion against authority figures may contribute to a propensity for breaking traffic laws, and consequently, engaging in risky driving. Authority defiance has not yet been sufficiently examined as a predictor of risky driving.

1.8. Time saving / convenience

Given that the most frequently reported reasons for continuing to drive when drowsy were meeting an appointment and wishing to arrive at a destination on-time (Nordbakke & Sagberg, 2007), time saving and convenience may be particularly relevant to driving while fatigued. Research also shows that people engaging in speeding are more likely to view being on time for appointments as desirable (Adams-Guppy & Guppy, 1995). Further research is required to identify whether convenience is associated with risky driving behaviors other than driving while fatigued and speeding.

1.9. Sensation seeking

Sensation seeking is a trait describing the tendency to seek new, different, and intense sensations and experiences (Zuckerman, 1994). A defining characteristic of sensation seeking is the willingness to accept risks for the sake of such experiences, and, as such, sensation seeking is closely linked to risky driving (Jonah, 1997; Jonah, Thiessen, & Au-Yeung 2001). Zuckerman (1994) suggests that sensation seeking is presently the most common purpose of risky driving for young men, aged 16–20 years. This demographic group exhibits the highest scores on Zuckerman's Sensation Seeking Scale.

1.10. Driver attitudes and beliefs

The Theory of Planned Behavior (Ajzen, 1985) proposes that attitudes toward health-relevant behaviors are key determinants of *intentions* to engage in the behavior, which, in turn, cause performance of the behavior. Relevant attitudes arise from beliefs about the outcomes of the behavior coupled with evaluation of those outcomes. For example, a belief that speeding increases the chance of crashing, along with a negative evaluation of crashing, would amount to a negative attitude toward speeding. A belief that speeding increases the chance of arriving at an appointment on time, along with a positive evaluation of arriving at an appointment on time, would amount to a positive attitude toward speeding. Normative beliefs – beliefs about significant others' expectation and their value – are also relevant. Several studies have illustrated the importance of investigating driver attitudes and beliefs in relation to risky driving (Parker, Reason, Manstead, & Stradling, 1995; Prabhakar et al., 1996; Ulleberg &

Rundmo, 2002). For example, in a longitudinal study examining self-reported risky driving and traffic safety attitudes, Iversen (2004) found that drivers with more positive attitudes toward rule violations and speeding were more frequently observed to engage in risky driving behavior.

1.11. Perceived risk

Perceived risk has received considerable attention as a determinant of risky driving (Brown & Cotton, 2003; Helweg-Larsen & Sheppard, 2001). For example, absolute perceived risk has been shown to significantly correlate with self-reported speeding (Ryb, Dischinger, Kufera, & Read, 2006). Perceived risk is a principal concept in a number of important and widely used theories of health behavior (Conner & Norman, 1996). For risky driving, this relates to the perceived risk of having a car crash, incurring demerit points, or being fined while driving.

Optimism bias is an aspect of risk perception that may also be relevant to risky driving. Optimism bias refers to people's tendency to expect a better future than their peers (Chua & Job, 1999; Weinstein & Klein, 1996). For example, people believe they are less likely than average to be injured or killed in a car crash (Job, 1990a), or be fined for drink-driving (Prabhakar et al., 1996). Optimism bias is hypothesized to promote risk-taking (Weinstein, 1988; Weinstein & Lyon, 1999), and perceived relative risk may be at least as important to risky driving as perceived absolute risk. Optimism bias has been shown to correlate positively (but weakly) with self-reported seat belt use (Svenson, Fischhoff, & MacGregor, 1985).

1.12. Risk utility

Risk utility refers to the value or usefulness of a risk, and has been proposed as a significant determinant of risky driving (Jonah, 1986). For example, drivers may engage in tailgating because it allows them to get to an appointment on time. Further, the risk itself may operate as a utility. Thus, drivers may engage in tailgating because it is exciting (see Job, 1999; Prabhakar et al., 1996). As another example, the utility of speeding may include winning competitions, venting frustration, saving time when late, enjoying speeding, and enjoying risk (Job, 1999).

This review highlights the possibility of different factors predicting different behaviors. A range of risky driving behaviors contribute to the high incidence of trauma on our roads, and it may be debated whether all risky behaviors are sufficiently similar to be explained by similar factors. Motivation to engage in different risky behaviors may vary considerably. For example, a decision to have unprotected sex may result from a range of factors that may not influence a decision to speed while driving. Similarly, the reasons for a driver engaging in one risky driving behavior may be different from the reasons for engaging in another risky driving behavior. That is, the factors that contribute to a person's decision to speed may not be the same factors that contribute to their decision to drink-drive.

There appears to be a pervasive assumption that attitudinal factors (e.g., optimism bias, risk perception) and more general personality features (e.g., sensation seeking, authority rebellion) contribute to different risky driving behaviors in the same way (e.g., Kanellaidis, Golias, & Zarifopoulos, 1995; Wasielewski, 1984). This assumption, however, has not been adequately tested, perhaps because past research has typically focused on single driving behaviors (e.g., Harre, Brandt, & Dawe, 2000). Given the range of factors implicated in the prediction of risky driving, it is necessary to examine such factors together (for argument in favor of multi-factor designs, and in relation to a range of risky driving behaviors), in order to tease apart the roles of different factors and identify which factors best predict which *individual* risky driving behavior.

2. Study 1: Investigating demographic, personality and attitudinal factors for risky driving in a student sample

It has been shown repeatedly that young drivers are over-represented in road crashes, compared with other age groups (Job, 1999; Jonah, 1986; Prabhakar et al., 1996). A complex constellation of factors is likely to contribute to the over-representation of young drivers in road crashes (Cameron, 1985; Job, 1999). The lack of driving experience in adolescent drivers is seen as a major contributor, with an important consequence believed to be an inadequate ability to cope with deviations from "normal" driving conditions (such as varying weather conditions; Job, 1999). Furthermore, young people with limited experience engage in risky driving behaviors without fully understanding the consequences of their actions (Bell & Bell, 1993). Exposure may be another contributing factor, with young people involved in more crashes at nighttime (which is associated with higher crash rates), compared to older drivers (Lee, Prabhakar, & Job, 1993; Roads and Traffic Authority of NSW, 2005).

Risky driving is a major determinant of the over-involvement of young drivers in road crashes (Cameron, 1985; Jonah, 1986; Prabhakar et al., 1996; Turner, McClure, & Pirozzo, 2004; Williams, 1998). Compared with older drivers, young drivers are more likely to drive fast, tailgate, engage in risky overtaking, allow too little time to merge, and fail to give way to pedestrians (Job, 1999; Jonah, 1986).

A range of factors may contribute to the greater risky driving of young people. Lee et al. (1993) showed that younger drivers were more likely than older drivers to report speeding when late to save time, speeding as a source of fun, venting anger upon other drivers, and taking risks 'for the sake of it.' In addition, Zuckerman (1994) suggests that sensation seeking is the most common purpose of risky driving for young people, particularly young male drivers. Furthermore, perceived risk appears to be important, in that young drivers display lower acknowledgement of risky driving situations, compared with older drivers (DeJoy, 1989; Prabhakar et al., 1996).

While young people may engage in risky driving for any of the reasons outlined previously, systematic investigation of the relative importance of these factors for different behaviors in young drivers is yet to be comprehensively examined.

Study 1 examined demographic, personality, and attitudinal factors in relation to predicting 10 risky driving behaviors, and investigated whether different factors predict different risky driving behaviors, in a sample of young drivers. The 10 risky driving behaviors were: speeding, drink-driving, driving while fatigued, red light running, aggressive driving, reckless driving, competitive driving, not wearing seat belts, not using indicators, and tailgating.

3. Method

3.1. Participants

One hundred-and-sixteen first-year Psychology students (67% female) from the University of Sydney participated in a study on "driving and road safety" for course credit. Participants were required to have held a current NSW drivers license for at least one year, and to be 22 years of age or less. The age range of the sample was 17–22 years, and mean age was 18.7 years.

3.2. Materials

Participants were required to complete a questionnaire with seven sections (given in order of administration):

3.2.1. Personal characteristics

Participants responded to questions regarding their age, gender, suburb, driving experience (in years), and drivers license status.

3.2.2. Optimism bias

Participants rated the chances that each of 25 events would happen to them, compared with peers of the same age and gender. Responses were made on a 7-point scale, ranging from "Much less chance" to "Much more chance." *Road-related specific optimism bias* questions related to being fined and having a crash due to a specific behavior (with one scale formulated for each of the 10 driving behaviors). *Road-related general optimism bias* questions related to general driving issues that were not specific to the individual behaviors (e.g., "Injured in a road accident, as a driver"). *Road-unrelated optimism bias* related to events other than driving (e.g., "Develop a mental illness").

3.2.3. Attitudes and beliefs

In accordance with the Theory of Planned Behavior, questions related to *specific attitudes and beliefs* toward the behavior (with some questions reflecting risk utility), for each of the 10 risky driving behaviors (e.g., "It is fun to drive fast"), as well as beliefs about *peer approval* (subjective norm; e.g., "When I'm driving with my friends, they don't mind if I drink-drive"). Questions also related to *general attitudes and beliefs* about driving and road safety (e.g., "I am a cautious driver"). Participants rated their agreement with 85 statements, and responses were made on a 7-point scale, ranging from "Strongly agree" to "Strongly disagree." One *general attitudes and beliefs* scale and one *peer approval* scale, in addition to 10 *specific attitudes and beliefs* scales (one relating to each of the 10 behaviors), were formulated by adding the ratings for all items in each scale.

In addition, questions related to *perceived risk* regarding the avoidance of negligent driving behaviors. Participants indicated the extent to which they avoid each of the 10 driving behaviors, related to each of three possible consequences: having a crash, being fined, and incurring demerit points (e.g., "To what extent are you likely to avoid speeding due to the possibility of being fined?"). Responses to the 30 items were made on a 6-point scale, ranging from "Not at all" to "Always." Ten *specific perceived risk* scales (one relating to each of the 10 behaviors) were formulated by adding the ratings for all items in each scale.

3.2.4. Driving behavioral intentions

Participants reported the frequency with which they intended to engage in each of the 10 behaviors, under various circumstances (instructions emphasized intention to engage in behavior, rather than estimates of behavior). Five different circumstances were presented for each behavior. For example, participants were asked: "How often would you intend to run a red light?" (a) "When in little traffic;" (b) "When in heavy traffic;" (c) "When driving with no other vehicle in sight;" (d) "When following a vehicle through a choked up intersection;" and (e) "When late for an important meeting." Participants gave responses as a percentage of times that they were in each circumstance, ranging from "0% of such occasions" to "100% of such occasions," on a percentage scale guide. For each behavior, behavioral intention scales were formulated by adding the percentage scores for each of the five questions pertaining to a given behavior.

The Theory of Planned Behavior predicts a direct relationship between intention and behavior, and behavioral intention is often employed as a surrogate for driving behavior measures in road safety research (Parker, Manstead, Stradling, & Reason, 1992; Parker, Lajunen, & Stradling, 1998). Self-reported intention to engage in risky driving behaviors has been found to offer a reasonably accurate surrogate of archival measures (Arthur et al., 2001; West, French, Kemp, & Elander, 1993).

3.2.5. Personality scales

Widely researched measures of relevant personality dimensions were administered. These were the *Hypercompetitive Attitude Scale* (Ryckman, Hammer, Kaczor, & Gold,

1990), the *Authoritarian-Rebellion Scale* (Kohn, 1972), *Levenson's Self-Report Psychopathy Scale* (Levenson, Kiehl, & Fitzpatrick, 1995), the *Aggression Questionnaire* (Buss & Perry, 1992), the *Time Urgency Scale* (Landy, Rastegary, Thayer, & Colvin, 1991), the *Openness, Conscientiousness, Extraversion, Agreeableness, Neuroticism Index Condensed* (*OCEANIC*; Roberts, 2001), and the *Sensation Seeking Scale* (Zuckerman, 1980).

Further, a 13-item true/false short form (Form C) of the Marlowe-Crowne Social Desirability Scale (Reynolds, 1982) was administered. It has been suggested that self-report data may be biased, at least to some extent, by socially desirable responding (Paulhus, 1984, 1989). The possibility of distortion due to socially desirable responding is particularly pronounced when there are clear social norms attached to the factor that is being measured, and this appears relevant to road-safety behaviors, attitudes, and beliefs. Participants with an extreme tendency toward socially desirable responding were excluded from the analyses (see Reynolds, 1982).

All of these scales have sound parametric properties.

3.2.6. Infringements and crashes

Participants indicated how many times they had been fined for traffic infringements (other than parking fines), and how many crashes (of any type) they had been involved in while driving. Participants gave further details for up to the three most recent infringements (e.g., type of infringement, amount fined), and three most recent crashes (e.g., extent of injuries, extent of repairs).

3.3. Procedure

Participants were seated in a room at the University of Sydney as a group in order to enhance feelings of anonymity. Questionnaires were completed individually. Participants were instructed to read all questions carefully and to answer each question honestly. Participants were given one hour to complete the questionnaire. Upon completion, participants were debriefed, given their course credit, and thanked for their participation.

4. Results and discussion

Data were analysed employing SPSS. A Type I error rate of 0.05 was set for all analyses, and all tests were 2-tailed.

4.1. Sample characteristics

Nine participants were omitted from the analysis because their excessive scores on the Marlowe-Crowne Social Desirability scale (scores > 10 [two standard deviations above the mean]) suggested a strong tendency toward socially desirable responding. Of the remaining 107 participants, 67% were female, and the average age of participants was 18.7 years (standard deviation = 1.2).

4.2. Scale reliability and construction

Internal consistency was assessed employing Chronbach's Alpha. Chronbach's Alpha for all scales in Study 1 used is shown in Table 1.

With the exception of the *general attitude* scale ($\alpha = 0.44$), the *specific attitude for red light running* scale ($\alpha = 0.53$), the *road-unrelated optimism bias* scale ($\alpha = 0.34$), as well as the *road-related specific optimism bias* scales for not wearing seat belts ($\alpha = 0.57$), tailgating ($\alpha = 0.57$) and reckless driving ($\alpha = 0.55$), internal consistency for all scales constructed was acceptable, ranging from 0.61 to 0.96. It should be noted that results involving scales with poor internal consistency should be interpreted with caution. Principal component analysis of the *specific perceived risk* scales indicated that, for each of the 10 behaviors, the avoidance of crashes item was lowering internal consistency. Thus, these items were cut from each *perceived risk* scale, and combined to produce an overall *perceived crash risk* scale ($\alpha = 0.87$), which was then entered in regression analyses for all behaviors.

4.3. Comparison of regression models for specific behaviors

Regression models for each of the four driving behaviors (each containing a range of possible factors) were compared. Hierarchical regression models were employed for the present research.

In order to curb risky driving, it may be more feasible for road safety interventions to target factors that are amenable to change. Thus, interventions that target driver attitudes and beliefs may be more successful in producing behavior change. However, in order to understand whether attitudes and beliefs significantly influence risky driving, the effects of age, gender, and personality factors must be taken into account. Consequently, these factors should be controlled prior to examining the attitudes and beliefs of drivers. Accordingly, three regression models were considered for each behavior:

4.3.1. 'Demographics only' model

Age and Gender are fixed attributes of an individual. These factors were included as covariates, and were forced to enter first in the regression analyses.

4.3.2. 'Demographics plus personality factors' model

Personality factors are defined as stable and consistent characteristics of an individual. These factors were included as covariates, and were considered after the effects of demographics were incorporated in the model.

4.3.3. 'Demographics plus personality factors plus attitudes and beliefs' model

In order to understand whether attitudes and beliefs significantly influence risky driving, the effects of age, gender, and personality factors must be taken into account.

Table 1
Internal consistency, mean, and standard deviation, for all scales constructed in Study 1

Scale	Cronbach's alpha	Mean	S.D.
Behavioral intention scales			
Speeding	0.9568	40.4	6.18
Red light running	0.9079	15.3	4.67
Competitive driving	0.9017	13.5	5.98
Tailgating	0.8847	28.3	3.24
Drink-driving	0.8741	20.1	4.65
Not wearing seat belts	0.8434	95.6	2.68
Reckless driving	0.7946	12.9	6.01
Driving while fatigued	0.7840	42.4	5.04
Not using indicators	0.7325	72.2	3.88
Aggressive driving	0.7420	28.8	9.77
Attitude and belief scales			
Road-related specific optimism bias (drink-driving)	0.8077	3.7	2.41
Road-related specific optimism bias (driving while fatigued)	0.7340	5.2	2.58
Road-related specific optimism bias (speeding)	0.6521	5.9	2.66
Road-related specific optimism bias (not wearing seat belts)	0.5681	4.1	2.14
Road-related specific optimism bias (red light running)	0.8045	5.3	2.38
Road-related specific optimism bias (tailgating)	0.5666	5.1	2.31
Road-related specific optimism bias (reckless driving)	0.5459	5.8	2.28
Road-related specific optimism bias (not using indicators)	0.5459	2.6	1.68
Road-related general optimism bias	0.6551	13.4	3.65
Road-unrelated optimism bias	0.3356	14.7	4.05
Specific attitude (competitive driving)	0.8309	27.5	6.05
Specific attitude (speeding)	0.7972	31.1	8.40
Specific attitude (aggressive driving)	0.6969	26.7	5.40
Specific attitude (tailgating)	0.7645	24.8	2.95
Specific attitude (reckless driving)	0.7716	25.8	5.15
Specific attitude (not using indicators)	0.7127	29.8	4.30
Specific attitude (drink-driving)	0.7049	44.4	4.15
Specific attitude (not wearing seat belts)	0.6384	37.8	4.17
Specific attitude (driving while fatigued)	0.6086	25.5	2.57
Specific attitude (red light running)	0.5283	24.8	2.87
General attitude	0.4423	69.3	7.16
Peer approval beliefs	0.8211	75.0	11.34
Specific perceived risk (competitive driving)	0.9159	8.5	2.57
Specific perceived risk (tailgating)	0.9159	8.7	2.95
Specific perceived risk (aggressive driving)	0.9090	8.9	2.91
Specific perceived risk (driving while fatigued)	0.8902	8.1	3.02
Specific perceived risk (reckless driving)	0.8648	9.4	2.25
Specific perceived risk (drink-driving)	0.8627	10.5	2.14
Specific perceived risk (not wearing seat belts)	0.8375	9.8	2.82
Specific perceived risk (not using indicators)	0.8077	9.0	2.87
Specific perceived risk (red light running)	0.6638	10.0	2.04
Specific perceived risk (speeding)	0.6487	9.6	1.79
Perceived crash risk	0.8739	49.7	7.96

Consequently, attitude and belief factors were considered after the effects of demographic and personality factors were incorporated in the model.

The summary of results for Study 1 regression analyses performed for each risky driving behavior is shown in Table 2. *Age* was not a significant predictor of any behavior. Three behaviors (drink-driving, reckless driving, and competitive

Table 2
Summary of Study 1 regression analyses results, illustrating the factors predicting each risky driving behavior within each of the three behavior models (with the proportion of variance accounted for by each model in brackets)

Behavior	Demographics only model	Demographics plus personality factors model	Demographics plus personality factors plus attitudinal factors model
Competitive driving	Gender ***	Gender ***	Hyper-competitiveness * Time urgency * Specific attitude ***
	(R^2 = 15.7%)	*(R^2 = 14.9%)*	*(R^2 = 59.7%)*
Tailgating	– *(R^2 = 1.5%)*	Aggression * *(R^2 = 5.5%)*	– *(R^2 = 15.3%)*
Red light running	– *(R^2 = 0.5%)*	– *(R^2 = −2.7%)*	Specific attitude *** *(R^2 = 31.0%)*
Not wearing seat belts	– *(R^2 = −0.7%)*	Extraversion * *(R^2 = −2.3%)*	Specific attitude * *(R^2 = 26.4%)*
Not using indicators	– *(R^2 = 1.5%)*	– *(R^2 = 0.4%)*	Road-related specific optimism bias * Specific attitude *** *(R^2 = 30.7%)*
Aggressive driving	– *(R^2 = −1.5%)*	Extraversion *** *(R^2 = 12.1%)*	Openness (OCEANIC) * Specific attitude *** *(R^2 = 30.0%)*
Reckless driving	Gender *** *(R^2 = 14.0%)*	Gender *** *(R^2 = 13.1%)*	Gender * Time urgency * Specific attitude * *(R^2 = 31.9%)*
Drink-driving	Gender *	Sensation seeking *	Sensation seeking * Perceived crash risk * Road-unrelated optimism bias * Specific attitude *** *(R^2 = 51.8%)*
	(R^2 = 2.8%)	*(R^2 = 17.1%)*	
Speeding	– *(R^2 = 1.4%)*	– *(R^2 = 1.3%)*	Authority rebellion * Specific attitude *** *(R^2 = 21.2%)*
Driving while fatigued	– (R^2 = −0.1%)	Sensation seeking * (R^2 = 6.4%)	Peer approval beliefs * Specific perceived risk * Road related general optimism bias *** (R^2 = 30.1%)

* $p < 0.05$.
*** $p < 0.01$.

driving) were initially predicted by *gender*, but gender was then superseded by a more dominant personality or attitudinal predictor. Five behaviors (speeding, drink-driving, reckless driving, aggressive driving, and competitive driving) were predicted by both personality and attitudinal factors. Four behaviors (red light running, not wearing seat belts, not using indicators, and driving while fatigued) were predicted by only attitudinal factors. The proportion of variance accounted for by the regression models ranged between 21.2% and 59.7%, with the exception of not wearing seat belts (6.4%) and tailgating (15.3%).

Overall, the results clearly illustrate the varying patterns of predictors between individual risky driving behaviors. For instance, speeding was significantly predicted by authority rebellion and specific attitude toward speeding, while competitive driving was significantly predicted by hyper-competitiveness, time urgency, and specific attitude toward competitive driving. Thus, results do not support the frequent assumption (in road safety research) that all risky driving behaviors are predicted by the same factors.

5. Study 2: Investigation of the generalizability of study 1 results

Study 2 examined whether Study 1 results could be generalized beyond the student population. Further, Study 2 aimed to provide a closer examination of the effect of age on risky driving. In Study 1, participants were required to be licensed drivers, 22 years or younger. The resulting low variance in age may have limited the apparent influence of age on risky driving behavior. Study 2 aimed to investigate the predictive power of age with the more extended age range of the general driving population. Study 2 also examined whether the results for a sub-group of the general population *of the same age as the student population* paralleled Study 1 results. This allows for a better understanding of the mechanisms underlying any differences between the student and general populations.

Study 2 was conducted at various RTA Motor Registries around Sydney in order to sample drivers efficiently. This methodology has the advantages of allowing approach to a wide sector of the driving public, and producing a high and apparently unbiased response rate. Due to concerns regarding response rate in a situation in which there is no incentive for participation, the original questionnaire was condensed by including only two risky driving behaviors from the questionnaire used in Study 1: *Speeding* and *not wearing seat belts*.

6. Method

6.1. Participants

Participants were 127 people (57.8% female, aged 16–26 years) who were required to have held a current NSW drivers license for at least one year. Participants were recruited outside one of four RTA Motor Registries in metropolitan Sydney that were selected to allow representation of a range of socioeconomic areas.

6.2. Material

The Study 2 questionnaire was the same as in Study 1, but without questions relating to the eight omitted behaviors.

6.3. Procedure

For all data collection sessions, data collectors worked in pairs, and stood outside the main entrance of each selected motor registry. All people entering the grounds of each motor registry were approached, and invited to participate in a study on "drivers' attitudes toward various risky driving behaviors." Participants who confirmed that they held a current NSW drivers license were asked to complete a short questionnaire, taking approximately 10 minutes, while they waited for service inside the registry, and to return the questionnaire upon leaving. The refusal rate was approximately 40%. Participants were assured that their involvement was entirely voluntary, that they could withdraw at any time, and that their responses would be confidential. All participants read the Participant Information Sheet, and were instructed to read all questions carefully and to answer each question as honestly as possible. All participants were debriefed and thanked for their participation.

7. Results

7.1. Sample characteristics

Twelve participants were omitted from the analysis, due to high scores on the Marlowe-Crowne Social Desirability scale (scores > 10 [two standard deviations above the mean]). Of the remaining 115 subjects, 57.8% were female, and the average age of participants was 23.2 years. For the 22 years of age or less sub-group, there were 31 participants (58.3% female), with an average age of 20.3 years (standard deviation = 11.8).

7.2. Scale reliability and construction

Internal consistency was assessed employing Chronbach's Alpha. Internal consistency for all scales used in Study 2 is shown in Table 3.

Internal consistency for all scales was satisfactory, ranging from 0.62 to 0.99, with the *road-unrelated optimism bias* scale exhibiting the lowest internal consistency.

7.3. Comparison of regression models for specific behaviors

In order to meet the aims for Study 2, three analyses were planned:

Table 3
Internal consistency, mean, and standard deviation, for all scales constructed in Study 2

Scale	Cronbach's alpha	Mean	S.D.
Behavioral intention scales			
Speeding	0.9096	44.2	4.62
Not wearing seat belts	0.8286	91.8	2.88
Attitude and belief scales			
Road-related specific optimism bias (speeding)	0.7681	6.3	2.86
Road-related specific optimism bias (not wearing seat belts)	0.9176	4.7	2.57
Road-related general optimism bias	0.6601	12.2	2.99
Road-unrelated optimism bias	0.6154	14.7	3.87
Specific attitude (speeding)	0.8249	33.2	7.42
Specific attitude (not wearing seat belts)	0.6927	36.8	5.98
Peer approval beliefs	0.7922	76.9	9.64
Specific perceived risk (speeding)	0.9114	9.8	2.79
Specific perceived risk (not wearing seat belts)	0.9959	9.7	2.62
Perceived crash risk	0.7446	50.9	6.88

7.3.1. Regression analyses A: Full regressions including age as a predictor

Initially, a repeat of Study 1 analyses was undertaken. The three regression models were tested for both speeding and not wearing seat belt behaviors. If age *is* found to be a dominant predictor here, it is necessary to test whether age was *not* a predictor amongst students in Study 1 only because of restricted variance in age, or whether students are really different from the general population. To test this, two relevant analyses were planned.

7.3.2. Regression analyses B: Regressions in age-restricted sample

First, in the 22 years old or younger sub-group, full regression analyses were performed for each behavior (with age included as a predictor). Selection of this specific age group allows direct determination of whether the results from Study 1 can be applied in the general population, although there is a loss of statistical power (i.e., parallel of Study 1 for young general population).

7.3.3. Regression analyses C: Regressions excluding age as a predictor

Secondly, the three regression models were again tested for each behavior for the full Study 2 sample, but *without age as a predictor*. This indicates which factors predict each driving behavior *when age is not considered in the model* (i.e., parallel of Study 1 for general population, if age is not a tenable predictor in Study 1).

7.3.4. Full regressions

The summary of results for Study 2 Regression Analyses A is shown in Table 4.

Age significantly predicted speeding through all three models, but failed to predict not wearing seat belts at all.

Table 4
Summary of Study 2 results from regression analyses A, illustrating the factors predicting speeding and not wearing seat belts (with the proportion of variance accounted for by each model in brackets)

Behavior	Demographics only model	Demographics plus personality factors model	Demographics plus personality factors plus attitudes model
Regression analyses A: Full regressions including age as a predictor			
Speeding	Age *** *(R^2=19.2%)*	Age *** *(R^2=18.4%)*	Age * *(R^2=22.5%)*
Not wearing seat belts	Gender *** *(R^2=4.0%)*	Gender *** *(R^2=3.1%)*	Specific attitude *** Road-related specific optimism biaS * *(R^2=27.1%)*

* p<0.05.
*** p<0.01.

There were also differences between the predictors found for each behavior across populations. For speeding, the predictor found in the present analysis (*age*) was substantially different to those found in the student population (*specific attitude to speeding* and *authority-rebellion*). For seat belts, while *specific attitude to not wearing seat belts* predicted the behavior in both student and general populations, *road-related specific optimism bias to not wearing seat belts* was also a significant predictor in the general (but not student) population. Results again illustrate different predictors for the two risky driving behaviors.

7.3.5. Age-restricted sample, and regressions excluding age as a predictor

Given that age did not significantly predict not wearing seat belts in Regression Analysis A, Regression Analyses B, and Regression Analysis C will be undertaken for speeding only. The summary of results for Study 2 Regression Analysis B and Regression Analysis C for speeding is shown in Table 5.

In the age-restricted sample (Regression Analysis B), *Age* continued to predict speeding within the first two models, but

Table 5
Summary of Study 2 results from regression analysis B and regression analysis C, illustrating the factors predicting speeding (with the proportion of variance accounted for by each model in brackets)

Behavior	Demographics only model	Demographics plus personality factors model	Demographics plus personality factors plus attitudes model
Regression analyses B: Regressions in age-restricted sample			
SPEEDING	Age * *(R^2=20.4%)*	Age * *(R^2=23.2%)*	– *(R^2=14.8%)*
Regression analyses C: Regressions excluding age as a predictor			
SPEEDING	– *(R^2=−0.6%)*	– *(R^2=−1.5%)*	Specific attitude * *(R^2=19.4%)*

* p<0.05.
*** p<0.01.

upon the addition of attitudes, no factor significantly predicted the behavior at all. With age omitted as a predictor (Regression Analysis C), speeding was significantly predicted by *specific attitude to speeding*.

8. General discussion

8.1. Varying pattern of predictors across individual risky driving behaviors

The present study tested the practical assumption that demographic, personality, and attitudinal factors contribute to risky driving behaviors in the same way, regardless of the behavior. The results clearly illustrate the varying patterns of predictors between individual risky driving behaviors, in both the student and general population samples.

In the student sample, driving while fatigued was significantly predicted by peer approval, specific perceived risk, and road-related general optimism bias, while reckless driving was significantly predicted by gender, time urgency, and specific attitude to reckless driving. Drink driving was significantly predicted by sensation seeking, perceived crash risk, specific attitude to drink-driving and road-unrelated optimism bias (although this result should be interpreted with caution given that the road-unrelated optimism bias scale showed poor internal consistency). Not wearing seat belts was significantly predicted by specific attitude to not wearing seat belts, while not using indicators was significantly predicted by road-related specific optimism bias, and specific attitude to not using indicators. Aggressive driving was significantly predicted by openness and specific attitude to aggressive driving, while competitive driving was significantly predicted by hyper-competitiveness, time urgency, and specific attitude to competitive driving. Speeding was significantly predicted by authority rebellion and specific attitude to speeding, while red light running was significantly predicted by specific attitude to red light running (although this result should be interpreted with caution given that this scale showed poor internal consistency). No factors significantly predicted tailgating when all factors were included in the model, and this model accounted for the lowest proportion of variance of all the behaviors (15.3%, compared to 21.2%–59.7% for the other behaviors).

Attitudes and beliefs appear to be the strongest predictors of risky driving, even after controlling for the effects of age, gender, and personality factors. In particular, those attitudes and beliefs specific to individual behaviors appear to be the most pertinent factors. In Study 1, specific attitudes were significant predictors of all behaviors, with the exception of tailgating and driving while fatigued. In Study 2, specific attitudes and beliefs predicted one of the two behaviors (not wearing seat belts). These findings support recent studies illustrating the importance of investigating attitudes and beliefs that are *specific* to each individual risky driving behavior, rather than *general* road safety attitudes and beliefs (Iversen, 2004; Ulleberg & Rundmo, 2002). Further, Sutton (1998) argues that a general attitude measure is a weak predictor of a specific behavior, implying that the investigation of attitudes specific to individual driving behaviors (rather than a general measure) would allow for the reliable prediction of those specific behaviors.

Furthermore, the finding that sensation seeking significantly predicted intention to drink-drive supports previous research on drink-driving (Jonah et al., 2001; Jonah, 1997; van Beurden, Zask, Brooks, & Dight, 2005). Sensation seeking, though, did not predict speeding, despite previous research showing sensation seeking to be a significant predictor of both observed speeding (Jonah, 1997) and self-reported speeding behavior (Jonah et al., 2001).

In addition, in Study 1, optimism bias scales showed high internal consistency, and significantly predicted three risky driving behaviors (not using indicators, drink-driving, and driving while fatigued), despite the high internal consistency of the optimism bias scale. Furthermore, in Study 2, road-related specific optimism bias significantly predicted not wearing seat belts. These results support previous literature suggesting optimism bias as a major determinant of risk taking (e.g., Job, 1990a,b, 1999; Lee et al., 1993).

8.2. Lack of generalization from student to general driving population

A key objective of Study 2 was to investigate whether the results from Study 1 hold in a community sample. Some results generalized from the student sample to the general population sample. In particular, in Study 2, specific attitude to not wearing seat belts significantly predicted the behavior when age was included as a predictor (Regression Analysis A), and specific attitude to speeding significantly predicted the behavior when age was excluded as a predictor (Regression Analysis C). Nonetheless, results also demonstrated substantial differences in terms of prediction of risky driving behaviors. For both speeding and not wearing seat belts, at least one of the predictors found in the general population were different to those found in the first-year psychology population.

Despite the different results found between samples examined in the present research, each sample demonstrated the finding that *different behaviors* seem to have *different predictors*, and in this respect support the central finding of Study 1.

There are several possible reasons for the failure of Study 1 results to generalize. Firstly, given the restricted age of participants in Study 1 (17–22 years), there may not have been enough variability in age for this factor to be uncovered as a significant predictor of risky driving. However, age was found to be a significant predictor of speeding even in the age-restricted general population subsample (Study 2 Regression Analysis B). Thus, the samples may differ in more substantive ways. For example, the

samples are likely to differ in terms of education and socioeconomic status, which may influence risky driving and associated factors.

8.3. Future research

The present research is based on self-report measures of risky driving behavior, which may suffer from inaccuracy in recall or report. However, relevant literature suggests that participants' self-reports in this area are reasonably accurate (e.g., Aberg, Larsen, Glad, & Beilinsson, 1997; Prabhakar et al., 1996; Ulleberg & Rundmo, 2002). For example, West et al. (1993) examined the relationship between self-reported intended driving speed and observations of speeding behavior (secretly monitored by in-car observers), and found a significant correlation between self-reported speeding intentions and observed driving speed. Further, self-report bias was controlled to some extent in the present study by excluding participants' who demonstrated a strong tendency to respond in a socially desirable manner. Nonetheless, validation against observed driving behavior or infringement records may increase confidence in these findings.

An extensive range of potential predictors were tested in the present research. However, it is conceivable that other factors may also be relevant.

Because this research provides only cross-sectional data, the causal relationship cannot be inferred from the findings. For example, the finding that specific attitude to speeding correlates significantly with self-reported speeding could indicate that the specific attitude causes the behavior, or vice versa. The present research has identified factors that are associated with different risky driving behaviors, in order to provide a basis for future experimental research. Only through manipulation of the relevant factors, and determination of the effects on associated risky driving behaviors, can underlying causal mechanisms for the risky driving behaviors be identified.

8.4. Practical implications

The present data have important practical implications for road safety interventions. The finding that different factors predict different behaviors indicates the importance of designing individual road safety campaigns for each risky driving behavior. For example, drink-driving campaigns may be formulated to reduce the impact of sensation seeking (e.g., by promoting driving as transport), while speeding campaigns may focus on specific attitudes to speeding (e.g., by emphasizing speeding as potentially resulting in damage/wear-and-tear to car engine).

Furthermore, the finding that the student and general populations differ in terms of predictors of various risky driving behaviors (even after controlling for the effect of age), suggests that different interventions may be needed in different driver populations.

Together, these results identify the importance of researching underlying mechanisms for each risky driving behavior, and in the relevant driver population, before countermeasures are designed.

Acknowledgement

All studies for this project were undertaken either on-campus at The University of Sydney, Sydney, or under their authority.

Dr. Julie Hatfield was supported by an NHMRC Population Health Capacity Building Grant in Injury Prevention, Trauma and Rehabilitation [ITR]. ITR is a collaborative program auspiced by the NSW Injury Risk Management Research Centre, UNSW; The George Institute for International Health, University of Sydney; Prince of Wales Medical Research Institute (UNSW); the School of Public Health and Community Medicine (UNSW); and the Rehabilitation Studies Unit.

References

Aberg, L., Larsen, L., Glad, A., & Beilinsson, L. (1997). Observed vehicle speed and drivers' perceived speed of others. *Applied Psychology: An International Review*, *46*(3), 287–302.

Adams-Guppy, J. R., & Guppy, A. (1995). Speeding in relation to perceptions of risk, utility and driving style by British company car drivers. *Ergonomics*, *38*, 2525–2535.

Ajzen, I. (1985). From intentions to actions: A theory of planned behaviour. In J. Kuhl. & J. Beckmann (Ed.), *Action control: From cognition to behaviour.* Berlin: Springer-Verlag.

Arthur, W., & Doverspike, D. (2001). Predicting motor vehicle crash involvement from a personality measure and a driving knowledge test. *Journal of Prevention and Intervention in the Community*, *22*, 35–42.

Arthur, W., Tubre, T., Day, E. A., Sheehan, M. K., Sanchez-Ku, M. L., Paul, D., et al. (2001). Motor vehicle crash involvement and moving violations: Convergence of self-report and archival data. *Human Factors*, *43*, 1–11.

Begg, D. J., & Langley, J. D. (2001). Changes in risky driving behavior from age 21 to 26 years. *Journal of Safety Research*, *32*, 491–499.

Begg, D. J., & Langley, J. D. (2004). Identifying predictors of persistent non-alcohol or drug-related risky driving behaviours among a cohort of young adults. *Accident Analysis and Prevention*, *36*, 1067–1071.

Begg, D. J., Langley, J. D., & Stephenson, S. (2003). Identifying factors that predict persistent driving after drinking, unsafe driving after drinking, and driving after using cannabis among young adults. *Accident Analysis and Prevention*, *35*, 669–675.

Bell, N. J., & Bell, R. W. (1993). *Adolescent risk taking.* California: Sage Publications.

Blows, S., Ameratunga, S., Ivers, R. Q., Lo, S. K., & Norton, R. (2005). Risky driving habits and motor vehicle injury. *Accident Analysis and Prevention*, *37*(4), 619–624.

Brown, S. L., & Cotton, A. (2003). Risk-mitigating beliefs, risk estimates, and self-reported speeding in a sample of Australian drivers. *Journal of Safety Research*, *34*, 183–188.

Buss, A. H., & Perry, M. (1992). The Aggression Questionnaire. *Journal of Personality and Social Psychology*, *63*, 452–459.

Cameron, T. L. (1985). Psychosocial and behavioral factors in the prevention of young driver accidents. In D. Mayhew, H. Simpson, A. Donelson (Eds.), *Young driver accidents: In search of solutions.* Ottawa: Traffic Injury Research Foundation.

Chua, F. J., & Job, R. F. S. (1999). Event-specific versus unitary causal accounts of optimism bias. *Journal of Behavioural Medicine*, *22*, 457−490.

Conner, M., & Norman, P. (1996). The role of social cognition in health behaviours. In M. Conner & P. Norman (Eds.), *Predicting health behaviour* (pp. 1−21). Buckingham: Open University Press.

DeJoy, D. M. (1989). The optimism bias and traffic accident risk perception. *Accident Analysis and Prevention*, *21*(4), 333−340.

Evans, L., & Wasielewski, P. (1983). Risky driving related to driver and vehicle characteristics. *Accident Analysis and Prevention*, *15*, 121−136.

Gulliver, P., & Begg, D. (2004). Influences during adolescence on perceptions and behaviour related to alcohol use and unsafe driving as young adults. *Accident Analysis and Prevention*, *36*, 773−781.

Harre, N., Brandt, T., & Dawe, M. (2000). The development of risky driving in adolescence. *Journal of Safety Research*, *31*, 185−194.

Harre, N., Field, J., & Kirkwood, B. (1996). Gender differences and areas of common concern in the driving behaviors and attitudes of adolescents. *Journal of Safety Research*, *27*(3), 163−173.

Helweg-Larsen, M., & Sheppard, J. A. (2001). Do moderators of the optimism bias affect personal or target risk estimates? A review of the literature. *Personality and Social Psychology Review*, *5*(1), 74−95.

Iversen, H. (2004). Risk-taking attitudes and risky driving behaviour. *Transportation Research Part F, 7*, 135−150.

Job, R. F. S. (1990a). The application of learning theory to driving confidence: The effect of age and the impact of random breath testing. *Accident Analysis and Prevention*, *22*, 97−107.

Job, R. F. S. (1990b). Psychological aspects in the implementation of road safety programmes. *The Proceedings of the Third Biennial National Traffic Evaluation Conference* Armidale, NSW: E.M.U Press.

Job, R. F. S. (1999). The road user: The psychology of road safety. In J. Clark (Ed.), *Safe and mobile: Introductory studies in traffic safety.* Armidale: EMU.

Jonah, B. A. (1986). Accident risk and risk-taking behaviour among young drivers. *Accident Analysis and Prevention*, *18*, 255−271.

Jonah, B. A. (1990). Age differences in risky driving. *Health Education Research*, *5*, 139−149.

Jonah, B. A. (1997). Sensation seeking and risky driving: A review and synthesis of the literature. *Accident Analysis and Prevention*, *29*(5), 651−665.

Jonah, B. A., Thiessen, R., & Au-Yeung, E. (2001). Sensation seeking, risky driving and behavioral adaptation. *Accident Analysis and Prevention*, *33*, 679−684.

Kanellaidis, G., Golias, J., & Zarifopoulos, K. (1995). A survey of drivers' attitudes toward speed limit violations. *Journal of Safety Research*, *26*(1), 31−40.

Kohn, P. M. (1972). The Authoritarianism-Rebellion scale: A balanced F Scale with left-wing reversals. *Sociometry*, *35*, 176−189.

Kuriychuk, M. (1992). The assessment of psychopathy and risk-taking behavior. *Dissertation Abstracts International*, *52*, 6124−6125.

Landy, F. J., Rastegary, H., Thayer, J., & Colvin, C. (1991). Time Urgency: The Construct and Its Measurement. *Journal of Applied Psychology*, *76*, 644−657.

Lee, S. H. V., Prabhakar, T., & Job, R. F. S. (1993). Optimism bias, risk utility and risk taking on the road. *Report to the Federal Office of Road Safety, Canberra*.

Levenson, M. R., Kiehl, K. A., & Fitzpatrick, C. M. (1995). Assessing psychopathic attributes in a noninstitutionalized population. *Journal of Personality and Social Psychology*, *68*, 151−158.

Lynam, D. R., Whiteside, S., & Jones, S. (1999). Self-reported psychopathy: A validation study. *Journal of Personality Assessment*, *73*, 110−132.

National Highway Traffic Safety Administration [NHTSA] (2005). *Traffic safety facts 2004: A compilation of motor vehicle crash data from the Fatality Analysis Reporting System and the General Estimates System.* Washington DC: U.S. Department of Transportation.

Nordbakke, S., & Sagberg, F. (2007). Sleepy at the wheel: Knowledge, symptoms and behaviour among car drivers. *Transportation Research Part F*, *10*(1), 1−10.

Parker, D., Lajunen, T., & Stradling, S. (1998). Attitudinal predictors of interpersonally aggressive violations on the road. *Transportation Research Part F*, *1*, 11−24.

Parker, D., Manstead, S. R., Stradling, S. G., & Reason, J. T. (1992). Determinants of intention to commit driving violations. *Accident Analysis and Prevention*, *24*, 117−131.

Parker, D., Reason, J. T., Manstead, A. S. R., & Stradling, S. G. (1995). Driving errors, driving violations and accident involvement. *Ergonomics*, *38*, 1036−1048.

Paulhus, D. L. (1984). Two-component models of socially desirable responding. *Journal of Personality and Social Psychology*, *46*, 598−609.

Paulhus, D. L. (1989). Socially desirable responding: Some new solutions to old problems. In D. M. Buss N. Cantor (Ed.), *Personality psychology: Recent trends and emerging directions* (pp. 201−209). New York: Springer-Verlag.

Prabhakar, T., Lee, S. H. V., & Job, R. F. S. (1996). Risk taking, optimism bias and risk utility in young drivers. *Proceedings of the Road Safety Research and Enforcement Conference* (pp. 61−68). Sydney, Australia: Roads and Traffic Authority of NSW.

Reynolds, W. M. (1982). Development of reliable and valid short forms of the Marlowe-Crowne Social Desirability Scale. *Journal of Clinical Psychology*, *38*, 119−125.

Roads and Traffic Authority of NSW. (2005). *Road Traffic Crashed in NSW: 2004*. Report prepared by the Information Section, Road Safety Strategy Branch.

Roberts, R. D. (2001). *The Openness- Conscientiousness- Extraversion-Agreeableness-Neuroticism Index Condensed (OCEANIC).* Sydney: Intelligent Testing Products.

Ryb, G. E., Dischinger, P. C., Kufera, J. A., & Read, K. M. (2006). Risk perception and impulsivity: Association with risky behaviors and substance abuse disorders. *Accident Analysis and Prevention*, *38*, 567−573.

Ryckman, R. M., Hammer, M., Kaczor, L. M., & Gold, J. A. (1990). Construction of a Hypercompetitive Attitude Scale. *Journal of Personality Assessment*, *55*, 630−639.

Sutton, S. (1998). Predicting and explaining intentions and behaviour: How well are we doing? *Journal of Applied Social Psychology*, *28*, 1317−1338.

Svenson, O., Fischhoff, B., & MacGregor, D. (1985). Perceived driving safety and seatbelt usage. *Accident Analysis and Prevention*, *17*(2), 119−133.

Turner, C., McClure, R., & Pirozzo, S. (2004). Injury and risk-taking behaviour — a systematic review. *Accident Analysis and Prevention*, *36*(1), 93−101.

Ulleberg, P. (2001). Personality subtypes of young drivers. The relationship to risk-taking preferences, accident involvement, and response to a traffic safety campaign. *Transportation Research. Part F, Traffic Psychology and Behaviour*, *4*, 279−297.

Ulleberg, P., & Rundmo, T. (2002). Risk-taking attitudes among young drivers: The psychometric qualities and dimensionality of an instrument to measure young drivers' risk-taking attitudes. *Scandinavian Journal of Psychology*, *43*, 227−237.

van Beurden, E., Zask, A., Brooks, L., & Dight, R. (2005). Heavy episodic drinking and sensation seeking in adolescents as predictors of harmful driving and celebrating behaviors: Implications for prevention. *Journal of Adolescent Health*, *37*, 37−43.

Wasielewski, P. (1984). Speed as a measure of driver risk: Observed speeds versus driver and vehicle characteristics. *Accident Analysis and Prevention*, *16*(2), 89−103.

Weinstein, N. D. (1988). The precaution adoption process. *Health Psychology*, *7*, 355−386.

Weinstein, N. D., & Klein, W. M. (1996). Unrealistic optimism: Present and future. *Journal of Social and Clinical Psychology*, *15*, 1−8.

Weinstein, N. D., & Lyon, J. E. (1999). Mindset, optimism bias about personal risk and health-protective behaviour. *British Journal of Health Psychology*, *4*, 289−300.

West, R. J., French, D., Kemp, R., & Elander, J. (1993). Direct observation of driving, self reports of driver behaviour, and accident involvement. *Ergonomics*, *36*, 557−567.

Williams, A. F. (1998). Risky driving behavior among adolescents. In R. Jessor (Ed.), *New perspectives on adolescent risk behavior* (pp. 221−237). Cambridge: Cambridge University Press.

Zuckerman, M. (1980). Sensation seeking and its biological correlates. *Psychological Bulletin*, *88*, 187−214.

Zuckerman, M. (1994). *Behavioral expressions and biosocial bases of sensation seeking.* Cambridge: Cambridge University Press.

Ralston Fernandes is a full-time PhD student in the School of Psychology at the University of NSW. He holds a Bachelor of Science with Honours in Psychology, and is currently employed as a Research Officer with the NSW Injury Risk Management Research Centre. Current research is in Health Psychology, specifically risk perception and injury prevention.

Dr Soames Job is the General Manager of the Road Safety Strategy branch of the Roads and Traffic Authority of NSW. He was previously the Director of the Health and Safety Psychology Research Unit, and Associate Professor of Psychology at the University of Sydney. He has been closely involved in road safety research since 1980. He is an Associate Fellow and National President of the Australian College of Road Safety.

Dr Julie Hatfield is a Senior Research Fellow at the NSW Injury Risk Management Research Centre at the University of NSW. Dr Hatfield holds a PhD in Psychology from the University of Sydney, where she was Deputy Director of the Health and Safety Psychology Research Unit. Dr Hatfield's research includes drivers' risk perception, risky driving, and pedestrian safety. Dr Hatfield is a member of the NSW Road Safety Task Force.