The risky behaviour of young drivers: Developing a measurement tool

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Abstract

The contribution of risky behaviour to the increased crash and fatality rates of young novice drivers is recognised in the road safety literature around the world. Exploring such risky driver behaviour has led to the development of tools like the Driver Behaviour Questionnaire (DBQ) to examine driving violations, errors, and lapses [1]. Whilst the DBQ has been utilised in young novice driver research, some items within this tool seem specifically designed for the older, more experienced driver, whilst others appear to asses both behaviour and related motives. The current study was prompted by the need for a risky behaviour measurement tool that can be utilised with young drivers with a provisional driving licence. Sixty-three items exploring young driver risky behaviour developed from the road safety literature were incorporated into an online survey. These items assessed driver, passenger, journey, car and crash-related issues. A sample of 476 drivers aged 17-25 years (M = 19, SD = 1.59 years) with a provisional driving licence and matched for age, gender, and education were drawn from a state-wide sample of 761 young drivers who completed the survey. Factor analysis based upon a principal components extraction of factors was followed by an oblique rotation to investigate the underlying dimensions to young novice driver risky behaviour. A five factor solution comprising 44 items was identified, accounting for 55% of the variance in young driver risky behaviour. Factor 1 accounted for 32.5% of the variance and appeared to measure driving violations that were transient in nature - risky behaviours that followed risky decisions that occurred during the journey (e.g., speeding). Factor 2 accounted for 10.0% of variance and appeared to measure driving violations that were fixed in nature; the risky decisions being undertaken before the journey (e.g., drink driving). Factor 3 accounted for 5.4% of variance and appeared to measure misjudgement (e.g., misjudged speed of oncoming vehicle). Factor 4 accounted for 4.3% of variance and appeared to measure risky driving exposure (e.g., driving at night with friends as passengers). Factor 5 accounted for 2.8% of variance and appeared to measure driver emotions or mood (e.g., anger). Given that the aim of the study was to create a research tool, the factors informed the development of five subscales and one composite scale. The composite scale had a very high internal consistency measure (Cronbach's alpha) of .947. Self-reported data relating to police-detected driving offences, their crash involvement, and their intentions to break road rules within the next year were also collected. While the composite scale was only weakly correlated with self-reported crashes ($r = .16$, $p < .001$), it was moderately correlated with offences ($r = .26$, $p < .001$), and highly correlated with their intentions to break the road rules ($r = .57$, $p < .001$). Further application of the developed scale is needed to confirm the factor structure within other samples of young drivers both in Australia and in other countries. In addition, future research could explore the applicability of the scale for investigating the behaviour of other types of drivers.

Résumé

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L'attitude irresponsable des jeunes conducteurs inexpérimentés contribue à l'augmentation du taux d'accidents et de mortalité parmi ces derniers ; cela est universellement reconnu dans la littérature consacrée à la sécurité routière. L'exploration de ce comportement routier à risque a permis le développement d'outils tel que le *questionnaire sur le comportement routier* (QCR) permettant d'analyser les infractions routières, les erreurs et les sources de distraction [1]. Le QCR a été utilisé dans le cadre de la recherche consacrée aux jeunes conducteurs débutants, pourtant certaines questions semblent spécifiquement concerner le conducteur plus âgé et expérimenté alors que d'autres paraissent évaluer les deux comportements et leurs motivations. Cette étude est issue du besoin d'établir un outil d'évaluation du comportement à risque pouvant être utilisé sur de jeunes conducteurs munis d'un permis de conduire provisoire. Soixante-trois questions explorant le comportement à risque des jeunes conducteurs et inspirées de la littérature sur la sécurité routière, furent posées dans un questionnaire en ligne. Ces questions portent sur le conducteur, le passager, le trajet, la voiture et les accidents. Un échantillon de 476 conducteurs âgés de 17 à 25 ans ((M = 19, DS = 1,59 an) détenteurs d'un permis provisoire, apparié selon l'âge, le sexe et le niveau d'instruction a été prélevé sur un échantillon de 761 conducteurs ayant participé à l'enquête. Une analyse factorielle, basée sur l'extraction de facteurs via une analyse en composantes principales, a été suivie d'une rotation oblique pour analyser les dimensions sous-jacentes du comportement à risque des jeunes conducteurs débutants. Une solution factorielle en cinq facteurs, recouvrant 44 questions, a été déterminée et intervient pour 55 % dans la variance du comportement à risque des jeunes conducteurs. Le facteur 1 explique 32,5 % de la variance et semble mesurer les infractions routières de nature transitoire – comportement téméraire issu de décisions comportant des risques prises au cours du trajet (p. ex. excès de vitesse). Le facteur 2 explique 10,0 % de la variance et semble mesurer les infractions routières de nature fixe, les décisions risquées étant prises avant de se mettre au volant (p. ex. conduite en état d'ivresse). Le facteur 3 explique 5,4 % de la variance et semble mesurer les erreurs de jugement (p. ex. mauvaise évaluation de la vitesse d'approche d'autres véhicules). Le facteur 4 explique 4,3 % de la variance et semble mesurer l'exposition à des situations de conduite dangereuse (p. ex. conduite de nuit avec des amis comme passagers). Le facteur 5 explique 2,8 % de la variance et semble mesurer les émotions ou l'humeur du conducteur (p. ex. la colère). L'objectif de l'étude étant de créer un outil de recherche, les facteurs ont servi à l'élaboration de cinq sous-échelles et d'une échelle composite. L'échelle composite présentait un degré d'homogénéité très élevé (l'alpha de Cronbach) dont la valeur s'établissait à 0,947. Des informations fournies directement par les jeunes contrevenants ont également été collectées concernant les infractions routières constatées par la police, notamment leur implication dans l'accident et leur intention de commettre d'autres infractions dans les 12 mois qui suivent. Si la corrélation entre l'échelle composite et les accidents déclarés par les intéressés est faible (*r* = 0,16, *p* < 0,001), on constate qu'elle devient moyenne en ce qui concerne les infractions (*r* = 0,26, *p* < 0,001) et encore plus forte lorsqu'il s'agit des intentions de commettre d'autres infractions (*r* = 0,57, *p* < 0,001). De plus amples applications de l'échelle doivent encore être réalisées avant d'être en mesure de confirmer la structure factorielle d'autres échantillons de jeunes conducteurs en Australie et ailleurs. À l'avenir, d'autres recherches pourraient explorer les possibilités d'application de l'échelle en vue de comprendre le comportement d'autres classes de conducteurs.

INTRODUCTION

1. The crashes of young novice drivers

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Young novice drivers constitute a major public health concern in terms of their numbers of crashes, their rates of crash involvement, and the injuries and fatalities arising from those crashes [2]. For example, persons aged 15-24 years contributed more than 1 in 4 of all crash fatalities in OECD countries in 2004 whilst only constituting 1 in 10 of the population [3]. Moreover, in Queensland in 2008, nearly one in three road fatalities involved a young driver [4]. It is therefore important to understand and, if possible, address the factors which contribute to this problem. Road safety research consistently demonstrates that young driver crashes and fatalities are influenced by numerous driver, passenger, journey, vehicle, and crash variables that interact, and these are summarised below.

Driver characteristics found to influence young driver crash and fatality rates include inexperience [5], gender (i.e. being male) [6], driving unlicensed [7], drink/drug driving [8-9], driving while fatigued, not using safety features such as seat belts [10] and driving while distracted by passengers or in-car technology [11-13]. Carrying young *passengers* (especially males carrying young males) presents a pronounced risk for both the young drivers and their passengers [14-15], especially when alcohol and distraction by passengers are also involved [16]. While the relationship to crashes is unclear, it is known that young drivers are prone to emotional driving [17] and, due to their developmental stage, increased risk-taking behaviour and vulnerability to negative peer influences [18].

The *journey characteristics* found to be associated with young driver crashes and fatalities include speeding behaviour, which is both more common and more risky among young drivers compared with older drivers [19-20]. Driving in darkness is more risky for young drivers [21], as is driving on weekends, and journeys at these times combine several risk factors: young drivers are more likely to carry young passengers at night and on weekends, and greater crash risk at these times, predisposition to risky driving, and limited driving experience [2, 23], are exacerbated by fatigue, drink driving, and recreational driving [24].

Some of the *vehicle and crash characteristics* found to be associated with young driver crash and fatality rates include the size and age of the vehicle, with smaller and older cars being over-involved and associated with higher risk of fatality [25-26]. Young drivers are more likely to rear-end shunt the car in front, inaccurately negotiate a curve, and be involved in an accident as they try to turn across traffic than older, more experienced drivers [27]. Gender contributes to crash type as well, as loss-of-control crashes are twice as likely for male as female young drivers, and are three times more likely to be fatal [28].

As can been seen, the key themes of the behaviours of young novices that contribute to risky driving relate to when they drive, how they drive and who they drive with, so that even apparently "non-human" factors such as type of journey and type of vehicle driven involve choices made by young drivers.

2. Measuring the Risky Behaviour of Young Drivers

A wide variety of research methods have been used to investigate the characteristics of the young novice driver, including
- focus groups [29];
- questionnaires and surveys via telephone [30], paper-and-pencil, internet, and interview with closed and open-ended questions [31];
- logbook analyses [32];
- longitudinal [33] and cross-sectional studies that frequently use data from police [34] and insurance [35] crash reports and hospital records [36], convictions, red light and speed camera photographs [37];

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- local, state, and national crash reporting databases of driving exposure and injuries and fatalities from car crashes [38];
- case-control [15], crash responsibility analysis [39] and crash reconstructions [40];
- objective measures and subjective estimates for factors such as alcohol intoxication; self-reported behaviour [41-42] and simulated [43] and naturalistic observations [44].

This road safety research, however, appears to haphazardly utilise a broad range of purpose-built scales of various types and sizes attempting to explore the constructs of research interest (e.g., two items exploring alcohol and driving among secondary students in New Zealand [6]; and 43 items in the Speeding Perception Inventory, formulated for use with an American University student driving population [45]).

In contrast, the behaviours of older, more experienced drivers are frequently investigated via the Driver Behaviour Questionnaire (DBQ). The DBQ was designed to measure driver errors, lapses, aggressive violations and highway code violations (Cronbach's alpha of .69 for errors, .75 for lapses, and .81 for violations [46]) via 28 items. Numerous studies have examined the factor structure of the DBQ within a range of countries [47-48] and acceptable measures of internal consistency have been found in recent Australian research [49]. Whilst this measurement tool has been utilised in young driver research (e.g., in Brazilian students [50] and in Israeli secondary and tertiary students [51]), the DBQ does not appear suited for specifically exploring the behaviours of young drivers.

To illustrate, a number of items combine both behaviour and related motives, for example item 16 (a highway code violation) asks the participant how often they "race away from the traffic lights with the intention of beating the driver next to you?" Such questions combine two constructs – behaviour and motivation – and therefore it may be unclear which concept the item is measuring. Moreover, whilst the young novice driver may indeed frequently "'race away from the traffic lights'" it is unlikely that will be because he or she wants to beat the driver next to him or her each time. Young novice driver road safety research ultimately seeks to inform countermeasure development and government road use policy, and to do so this research needs to report clear findings obtained through the use of concise measures. In addition, some items in the DBQ appear suited to the older, rather than the younger, driver. For example, the lapse item "how many times did you forget where you left your car in the car park?" is unlikely to be relevant to many young novice drivers who perceive their car as a significant part of their identity [52].

3. The Study

There is a need for a reliable and valid measure of young novice driver behaviour containing a more comprehensive range of behaviours that have been identified as contributing to young novice driver crashes. It is vital that this tool be drawn from the breadth of behaviours apparent in the young driver crash characteristics already identified in the road safety literature and discussed earlier. This study is part of a larger study undertaken in Queensland, Australia designed to explore the risky behaviour of young novice drivers. In Queensland, young novice drivers progress through a multiphase graduated driver licensing (GDL) system of Learners (under full supervision for one year; must be 16 years old), Provisional P1 (with various driving restrictions; must be held for at least one year if under 24), Provisional P2 (with various driving restrictions; must be held for two years if under 25, one year otherwise), and Open licence (full driving privileges). An online survey was informed by the young driver literature. The aim of the present study was to identify the behavioural dimensions underlying risky young novice driving, and to create scale(s) representing these dimensions.

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METHOD

1. Participants

Seven hundred and sixty-one drivers (523 women and 238 men) aged 17-25 years (M = 19 years, SD = 1.59) with a provisional driving licence (281 P1, 480 P2) volunteered to complete the 25 minute online survey. Given the greater participation of female young drivers, a sub-sample was randomly selected that matched the male young driver participants upon the demographic measures of age and the geographic and socioeconomic measure of the educational institution they attended to address the possibility of bias. The matched participants sample was comprised of 238 male and 238 female young drivers aged 17-25 years with a provisional driving licence (166 P1, 310 P2). Two hundred and twenty-eight of the participants were students of the Queensland University of Technology (QUT), 230 were students of the University of Queensland (UQ), and 18 were students of the Technical and Further Education (TAFE) Colleges of Queensland.

2. Procedure and the Survey Instrument

The study featured a cross-sectional survey design. The online survey was distributed to all tertiary education institutions in Queensland, Australia, and available online from mid-August to 30 October, 2009. Students aged 17-25 years with a provisional driving licence were eligible to participate for the opportunity to receive one of four $350 fuel vouchers; if they were a first-year psychology undergraduate student at QUT they were eligible for certified credit for study participation. Participants were asked a range of sociodemographic questions, including age, gender, and marital status. They were instructed to think about their driving experiences whilst on a provisional driving licence. The young drivers then rated their agreement with 63 items derived from the literature including Queensland's GDL provisions. Participants also responded to items asking if they had ever been in a car crash as a driver (*yes*, *no*), been caught by police for committing a driving offence (*yes*, *no*), and if they were likely to bend any road rules, including GDL provisions, over the next year (1 *definitely will not* to 7 *definitely will*). The online survey tool was created and distributed in the KeySurvey Enterprise Online Survey Software program. All analyses were conducted using the Statistical Package for the Social Sciences (SPSS) version 16.0.

3. Statistical Analysis

A minimum sample size of 5 observations per variable is recommended for exploratory factor analysis (EFA), and for a preferred power of 80% and to detect a medium effect size of .20, a sample size of 315 participants is required with a minimum of .30 as a significant factor loading [53]. This sample size requirement was met. Bivariate correlations were used to explore the strength of association between the factors and the sociodemographic variables, and the risky behaviour measures of crash involvement, offence detection, and intentions to comply with rules. Bivariate correlations between continuous variables utilised Pearson's product moment correlation (r); bivariate correlations between continuous and dichotomous variables utilised point biserial correlations (r_{pb}); and bivariate correlations between dichotomous variables utilised the phi coefficient (Φ) [54]. These were evaluated at a significance level of α = .05.

RESULTS

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An exploratory factor analysis of the 63 self-reported behaviour items with principal component extraction identified 12 factors with eigenvalues greater than 1.00 explaining 62.25% of variance; 3 factors explaining more than 4% of variance each; and 5 factors according to the scree test. The Kaiser-Meyer-Olkin measure of sampling adequacy was acceptable at .921, and the Bartlett's test of sphericity was significant at $p < .001$. Given that the factors were likely to be correlated, an oblique promax rotation with Kaiser Normalisation was undertaken. The most interpretable solution emerged from using five factors. Considering that (a) as the number of factors extracted increases, the factor loadings considered significant should also increase; (b) larger factor loadings correspond to more variance in the item being explained by the factor (e.g., a .40 factor loading corresponds to 16% of the item's variance being accounted for by that factor), and (c) that factor loadings greater than .40 are considered "more important" [63], items that did not load above .40 upon any factor and those that loaded highly on two or more factors were excluded. The factor analysis with promax rotation of the remaining 44 items revealed an easily interpretable five factor structure, explaining 55% of the variance in young provisional risky driving behaviour as depicted in Table 1.

Item	F1	F2	F3	F4	F5
You drove over speed limit in areas where it was unlikely there was a radar or speed camera	.91				
You went 10-20 km/hr over the speed limit (e.g., 72 km/hr in a 60 km/hr, 112 km/hr in a 100 km/hr)	.83				
You deliberately sped when overtaking	.83				
You sped at night on roads that were not well lit	.81				
You went up to 10 km/hr over the speed limit (e.g. 65 km/hr in a 60 km/hr, 105 km/hr in a 100 km/hr)	.79				
You went more than 20 km/hr over the speed limit (e.g. 60 km/hr in a 40 km/hr, 100 km/hr in an 80 km/hr)	.79				
You raced out of an intersection when the light went green	.74				
You travelled in the right lane on multi-lane highways	.65				
You sped up when the lights went yellow	.64				
You went too fast around a corner	.56				
You did an illegal u-turn	.50				
You overtook a car on the left	.48				
You spoke on a mobile that you held in your hands	.41				
Your passengers didn't wear seatbelts		.83			
You drove after taking an illicit drug such as marijuana or ecstasy		.80			
You carried more passengers than could legally fit in your car		.78			
You didn't always wear your seatbelt		.75			
You drove without a valid licence because you hadn't applied for one yet or it had been suspended		.75			
You didn't wear a seatbelt if it was only for a short trip		.69			
If there was no red light camera, you drove through intersections on a red light		.68			
You carried more passengers than there were seatbelts for in your car		.65			
You drove when you thought you may have been over the legal alcohol limit		.49			
You drove a high-powered vehicle		.47			
You misjudged the speed when you were exiting a main road			.83		
You misjudged the speed of an oncoming vehicle			.78		

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Item	F1	F2	F3	F4	F5
You misjudged the gap when you were turning right			.71		
You misjudged the stopping distance you needed			.70		
You turned right into the path of another vehicle			.62		
You misjudged the gap when you were overtaking another vehicle			.61		
You missed your exit or turn			.59		
You entered the road in front of another vehicle			.54		
You didn't always indicate when you were changing lanes			.47		
You drove on the weekend				.82	
You drove in the rain				.80	
You drove at peak times in the morning and afternoon				.78	
You drove at night				.78	
You drove at dusk or dawn				.70	
You carried your friends as passengers at night				.55	
You drove when you knew you were tired				.43	
Your car was full of your friends as passengers				.42	
You went for a drive with your mates giving directions to where they wanted to go				.42	
Your driving was affected by negative emotions like anger or frustration					.85
You allowed your driving style to be influenced by what mood you were in					.80
You drove faster if you were in a bad mood					.79

Table 1 - Items and Factor Loadings for Each Item

Factor 1 contained 13 items and accounted for 32.5% of variance and appeared to measure driving violations that were transient in nature, i.e. violations that drivers can perform multiple times during a journey (e.g., speeding). Factor loadings ranged from .41 to .91, the majority of which were greater than .60. Factor 2 contained 10 items and accounted for 10.0% of variance and appeared to measure driving violations that were more fixed in nature, i.e. violations that apply throughout the journey (e.g., drink driving). Factor loadings ranged from .47 to .83, again the majority of which exceeded .60. Factor 3 contained nine items and accounted for 5.4% of variance and appeared to measure misjudgement (e.g., misjudging the speed of an oncoming vehicle). Factor loadings ranged from .47 to .83, two thirds of which were greater than .60. Factor 4 contained nine items and accounted for 4.3% of variance and appeared to measure potentially risky driving exposure (e.g., driving at night with friends as passengers). Factor loadings ranged from .42 to .82, more than half exceeding .60. Factor 5 contained three items and accounted for 2.8% of variance and appeared to measure driver emotions or mood (e.g., anger). Factor loadings ranged from .79 to .85.

The Factors informed the development of five provisional subscales and one composite scale. Table 2 shows the correlations between the factors and the composite measure. As can be seen the strongest associations were between Factors 1 and 4, and Factors 1 and 5, indicating that transient rule violations were highly associated with greater risky driving exposure and driver mood. That is, the young novice driver was more likely to report breaking the road rules during the journey if they were travelling under higher risk circumstances (e.g., they were tired or were carrying their friends as passengers), and if they were in a bad mood. The associations between Factors 4 and 2, and Factors 4 and 3, were weakest, indicating that risky driving exposure was least related to fixed rule violations and misjudgement.

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	Factor 1 (Transient)	Factor 2 (Fixed)	Factor 3 (Misjudge)	Factor 4 (Exposure)	Factor 5 (Emotions)	Risky Behaviour Composite
Factor 1	1	-	-	-	-	-
Factor 2	.53	1	-	-	-	-
Factor 3	.53	.55	1	-	-	-
Factor 4	.63	.33	.31	1	-	-
Factor 5	.61	.40	.52	.45	1	-
Composite	.92	.69	.70	.76	.71	1

Note: All correlations were significant, $p < .001$.

Table 2 - Correlations between Factors and the Composite Provisional Measure

The composite scale had a very high internal consistency Cronbach's alpha (.947), and the subscales of Factors 1 to 5 were similarly high (.923, .846, .870, .869, and .891 respectively). Table 3 depicts the means, standard deviations, number of items, and the range for the subscales and composite scale.

Provisional Behaviour Measure	*M*	*SD*	No. of items	Range
Transient rule violations (Factor 1)	27.06	9.61	13	13 - 65
Fixed rule violations (Factor 2)	12.44	4.10	10	10 - 50
Misjudgement (Factor 3)	13.61	4.18	9	9 - 45
Risky driving exposure (Factor 4)	26.11	6.31	9	9 - 45
Driver mood (Factor 5)	5.60	2.63	3	3 - 15
Risky Driving Behaviour (Composite)	84.82	21.28	44	44 - 220

Table 3 - Characteristics of the Provisional Behaviour Factors

Overall, the young drivers reported a large amount of risky driving exposure (average score per item in the scale = 2.90), a moderate amount of transient rule violations (2.08) and driving in response to their mood (1.87), and some misjudgement (1.51) and fixed rule violations (1.24). Table 4 illustrates the correlations between the risky behaviour measures and sociodemographics (age, gender, and type of provisional licence), crashes, offences and intentions to bend the road rules in the next year.

Variable	Factor 1 (Transient)	Factor 2 (Fixed)	Factor 3 (Misjudge)	Factor 4 (Exposure)	Factor 5 (Emotion)	Risky Composite
Age	-.05	.05	.02	-.05	-.04	-.04
Gender	-.11*	-.17*	.03	.09*	.05	-.03
Licence type	.07	.00	.06	.13**	.07	.09*
Offences	.24***	.29***	.16**	.17***	.14**	.26***
Crashes	.13**	.11*	.10*	.13**	.15**	.16**
Intentions	.62***	.38***	.33***	.34***	.38***	.57***

Note: * $p < .05$, ** $p < 01$, *** $p < .001$.

Table 4 - Correlations between the Provisional Risky Behaviour Measures and Sociodemographics, Self-Reported Crashes and Offences, and Driving Intentions

One hundred and thirty-seven (28.8%) of the participants reported they had previously been involved in a car crash, and 101 (21.2%) had been caught committing a driving offence. As shown in Table 4, while the risky driving composite scale was only weakly associated with self-reported crashes, it was moderately associated with offences, and highly associated

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with participants' intentions to bend the road rules. One in six of the young novice drivers reported they would, or definitely would, whilst 4 in 10 reported they would not or definitely would not, bend the road rules in the next year. Of the five factors, transient rule violations (Factor 1) was most highly associated with intentions to bend road rules and involvement in a crash, whilst both transient (Factor 1) and fixed rule violations (Factor 2) were most highly associated with offences.

DISCUSSION

1. Psychometric Implications

As was discussed earlier, young driver road safety research has occasionally utilised the DBQ to provide a measure of self-reported risky driving. This may have been due to a lack of a suitable alternative that specifically explores the risky behaviour of young and novice drivers. The study offers one such alternative. It is interesting to note however the similarities of the composite scale to the DBQ. To illustrate, the DBQ contains three factors – errors, lapses, and violations, the latter which was subsequently dichotomised as aggressive violations and highway code violations. The risky behaviour composite herein referred to as the BYNDS (The Behaviour of Young Novice Drivers Scale) contains 5 factors – misjudgement (which may reflect the dimension of 'errors' within the DBQ), transient and fixed violations (which may parallel highway code violations), risky driving exposure (which may be particular to the young novice driver) and mood (which may reflect the causal mechanism underpinning some aggressive violations). Importantly, the study further delineates some more specific young driver risky behaviours. For example, the DBQ highway code violation item "cross a junction knowing that traffic lights have already turned against you" is examined by two study items that load on two different factors: "sped up when the lights went yellow" (transient violation) and "if there was no red light camera, you drove through intersections on a red light" (fixed violation).

Studies utilising the DBQ frequently omit the errors items as researchers report that errors are not predictive of road crashes. However young drivers are novices, and as such errors – or in the case of the present study, misjudgement – are more likely to play a role. To illustrate, young drivers with a provisional licence involved in a crash in Queensland between 1 July 1998 and 30 June 2008 were at fault in 78% of their crashes [55]. It is also noteworthy that the subscales identified in the present study exhibit higher internal consistency than those typically found for the DBQ. Furthermore, whilst there were weak correlations between the composite scale and self-reported involvement in a crash, crashes are comparatively infrequent events [56] and this does not diminish the potential utility of the tool (although it highlights the need for further refinement).

2. Practical Implications

There are considerable practical implications arising from the study. Not only has a reliable and potentially valid measurement tool for young driver risky behaviour been created, but the five subscales of transient and fixed rule violations, misjudgement, risky exposure and driver mood have also been developed and could be used as independent measures. Accordingly road safety researchers can utilise the entire behaviour scale, one of the five subscales, or any combination of these subscales within their research. In addition, all risky behaviour factors were moderately associated with car crashes; therefore these can inform young novice driver countermeasure evaluations and government policy. To illustrate, the relationship with transient and fixed rule violations indicates that enforcement and education

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campaigns targeting risky behaviours such as speeding and drink driving may prove beneficial. Similarly misjudgement, which may reflect the driving experience and developing hazard detection skills of the young driver, may similarly benefit from targeted education in the learner phase of licensing. The considerable role of risky driving exposure indicates that graduated driver licensing restrictions may need to be strengthened. Education campaigns targeting the young novice driver could emphasise the greater risk associated with this exposure, and also the greater risk associated with driving in response to their mood particularly if they are angry or excited.

3. Strengths and Limitations

The study used an adequate sample size for the exploratory factor analysis and controlled for gender (and socioeconomic) effect by matching a sub sample of novice drivers by age and educational institution. The items utilised in the study were drawn directly from the road safety literature and reflected the graduated driver licensing restrictions in Queensland. These items can also be easily modified for use in populations outside Australia; for example, travelling at "10-20 km/hr over the speed limit" can be readily converted to miles, travelling in the "right-hand lane" easily converted to "left-hand lane". The data used in the study were collected via self-report and may have been subject to biases inherent in this technique. However the anonymous nature of the questionnaire and the lack of consequences for reporting risky driving behaviour hopefully minimised this potential [57]. In addition, whilst it is preferable that the scales and subscales be internally consistent, indicated by a high Cronbach's alpha, such high alphas may suggest there is some redundancy within the instrument [53].

The generalisability of the study findings is limited by the survey procedure and method and the number and type of participants sampled. The survey tool was an online survey that was made available to all enrolled students at tertiary education institutions only, and therefore the sample may not be representative of all young novice drivers in Queensland. Unfortunately 4 out of 13 institutions declined to participate or did not respond to the participation request; therefore the respondents may not accurately represent young novice drivers attending a tertiary education institution in Queensland. In addition, the response rate for the study could not be calculated as it was not possible to determine how many young novice drivers accessed the survey and declined to participate. Furthermore, more female than male young novice drivers completed the survey (31.3% male, 68.7% female), and these ratios appear to reflect a greater participation of female young drivers as both UQ and QUT report that in 2009 55% of their student population were female.

4. Future Research

Future research provides an opportunity to further explore the reliability of the BYNDS and its subscales, particularly the refining of each scale by determining the optimal number of items within each, thereby improving its parsimony. This research could incorporate additional survey modes, such as paper and pencil tests, or telephone interviews, and also incorporate the capacity to appraise both the response rates and participant biases pertaining to each data collection method. Future samples should include young novice drivers who are not tertiary education students. There is a need to further examine the validity and reliability of the BYNDS by establishing its relationship with other measures of risky behaviour, for example using simulator studies, diary studies, and official crash and offence records. A longitudinal methodology may also allow identification of developmental changes in the risky behaviour of young novice drivers, particularly as they progress from their Learner licence to their P1, their P2, and ultimately to their Open licence. This approach

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may also inform countermeasure development that may need to target particular groups of young drivers. Future studies could also compare the explanatory and predictive ability of the BYNDS with the DBQ, including examination of the identified factor structure of the items in other young driver populations around the world.

CONCLUSIONS

Young driver risky behaviour contributes to their increased car crash and fatality rates in Queensland and in other jurisdictions around the world. A range of contributing factors has been identified by road safety researchers utilising multiple methods and these relate to the way young people drive, who they drive with and when they drive. This study recognised the need for a reliable and valid tool that can measure the self-reported risky behaviour undertaken by the novice young driver. Accordingly an online survey was completed by 761 young drivers, and exploratory factor analysis using a sub-sample of 476 (equal numbers of males and females, matched) resulted in a 5-factor solution. The factors include transient and fixed violations, misjudgement, risky driving exposure, and driver emotion and mood. The factors informed the development of one composite scale and five subscales, each with very high internal reliability. The composite scale or any combination of subscales can be used in future young novice driver research, and may prove suitable for research involving older, more experienced drivers as well.

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APPENDIX

Behavioural Items that Loaded less than .40 or Loaded on Two or More Factors
You drove with the stereo up really loud
Your passengers had their mobile on loudspeaker
You changed your mind about your destination mid-journey
You didn't give way to traffic (e.g. already on the roundabout or at a give way sign)
You drove without having a destination in mind
You drove a small car, such as a hatchback
You overtook a car illegally
You carried more passengers than you were allowed to under the graduated driver licensing restrictions passenger limits
You took chances for the fun of it when driving in traffic
You made a lane change when there probably wasn't enough room to do so
You sent or replied to a text while driving
You raced with other drivers
You found yourself driving when you were really "pumped up"
You yelled or used rude gestures at another driver who had cut you off
You didn't always display your novice plates
You followed someone who had cut you off
You didn't stop at a stop sign or a red light
You drove over the white centre line when you weren't overtaking
You drove a car that was more than 10 years old

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