

## Can personality characteristics predict the crash involvement of young drivers?

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### Abstract

There is an increasing body of research investigating relationships between personality factors and crash involvement. This research estimates that personality factors account for about 10 to 20% of the variance in crashes. However, there are a number of limitations associated with this research. Most studies are cross-sectional or retrospective in design, are based on self-reported crashes or other self-reported driver behaviour and do not adequately consider driving exposure. The aim of this paper was to identify personality-related characteristics associated with crashes among young drivers using a prospective and retrospective design and official driver records. A total of 396 young drivers, aged 16 to 24 years, were administered a questionnaire measuring a wide variety of personality characteristics and driving-related factors to determine whether these variables could predict crash involvement. To determine whether personality characteristics could consistently predict crashes among young drivers, crash involvement prior to questionnaire administration and three years following were investigated separately. The results indicated that no personality factors consistently predicted crashes before and after questionnaire administration. The use of driving to reduce tension was associated with young driver crashes prior to questionnaire administration. However, this relationship disappeared when controlling for driving exposure and sex. Driving in a competitive way predicted crashes for the following three years. A greater understanding of any personality factors and attitudes that predict young driver crash involvement will assist in matching interventions to the individual needs of these drivers.

### Keywords

Young drivers, Driver behaviour, Personality, Crashes

### Introduction

Young drivers (aged 16 to 24 years) are over-represented in fatal and injurious crashes and this age group accounts for a large proportion of crashes and fatalities in most industrialised countries [for an overview see 1]. Research suggests that approximately 90% of crashes are, to some extent, caused by human factors or road user behaviour [2]. As a result, many studies have been undertaken to identify driver characteristics and behaviour associated with crash involvement.

Personality can be defined as a collection of emotion, thought and behaviour patterns unique to a person that interact to determine how individuals perceive and respond to events [3]. In the driving context, personality can influence how individuals approach and behave in certain driving situations. Consequently, personality can influence risky driving behaviour and driving outcomes such as traffic offences and crash involvement. Personality characteristics, by definition, are relatively stable over time and, therefore, changing them is not an appropriate goal for young driver countermeasures. However, understanding which personality factors predict driver behaviour might assist in developing interventions and public education programs matched to the individual needs of young drivers.

An increasing body of research has shown that a variety of personality characteristics have a relatively strong relationship with young driver risky driving or the propensity to commit traffic offences and a relatively weak, but consistent, relationship with young driver crash involvement [for a review, see 4, 5]. From a review of the literature, Beirness [5] concluded that although correlations were not generally large, personality factors accounted for about 10 to 20% of the variance in crashes and up to 35% of the variance in risky driving. However, this latter estimate is most likely at the higher end because, generally, personality rarely explains more than 25% of the variance in an individual's social behaviour [6].

Some of the most significant personality characteristics associated with young driver risky driving and, to a lesser extent, crash involvement include sensation seeking, mild social deviance, hostility, aggression, and emotional instability [e.g., 7, 8-12]. Some personality measures specific to the driving task have also been associated with risky driving and crashes among young drivers: a risky driving style (the way in which one chooses to drive), driving-related aggression, competitiveness when driving, and the use of driving to reduce tension or stress [e.g., 13-15].

However, there are some limitations associated with the literature investigating relationships between personality factors and young driver crash involvement. Firstly, most of these studies are cross-sectional or retrospective in design, whereby the relationship between personality factors and driver behaviour is measured simultaneously or after driving incidents have occurred. A prospective design enables self-reported measures of individual differences to be obtained before potentially being affected by crash involvement. Secondly, although personality characteristics are relatively stable over time, few studies have investigated the consistency of personality to predict crash involvement over time. The combination of a retrospective and prospective analysis would provide the most convincing evidence of the consistency of personality (i.e. stable individual characteristics) in the prediction of young driver crash involvement. Another criticism is that these studies predominantly rely on self-reported driver behaviour outcomes. Self-reported crash and traffic offence data allows for the possibility of intentional or unintentional misrepresentation [4]. For example, one study found that 14% of people involved in an injury crash had forgotten about it one year later [16]. Finally, many of the studies did not adequately consider the role of driving exposure. Generally, driving exposure varies with age [17]. However, there can also be considerable variation in the level of driving exposure and travel patterns within different age groups. This is because driving exposure is not a random factor but an individual choice. Driving exposure has been found to vary among young drivers by factors such as sex, and motivation for driving [17-19].

A recent study adopted a prospective design to determine the personality and attitudinal predictors of traffic offences, recorded in official driver records, among young drivers [20]. The use of driving to reduce tension and driving exposure (kilometres driven per year) were the only variables associated with risky driving behaviour. Given these findings, it is possible that these personality variables might also predict young driver crash involvement.

The aim of the present study was to identify personality factors that consistently predict young driver crash involvement, recorded in official driver records. To investigate this aim, crash involvement prior to questionnaire administration and three years following were examined separately. The length of the follow-up period enabled a sufficient period to accumulate crashes but also took into consideration the fact that crash risk is not stable and varies with age (i.e. generally decreases with age). During the period prior to questionnaire administration, there was some variation in the length of time young drivers held a driver's licence. Consequently, a measure of driving exposure (estimated number of kilometres driven) was included to account for any variation. The number of months holding a licence was not used as a measure of driving exposure because it says nothing about how much actual driving takes place during this time. This study contributes to past research on this topic by being one of the few studies to use a prospective and retrospective design and official records to examine the role of personality in young driver crashes.

## Methods

### *Participants*

The sample consisted of 396 young drivers (217 males, 179 females) aged 16 to 24 years ( $M=18.2$ ,  $SD=1.0$ ) who consented to the release of their driver records. Participants were required to hold a current South Australian provisional driver's licence ensuring all had some unsupervised driving experience. Participants had held a provisional licence for an average of 1.2 years ( $SD=0.8$ ) prior to questionnaire administration.

Participants consisted of two groups of young drivers: undergraduate university students ( $n=188$ ) and young drivers attending an intervention program ( $n=208$ ). Drivers aged 25 years and under who violate the conditions of their learner's permit or provisional licence, resulting in licence disqualification are required to attend this program [for details see 21]. Note that 14 participants attended the intervention

because an offence was detected as a result of crash involvement. It is not assumed that participants from either of these groups are representative of the general young driver population. The results from these two groups were combined for the purpose of this paper. Participants were recruited from April 2003 to June 2004.

#### *Questionnaire*

Participants completed an extensive self-report questionnaire consisting of 136 items. The measures included in this questionnaire were selected for their known association with risky driving and crash involvement in the literature. The questionnaire took approximately 10 to 15 minutes to complete. Note that 37 items were omitted from the original scales primarily due to time constraints. To reduce the questionnaire, reliability analysis was undertaken on preliminary data to identify any items contributing to low internal consistency in each scale. Individual items were deleted if their omission increased the internal consistency of the scale [for details, see 22].

The first part of the questionnaire sought information on a number of general demographic, licensing, and background variables including driving exposure (estimated number of kilometres driven per week). The second section incorporated 72 true-false items measuring general personality traits: assertiveness (5 items) [23], depression (mood rather than clinical symptoms; 9 items) [24], emotional adjustment (6 items) [25], and sensation seeking (10 items from the Thrill and Adventure Seeking scale and 7 items from the Disinhibition scale) [26]. In addition, five measures of the expression of hostility or aggression were included [27]: assaultiveness (9 items), indirect hostility (5 items), verbal hostility (9 items), irritability (8 items), and resentment (4 items). A further 20 true-false items measured a variety of driving-related attitudes and behaviours, that is, behavioural expressions of personality factors in the driving context: driving aggression (10 items) [28], driving competitively using speed (5 items) [13], driving inhibition (cautious driving when upset or angry; 3 items) [29], and the extent to which driving reduced tension (2 items) [14, 30]. In following sections, a measure of mild social deviance (8 items) [31], self-reported driving style or risky driving (7 items) [32], and alcohol consumption were also incorporated. The internal consistency of the measures used in this research is satisfactory and has been established in another study [see 21].

#### *Official driver records*

To obtain official crash records, participants provided their driver's licence number. Driver licence numbers were used to search the TARS (Traffic Accident Reporting System) database for any crashes on South Australian roads reported to police. All crashes in which anyone was injured or there were property damages of \$1000 or more were required to be reported to police. From July 2003, property damage only crashes in which the total damage was less than \$3000 were not recorded. Consequently, crashes recorded from this date onwards are likely to be more serious crashes than those recorded prior.

The crash records of participants were tracked for 12 months prior to questionnaire administration and three years following. It is acknowledged that some drivers were disqualified for part of this period ( $n=53$ ). Consequently, the number of subsequent crashes recorded is likely to be an underestimate. Nevertheless, research suggests around one third of disqualified drivers continue to drive while disqualified [33]. It is unknown to what extent the disqualified drivers in this study continued to drive.

#### *Statistical analysis*

Statistical analyses were performed to determine if young drivers reporting crash involvement possessed certain personality characteristics. For univariate analyses, chi-square tests were conducted for categorical variables and independent samples *t*-tests were conducted for continuous variables. Note that if the assumption of normally distributed data was violated, *t*-tests were performed using Welch's procedure because it does not assume equal population variances, making the *t*-test more robust. For all analyses, a level of  $p<.05$  was considered to be statistically significant. This value was less stringent than what is typically used for multiple tests because the purpose of the analyses was to select variables for entry into logistical regression given the number of crashes in the sample.

Cohen's *d*, a standardised measure of the effect size or strength of the difference between means, was reported for *t*-tests with significant results. According to Cohen's guidelines [34], an effect size of  $d=0.2$  represents a small effect,  $d=0.5$  a medium effect, and  $d=0.8$  a large effect.

Binary logistic regression was conducted for the multivariate analysis. Logistic regression does not make any assumptions about the statistical distribution of individual drivers' crash frequency.

## Results

Analysis of official driver records showed that 23% ( $n=92$ ) of young drivers were involved in at least one crash prior to questionnaire administration. During the three-year follow up period, 17% ( $n=68$ ) of drivers recorded at least one crash. Three drivers recorded two subsequent crashes. While 24 drivers recorded a crash during both periods of analysis, the correlation between recording a crash during both periods was low ( $r=0.13$ ,  $p<.05$ ).

The demographic characteristics and driving exposure of young drivers recording at least one crash before and after (three years) questionnaire administration are shown in Table 1. Prior to the survey, males (30%) ( $\chi^2(1) = 13.9$ ,  $p<.001$ ), older drivers ( $t(117) = 2.5$ ,  $p=.016$ ), and those who reported driving more kilometres per year were statistically significantly more likely to record a crash ( $t(365) = 3.5$ ,  $p=.001$ ). Crash status was not related to any of these variables during the follow-up period.

**Table 1:** Background variables for young drivers recording and not recording a crash before and after questionnaire administration

Variables	Before			After		
	None	At least one	<i>p</i> -value	None	At least one	<i>p</i> -value
Sex (%)						
Males	69.6	30.4	<0.001	82.5	17.5	0.844
Females	85.5	14.5		83.2	16.8	
Age at time of survey (years) ( <i>sd</i> )	18.1 (0.9)	18.5 (1.3)	0.016	18.2 (1.0)	18.2 (1.1)	0.669
Kilometres driven per year ( <i>sd</i> )	10,664.7 (12,584.6)	16,239.1 (14,076.5)	0.001	11,800.9 (13,436.8)	12,514.3 (11,623.0)	0.693

### *Prior crashes*

To determine if young drivers involved in crashes were characterised by certain personality measures, their mean scores on such measures were compared to drivers who were not involved in a crash prior to questionnaire administration. The results, displayed in Table 2, show that drivers recording a crash had statistically significantly higher levels of assaultiveness ( $d=0.25$ ) and used driving to reduce tension ( $d=0.30$ ). The effect sizes indicate that these differences were small. There were no other statistically meaningful differences by crash status.

To determine whether any personality characteristic *predicted* crash involvement prior to questionnaire administration, the two measures that differed by crash record in univariate analyses were entered into a logistic regression (dependent variable: no crashes/at least one crash) (step 1). Sex and kilometres driven per year were also included as predictor variables because group differences were found in univariate analyses (step 2). The results from the logistic regressions are summarised in Table 3.

**Table 2:** Mean scores on selected personality measures by crash status prior to questionnaire administration (N=396)

Measure	At least one crash (n=92)		No crashes (n=304)		t-value	p-value
	Mean	SD	Mean	SD		
<b>Personality</b>						
Assertiveness	7.50	1.38	7.58	1.45	0.48	0.631
Depression	10.33	1.93	10.31	2.12	0.08	0.935
Emotional adjustment	7.83	1.65	7.95	1.73	0.61	0.540
Sensation seeking	26.22	3.55	26.47	3.52	0.61	0.542
Mild social deviance	12.37	3.14	12.68	3.11	0.84	0.401
<b>Hostility and aggression</b>						
Assaultiveness	13.30	2.36	12.73	2.27	2.10	0.037*
Indirect hostility	8.25	1.31	8.27	1.43	0.99	0.922
Verbal hostility	13.74	1.86	13.56	1.96	0.78	0.436
Irritability	11.58	1.77	11.64	2.03	0.28	0.778
Resentment	5.52	1.30	5.45	1.21	0.49	0.628
<b>Driving-related</b>						
Aggression	12.65	2.47	12.45	2.34	0.71	0.476
Competitive speed	7.27	1.68	7.13	1.66	0.73	0.469
Inhibition	4.49	1.19	4.57	1.23	0.53	0.598
Tension reduction	3.24	0.86	2.97	0.91	2.55	0.011*
Risky driving style	18.67	6.08	17.41	5.30	1.93	0.055

\*Statistically significant difference at  $p < .05$

The use of driving to reduce tension predicted young driver crashes prior to questionnaire administration (step 1). However, this relationship disappeared when controlling for estimated kilometres driven per year and sex (step 2). A positive regression coefficient indicated that the probability of recording at least one crash increased for males. The odds ratio showed that male drivers were 2.1 times as likely to crash. No other personality measures entered into the logistic regression predicted crashes. This model was statistically significant ( $\chi^2(4) = 22.3, p < .001$ ).

**Table 3:** Results of logistic regression analysis for predicting at least one crash prior to questionnaire administration, using personality measures as predictors (N=367)

Variable	B	SE	Wald	p-value	Odds ratio	95% CI
<b>Step 1</b>						
Use driving to reduce tension	0.33	0.14	5.06	0.024	1.38	1.04 – 1.84
Assaultiveness	0.10	0.06	3.09	0.079	1.10	0.99 – 1.23
<b>Step 2</b>						
Use driving to reduce tension	0.22	0.15	2.09	0.148	1.24	0.93 – 1.67
Assaultiveness	0.03	0.06	0.28	0.594	1.03	0.92 – 1.16
Sex	0.76	0.30	6.56	0.010	2.13	1.19 – 3.79
Kilometres driven per year	<0.01	<0.01	2.87	0.090	1.00	1.00 – 1.00

Note: Data for kilometres driven was missing for 29 participants.

#### *Crashes during following three years*

Young drivers mean scores on personality measures by crash status for the three-year follow up period are shown in Table 4. The only statistically meaningful difference by crash status was for competitive speed; drivers recording a crash were more likely to drive competitively using speed ( $d=0.28$ ).

**Table 4:** Mean scores on selected personality measures for drivers by crash status in the following three years (N=396)

Measure	At least one crash (n=68)		No crashes (n=328)		t-value	p-value
	Mean	SD	Mean	SD		
<b>Personality</b>						
Assertiveness	7.66	1.58	7.54	1.41	0.62	0.534
Depression	10.16	1.80	10.34	2.13	0.65	0.516
Emotional adjustment	7.82	1.68	7.94	1.71	0.52	0.603
Sensation seeking	26.47	3.53	26.40	3.53	0.15	0.885
Mild social deviance	12.56	2.85	12.62	3.17	0.15	0.885
<b>Hostility and aggression</b>						
Assaultiveness	12.66	1.68	12.91	2.41	1.01	0.312
Indirect hostility	8.29	1.31	8.26	1.42	2.00	0.839
Verbal hostility	13.56	1.71	13.61	1.98	0.22	0.828
Irritability	11.65	1.77	11.62	2.01	0.11	0.915
Resentment	5.41	1.23	5.48	1.23	0.41	0.684
<b>Driving-related</b>						
Aggression	12.57	2.19	12.48	2.41	0.29	0.772
Competitive speed	7.54	1.63	7.08	1.66	2.09	0.037*
Inhibition	4.62	1.19	4.53	1.23	0.52	0.605
Tension reduction	3.09	0.88	3.02	0.91	0.58	0.561
Risky driving style	18.72	5.57	17.50	5.48	1.67	0.096

\*Statistically significant difference at  $p < .05$

A logistic regression analysis (see Table 5) showed that driving competitively using speed was the only personality variable found to predict crash involvement for the following three years (step 1). This relationship persisted when accounting for sex and driving exposure (step 2). The odds ratio indicated that drivers who drive competitively using speed were 1.2 times as likely to record a subsequent crash. This model was not statistically significant ( $\chi^2(3) = 4.1, p = .247$ ). Taken together, these results indicate that no personality factors consistently predicted crashes before and after questionnaire administration.

**Table 5:** Results of logistic regression analysis for predicting at least one subsequent crash, using personality measures as predictors (N=367)

Variable	B	SE	Wald	p-value	Odds ratio	95% CI
<b>Step 1</b>						
Competitive speed	0.17	0.08	4.30	0.038	1.18	1.01 – 1.38
<b>Step 2</b>						
Competitive speed	0.17	0.09	3.88	0.049	1.19	1.00 – 1.42
Sex	0.07	0.30	0.06	0.807	1.08	0.60 – 1.95
Kilometres driven per year	<0.01	<0.01	<0.01	0.994	1.00	1.00 – 1.00

Note: Data for kilometres driven was missing for 29 participants.

## Discussion

Understanding which personality characteristics predict young driver crash involvement might assist in matching interventions to the individual needs of young drivers and consequently reduce the number of young driver crashes. The primary purpose of the present study was to identify personality factors that predict crash involvement among young drivers using official driver records. Unlike previous studies, the current investigation was able to examine the consistency of personality to predict crashes by conducting a prospective and retrospective analysis. The results of this study demonstrated that none of the selected

personality measures consistently predicted crashes before and after questionnaire administration. The use of driving to reduce tension was associated with young driver crashes prior to questionnaire administration. However, this relationship disappeared when controlling for driving exposure and sex. Driving competitively using speed predicted crashes for the following three years.

While these findings suggest that personality is not a consistent or strong predictor of crashes, there are some methodological limitations associated with personality and crash prediction to consider. The role of personality in crash involvement may be underestimated because crashes are relatively rare events. As a result, any differences in crash rates attributed to personality will be difficult to detect statistically [see 35 for a discussion]. Even though driver records were examined for a three-year follow-up period in this study, the statistical power of analyses is likely to be low, possibly too low to detect small differences.

The contribution of personality to crash involvement is also likely to be underestimated because personality measures might interact with other situational factors [5]. In the context of this study, such indirect effects of personality on crash causation were not measured. Alternatively, personality characteristics might be a poor predictor of crashes because, in some cases, crash causation is not associated with the behaviour of a particular driver at all, but with other factors such as environmental circumstances (e.g., weather conditions) or the behaviour of other drivers [36, 37]. To avoid this possibility, future research could examine only crashes for which the driver is deemed culpable or responsible for the crash. Few studies examining personality predictors have used culpable crashes as the dependent variable, most likely because a large sample size is needed [38].

There are many advantages of using official driver records over self-reported data (i.e. avoid misrepresentation and poor recall) but there are also some limitations associated with official records that affect their ability to detect relationships. Zylman [39] argued that research based solely on official driver records may yield spurious results and, in many cases, non-significant results because the likelihood of recording a crash or traffic offence may be more dependent on local policies and practices than the driver's proficiency or driving behaviour. For example, official driver records appear to underestimate the number of young driver crashes because only crashes reported to the police are listed and young drivers are typically involved in minor crashes with insufficient damage/injury that are not reported to police [22]. Note that the number of crashes reported during the follow-up period is likely to be an underestimate of the true number of young driver crashes due to the increase in the monetary threshold for reporting crashes resulting in property damage. Consequently, finding any relationships between personality variables and crashes reported in official records is notable given that crashes reported in driver records are relatively uncommon and most likely under-represent the actual number of young driver crashes.

The failure to find a consistent predictive relationship between personality and crashes may not be due to problems associated with crash prediction, but may be attributable to insensitive personality measures. Due to time constraints, some of the measures were shorter than the original scales [see 21]. Nevertheless, despite fewer items in each scale, the internal consistency of most measures was satisfactory.

The results from this study showed that the use of driving to reduce tension was associated with young driver crash involvement before questionnaire administration but not after adjusting for driving exposure and sex. Social learning theory suggests that if an individual has not learnt sufficient means of coping with tension or frustrations, driving may be used as an outlet to express these feelings [40]. The inability to deal with such feelings and the resultant misuse of driving to release tension has previously been associated with traffic offences, crash involvement and greater driving exposure [14, 20, 41, 42].

Sex contributed significantly to involvement in prior crashes with young males reporting greater involvement than young females. However, there were no sex differences in crash involvement during the follow up period. Williams [43] observed similar trends in crash rates; males had higher crash rates per miles driven than females at the youngest age (16 years) but as age increased there was little difference in crash rates. Reasons for this finding remain speculative, but it is possible that the combination of inexperienced young male drivers' tendency to underestimate risks when driving and overconfidence in their driving ability results in the placement of inappropriate demands on limited driving skills and, consequently, greater crash involvement [44]. The greater driving exposure of young males [45],

compared to young females, might contribute to faster proficiency at mastering vehicle control skills and the decrease in crash involvement during the follow-up period.

Males and females may differ in which personality characteristics are associated with crash involvement [9]. While it would be interesting to examine the personality predictors for male and female crash involvement separately, the number of crash involved drivers was too small to conduct these analyses.

Driving competitively using speed was the only personality measure that predicted crashes for the following three years although it was not a strong relationship. This finding supports previous research that reported driving in a competitive way was related to traffic offences and crash involvement, particularly among males [9, 13, 46]. Competitiveness when driving has also been associated with aggressive driving [47, 48]. For example, Yagil [48] found that males who perceived driving as competitive (i.e. driving used as a means of demonstrating power or to get a thrill rather than as a simple way of getting from one place to another) were inclined to react aggressively to the frustrating behaviour of other drivers more than other male drivers. While the literature links competitiveness with a risk-taking propensity and views it as primarily as a male attribute [49], the findings from this study suggest it is not confined to males only. Furthermore, Wilson and Daly [49] argue that competitiveness and risk-taking are socially facilitated by the presence of peers who seek the same goals. Their argument is based on observations of driving, gambling and homicidal behaviour. The social context surrounding young driver competitiveness and its interaction with situational factors are interesting areas for further research.

Both the measure of competitive speed and driving to reduce tension are not strictly personality traits but are behavioural expressions of such traits in the driving context that has been learned and so are more amenable to change. Consequently, it may be beneficial to develop interventions or public education programs for young drivers that challenge young drivers' orientation toward driving. Such interventions might assist young drivers in recognising how they drive and developing effective strategies to deal with feelings of tension or find outlets for competitiveness, other than on the road. Peer passenger restrictions might assist in altering the social context that potentially facilitates competitiveness when driving, and consequently reduce risky driving behaviour and crashes.

## Conclusion

Much of the literature investigating relationships between personality factors and young driver crash involvement is subject to methodological limitations. To determine whether personality characteristics could consistently predict crashes among young drivers, the present study sought to overcome some of these limitations by using a prospective and retrospective design, official driver records and a measure of driving exposure. The personality measures in this study did not consistently predict young driver crash involvement. While some behavioural measures of personality in the driving context were associated with young driver crashes (i.e. competitiveness while driving), the relationship was generally too small to be practical in predicting young driver crash risk.

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## References

1. OECD, *Young drivers: the road to safety*. 2006, Paris: Organisation for Economic Co-operation and Development and European Conference of Ministers of Transport.
2. Shinar, D., *Psychology on the road - The human factor in traffic safety*. 1978, New York: Wiley.
3. Kassir, S., *Psychology*. 2003, USA: Prentice-Hall Inc.



4. Elander, J., R. West, and D. French, *Behavioral correlates of individual differences in road-traffic crash risk: An examination of methods and findings*. Psychological Bulletin, 1993. **113**(2): p. 279-294.
5. Beirness, D.J., *Do we really drive as we live? The role of personality factors in road crashes*. Alcohol, Drugs and Driving, 1993. **9**(3-4): p. 129-143.
6. Argyle, M., *The psychology of interpersonal behaviour*. 1983, Harmondsworth, GB: Penguin Books.
7. Jonah, B.A., *Sensation seeking and risky driving*, in *Traffic and Transport Psychology - Theory and Application*, T. Rothengatter and E. Carbonell Vaya, Editors. 1997, Pergamon: Great Britain. p. 259-267.
8. Trimpop, R. and B. Kirkcaldy, *Personality predictors of driving accidents*. Personality and Individual Differences, 1997. **23**(1): p. 147-152.
9. Gulliver, P. and D. Begg, *Personality factors as predictors of persistent risky driving behaviour and crash involvement among young adults*. Injury Prevention, 2007. **13**: p. 376-381.
10. Lawton, R., et al., *Predicting road traffic accidents: The role of social deviance and violations*. British Journal of Psychology, 1997. **88**(2): p. 249-262.
11. Patil, S.M., et al., *The role of personality characteristics in young adult driving*. Traffic Injury Prevention, 2006(7): p. 328-334.
12. Oltedal, S. and T. Rundmo, *The effects of personality and gender on risky driving behaviour and accident involvement*. Safety Science, 2006. **44**: p. 621-628.
13. Goldstein, L.G. and J.N. Mosel, *A factor study of drivers' attitudes, with further study on driver aggression*. Highway Research Board Bulletin, 1958. **172**: p. 9-29.
14. Mayer, R. and J. Treat, *Psychological, social and cognitive characteristics of high-risk drivers: A pilot study*. Accident Analysis and Prevention, 1977. **9**(1): p. 1-8.
15. Beirness, D.J., H.M. Simpson, and D.R. Mayhew, *Predicting crash involvement among young drivers*, in *Proceedings of the International Conference on Alcohol, Drugs and Traffic Safety*, H.D. Utzelmann, G. Berghaus, and G. Kroj, Editors. 1993, Verlag TUV Rhineland: Cologne.
16. Loftus, E.F., *The reality of repressed memories*. American Psychologist, 1993. **48**(5): p. 518-537.
17. Massie, D.L., P.E. Green, and K.L. Campbell, *Crash involvement rates by driver gender and the role of average annual mileage*. Accident Analysis and Prevention, 1997. **29**(5): p. 675-685.
18. Crettenden, A.V., E.-Y. Yeo, and A.E. Drummond, *Qualitative dimensions of young driver driving exposure as a function of time of day*. 1994, Federal Office of Road Safety: Canberra.
19. Gregersen, N.P. and H.Y. Berg, *Lifestyle and accidents among young drivers*. Accident Analysis and Prevention, 1994. **26**: p. 297-303.
20. Wundersitz, L.N. and N. Burns, *Personality and attitudinal predictors of traffic offences among young drivers: a prospective analysis*, in *Driver Behaviour and Training, Volume III*, L. Dorn, Editor. 2008, Ashgate: Aldershot, UK.
21. Wundersitz, L.N. and T.P. Hutchinson, *South Australia's Driver Intervention Program: A discussion of best practice, with data on characteristics of the participants and a selective literature review*. 2006, Centre for Automotive Safety Research: Adelaide, South Australia.
22. Wundersitz, L.N., *Characteristics identifying young drivers at a higher risk of crashing*, in *School of Psychology*. 2007, University of Adelaide: Adelaide. p. 361.
23. Rathus, S.A., *A 30-item schedule for assessing assertive behavior*. Behavior Therapy, 1973. **4**: p. 398-406.
24. Costello, C.G. and A.L. Comrey, *Scales for measuring depression and anxiety*. Journal of Psychology, 1967. **66**: p. 303-313.
25. Howarth, E., *A psychometric investigation of Eysenck's personality inventory*. Journal of Personality Assessment, 1976. **40**(2): p. 173-185.
26. Zuckerman, M., *Dimensions of sensation seeking*. Journal of Consulting and Clinical Psychology, 1971. **36**: p. 45-52.
27. Buss, A.H. and A. Durkee, *An inventory for assessing different kinds of hostility*. Journal of Consulting and Clinical Psychology, 1957. **21**: p. 343-349.
28. Parry, M.H., *Aggression on the road*. 1968, London: Tavistock Press.
29. Donovan, D.M. and G.A. Marlatt, *Personality subtypes among driving-while-intoxicated offenders: relationship to drinking behavior and driving risk*. Journal of Consulting and Clinical Psychology, 1982. **50**(2): p. 241-249.

30. Pelz, D.C. and S.H. Schuman, *Are young drivers really more dangerous after controlling for exposure and experience?* Journal of Safety Research, 1971. **3**(2): p. 68-79.
31. West, R., J. Elander, and D. French, *Mild social deviance, Type-A behaviour pattern and decision-making style as predictors of self-reported driving style and traffic accident risk.* British Journal of Psychology, 1993. **84**: p. 207-219.
32. Deery, H.A. and A.W. Love, *The driving expectancy questionnaire: development, psychometric assessment and predictive utility among young drink-drivers.* Journal of Studies on Alcohol, 1996. **57**(193-202).
33. Watson, B. *A survey of unlicensed driving offenders.* in *2002 Road Safety Research, Policing and Education Conference.* 2002. Adelaide, South Australia: Plevin and Associates.
34. Cohen, J., *Statistical power analysis for the behavioural sciences.* 2nd ed. 1988, Hillsdale, NJ: Erlbaum.
35. Evans, L., *Traffic Safety.* 2004, Bloomfield Hills, Michigan: Science Serving Society.
36. Friedstrom, L., et al., *Measuring the contribution of randomness, exposure, weather, and daylight to the variation in road accident count.* Accident Analysis & Prevention, 1995. **27**: p. 1-20.
37. Struckman-Johnson, D.L., et al., *Comparative effects of driver improvement programs on crashes and violations.* Accident Analysis & Prevention, 1989. **21**(3): p. 203-215.
38. Wahlberg, A.E., *Some methodological deficiencies in studies on traffic accident predictors.* Accident Analysis & Prevention, 2003. **35**: p. 473-486.
39. Zylman, R., *Drivers' records: are they a valid measure of driving behavior.* Accident Analysis & Prevention, 1972. **4**: p. 333-349.
40. Grey, E.M., T.J. Triggs, and N.L. Haworth, *Driver Aggression: The role of personality, social characteristics, risk and motivation.* 1989, Monash University: Clayton, Victoria.
41. Donovan, D.M., et al., *Intoxicated and bad drivers: Subgroups within the same population of high risk men drivers.* Journal of Studies on Alcohol, 1985. **46**: p. 375-382.
42. Harano, R.M., R.C. Peck, and R.S. McBride, *The prediction of accident liability through biographical data and psychometric tests.* Journal of Safety Research, 1975. **7**: p. 16-52.
43. Williams, A.F., *Teenage drivers: Patterns of risk.* Journal of Safety Research, 2003. **34**(1): p. 5-15.
44. Deery, H.A., *Hazard and risk perception among young novice drivers.* Journal of Safety Research, 1999. **30**(4): p. 225-236.
45. Ryan, G.A., M. Legge, and D. Rosman, *Age related changes in drivers' crash risk and crash type.* Accident Analysis and Prevention, 1998. **30**(3): p. 379-387.
46. MacMillan, J., *Deviant drivers.* 1975, Westmead, UK: Saxon House.
47. Galovski, T. and E.B. Blanchard, *Psychological characteristics of aggressive drivers with and without intermittent explosive disorder.* Behaviour Research and Therapy, 2002. **40**(10): p. 1157-1168.
48. Yagil, D., *Interpersonal antecedents of drivers' aggression.* Transportation Research Part F: Traffic Psychology and Behaviour, 2001. **4**(2): p. 119-131.
49. Wilson, M. and M. Daly, *Competitiveness, risk-taking, and violence: The young male syndrome.* Ethnology and Sociobiology, 1985. **6**: p. 59-73.