

## **Orange Light Versus Yellow Light: Validation of the Behaviour of Young Novice Drivers Scale (BYNDS) in a New Zealand Young Driver Population**

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### **Abstract**

The Behaviour of Young Novice Drivers Scale (the BYNDS, Scott-Parker et al., 2010) is a reliable and valid self-report 44-item instrument which explores the frequency of a breadth of risky driving behaviours which appear to place young and novice drivers at increased risk of road crash injury. As part of a larger collaborative research project, the Australian-developed BYNDS was piloted in a sample of 20 young New Zealand drivers ( $n = 14$  aged 16-18 years, 9 males;  $n = 6$  aged 19-24 years, 2 males). The wording of 21 BYNDS items was modified to reflect the cultural context of the participating New Zealand drivers. The refined BYNDS was applied in a sample of 325 young drivers ( $n = 116$  aged 16-18 years, 65 males;  $n = 209$  aged 19-24 years, 98 males), and the factor structure examined, including exploratory factor analysis for each gender. The 5-factor structure of the BYNDS was supported, with young drivers reporting considerable engagement in risky driving exposure, moderate engagement in transient violations and mood-related driving, and less fixed violations and driving misjudgements. Risky driving exposure was predictive of self-reported crash involvement for both males and females, suggesting targeted intervention regarding when, and the circumstances under which, the young driver is on the road.

### **Introduction**

#### ***The young driver problem in the New Zealand context***

Road crashes remain the single greatest killer of young people in New Zealand and the leading cause of their permanent injury (Gulliver and Simpson, 2007a, 2007b). Young drivers (16 to 24 year olds) are significantly over-represented in road crashes, leading to high social and economic costs to individuals, families and communities. The New Zealand government has estimated that the social cost of crashes resulting in deaths ( $n = 122$  in 2008) or serious injuries ( $n = 800$  in 2008) where young drivers were deemed at fault to be \$NZ1.1 billion in the 2008 calendar year alone (Ministry of Transport, 2010).

New Zealand has had a Graduated Driver Licence System (GDLS) since 1987. Several evaluations have shown the GDLS to be effective in reducing the crash rate among New Zealand's young drivers, by reducing the overall exposure to crash risk factors such as driving at night or with passengers (Langley et al., 1996; Begg et al., 2001). Moreover, this crash reduction has found to have been sustained over time (Begg and Stephenson, 2003). However, even with this reduction, young New Zealand drivers at the learner or restricted (provisional) stages of licensure continue to crash at significantly higher rates than older drivers. This is consistent with the overrepresentation of young drivers in road crashes throughout the world (OECD, 2006).

New Zealand's Centre for Road Safety Intelligence has suggested that the effectiveness of New Zealand's GDLS is reduced because some drivers do not comply with the restrictions. Published research and administrative data collected by New Zealand government agencies suggest that those who breach the GDLS restrictions are more likely to crash (Mayhew et al,

2006). According to NZ Police data, over half (55%) of young drivers who were at fault in a fatal or serious crash between 2007 and 2011 had a history of GDLS breaches. Moreover, the proportion of young drivers in New Zealand who breach the conditions of their license is high. The New Zealand Driver's Study (NZDS, a prospective cohort study of 3992 newly licensed young drivers) found that almost two-thirds of participants had driven unsupervised at night, over 80% had driven unsupervised with passengers while on provisional licences and 62% breached both conditions (Brookland et al, 2013).

The NZDS findings were replicated in a qualitative study in Mangere, an ethnically diverse area of medium to high deprivation in Auckland, which found a normalisation of driving unlicensed and breaching of license conditions among young people. Alarmingly this risky behaviour was found to be tacitly condoned by the wider community (ACC, 2013), suggesting that the consistently high prevalence of breaching of the GDLS conditions indicates it has become the norm for young drivers in New Zealand. Thus in order to combat this issue and others which have been found to contribute to the overrepresentation of young drivers in road crashes, a multi-agency program of intervention has been established and will be evaluated using an action research model.

A fundamental element of the program is a reliable and validated instrument which can be used to measure change in the risky driving behaviours of the target population of young drivers. The Behaviour of Young Novice Drivers Scale (BYNDS, Scott-Parker et al., 2010) is a 44-item self-report instrument containing five subscales which are added to obtain a composite risky driving score (see Appendix 1). Transient violations (13 items) measures risky driving behaviours that can change throughout the journey, such as driving speed or speaking on a cell phone. Fixed violations (10 items) explores risky driving behaviours that are unlikely to change throughout the journey, such as alcohol or drug intoxication, and the wearing of seatbelts. Misjudgement (9 items) captures the novice driving errors which place the young driver at increased risk of crash, such as underestimating the distance required to stop, and misjudging the gap when overtaking or turning across traffic. Risky exposure (9 items) gauges the risky circumstances of the young novice's driving, including driving at night and with their friends as their passengers. Driver mood (3 items) demonstrates the extent to which the young novice is driving in response to their emotions, including anger and frustration. Confirmatory factor analysis (Scott-Parker et al., 2012) has produced a 36-item refined BYNDS; however given that the BYNDS has not yet been applied in a young driver population in New Zealand, the full 44-item BYNDS was applied for this study.

### *Study aims*

The study had two aims: to pilot the Australian-developed BYNDS in a New Zealand young driver population, thus identifying culturally-appropriate changes to the wording of individual BYNDS items; and to apply the refined BYNDS in a sample of New Zealand young drivers to more fully understand their risky driving behaviour, including the relationship to self-reported crash involvement.

### **Study 1: Piloting the Behaviour of Young Novice Drivers Scale (BYNDS) in a high risk young driver population in New Zealand**

#### *Participants and Method*

Twenty young novice drivers ( $n = 14$  aged 16-18 years, 9 males;  $n = 6$  aged 19-24 years, 2 males) completed the survey within a focus group environment. Eight participants advised

they had 'no licence'; however they reported driving behaviours such as speeding (consistent with research findings discussed earlier). One participant reported being in a road crash as a driver. Ten participants completed the survey independently, whilst the remaining 10 completed the survey with facilitator assistance. Participants were then questioned by an interviewer on their understanding of each item, and asked to provide feedback regarding the language and terminology.

## **Results**

Appendix 1 summarises the original BYNDS items and the revised items. Twenty-one items were reworded, or additions made, to improve the clarity of the BYNDS items for the target population. For example, "You drove after taking an illicit drug such as marijuana or ecstasy" was changed to "You drove after taking an illegal drug such as marijuana or ecstasy". It is important to note that whilst some changes were made to reflect the different cultural context, minimal change to the BYNDS is fundamental for maintaining the fidelity of the individual items, the subscales, and the composite measure. The BYNDS items that were revised were done so primarily to reflect the different driving and road rule enforcement context of New Zealand. To illustrate, "You sped up when the lights went yellow" was modified to "You sped up when the lights went orange".

Some items were also amended to ensure that participants would be more likely to understand the intention of the question. Pilot interviewers noted several instances of items not being well understood by participants because of unfamiliar vocabulary or concepts. For example, the items beginning with "you misjudged" were reported as being misunderstood by several participants, leading to those items being revised to "you made a mistake with [...]" or "you got with wrong idea about [...]".

In addition, the option of incorporating pictorial representations of some of the driving manoeuvres (e.g., turning right across the oncoming traffic) to aid understanding and interest was also considered based on participant feedback. Given that the BYNDS is typically administered via an online survey, and that developing and maintaining a bank of pictorial representations of driving manoeuvres that are relevant to right- and left-hand drive countries is expensive and requires high fidelity pictures for an online (or printed) survey, this option has not been pursued at this time and is unlikely to be pursued in the near future.

Finally, two new items were posited to be used in addition to, or in place of, two existing BYNDS items:

**Item 1:** "You spoke on a mobile that you held in your hands" was modified to "While driving, you spoke on a mobile that you held in your hands". The additional item "While driving you sent or read a text message" was included in Study 2 of the research to capture a behaviour distinctly different from speaking on a mobile (i.e., different cognitive workload and attention resources, including visual attention, are required for these two mobile-related activities).

**Item 2:** Reflecting different road rule enforcement behaviours in New Zealand as compared to Australia, "If there was no red light camera, you drove through intersections on a red light" was replaced with "You drove through an intersection on a red light" and the additional item "You drove through an intersection on a red light when there were no Police around".

Finally, the instructions for completing the survey were modified from "Whilst you have been driving on your Provisional drivers licence, how often have you done the following behaviours?" with response options of "never, occasionally, sometimes, usually, nearly all

the time ” corresponding to numbers ranging from 1 to 5; to “Please circle the appropriate number, using a scale of 1 to 5, where 1 is Never, 2 is Occasionally, 3 is Sometimes, 4 is Usually and 5 is Nearly all the time ”.

## **Study 2: Application of the BYNDS in a high risk young driver population in New Zealand**

### ***Method***

#### ***Participants***

The BYNDS was applied in a sample of 325 young drivers ( $n = 116$  aged 16-18 years; 65 males;  $n = 209$  aged 19-24 years, 98 males) from the Auckland region of New Zealand. Only 324 of these participants responded to the item “Do you have a current NZ driver’s licence?” therefore one person (female aged 16-18 years) was excluded from all analyses (74 participants subsequently responded they did not have a licence, however they reported driving behaviour and as such were retained in all analyses). Participants were recruited via fieldwork company Reid Research’s existing database of research participants, supplemented with random dialling cold calling. The sample was recruited according to quotas derived from New Zealand Census data, to ensure the sample was representative according to age, gender and ethnicity (NZ Maori and Pacific Islander ethnicities in particular).

#### ***Procedure and materials***

The questionnaire was administered via telephone interview. Participants reported their age (16-18, 19-24 years), gender (*male, female*), and driver’s licence type; completed the 44-item BYNDS with the revised wording; and self-reported their crash involvement (“Have you ever been involved in a car crash where you were driving?” *yes/no*). The BYNDS subscales and composite scale were found to be internally reliable (Transient violations Cronbach’s alpha  $\alpha = .84$ ; Fixed violations  $\alpha = .79$ ; Misjudgement  $\alpha = .78$ ; Risky exposure  $\alpha = .93$ ; Driver mood  $\alpha = .84$ ; Composite  $\alpha = .92$ ).

#### ***Statistical analysis***

Measures of internal consistency utilised Cronbach’s alpha ( $\alpha$ ). Bivariate correlations between continuous variables utilised the non-parametric Spearman’s correlation coefficient ( $r_s$ ). Bivariate correlations between continuous and dichotomous variables utilised the non-parametric Kendall’s tau-b ( $\tau$ ) correlations. 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 220 participants is required (Hair et al., 1998). This sample size requirement was met. Means were compared via analysis of variance. Logistic regression analyses were conducted to explore the relationship between the BYNDS subscales and self-reported crash involvement. All analyses are undertaken in Statistical Package for the Social Sciences (SPSS) version 20.

### ***Results***

#### ***Self-reported crash involvement***

Eighty-eight drivers reported they had been involved in a total of 142 road crashes. Between one (59.1% of drivers; 75.0% of males, 43.2% of females; 85.7% of drivers aged 16-18 years, 54.1% of drivers aged 19-24 years) and five (2.3% of drivers; 2.3% of males and females; no

drivers aged 16-18 years, 2.7% of drivers aged 19-24 years) car crashes were reported by the crash-involved drivers, of which 10 persons (3.1%) reported needing medical treatment. Forty-four males (27.0%) and 44 (27.3%) females reported they had been involved in a car crash as a driver. Fourteen drivers aged 16-18 years (12.2%) and 74 drivers aged 19-24 years (35.4%) reported crash involvement as a driver (a significantly larger proportion,  $p < .001$ ).

### ***BYNDS descriptive statistics***

Prior to analysis, the relationship between the additional items exploring “You spoke on a mobile that you held in your hands” (“While driving, you spoke on a mobile that you held in your hands”; “While driving you sent or read a text message”) and “If there was no red light camera, you drove through intersections on a red light” (“You drove through an intersection on a red light”; “You drove through an intersection on a red light when there were no Police around”) was examined through bivariate correlations (Pearson’s product moment correlation). The two mobile items were highly correlated ( $r = .64$ ,  $p < .001$ ), suggesting multicollinearity and redundancy of measurement if both items were retained in the analyses. As such, “While driving, you spoke on a mobile that you held in your hands” was retained in all analyses as it aligned most closely with the original BYNDS item. The two red light items were also highly correlated ( $r = .77$ ,  $p < .001$ ), again suggesting multicollinearity and redundancy of measurement if both items were retained in the analyses. Therefore “You drove through an intersection on a red light” was retained in the analyses as the original BYNDS item does not specifically refer to Police being within the vicinity.

Table 1 summarises the descriptive statistics for the BYNDS subscales and composite scale, including the mean, standard deviation, minimum, maximum, median, and modal scores. As can be seen, the participants reported considerable engagement in risky driving exposure, moderate engagement in transient violations and driving in response to their mood, and lower engagement in fixed violations and driving misjudgements. Table 2 also reports the descriptive statistics for the BYNDS subscales and composite scale, separately for each gender. Gender differences are apparent in young driver road safety, from representation in road crashes (e.g., in Queensland each year, consistent with other motorised jurisdictions, approximately three-quarters of fatalities are young males), to vulnerability to negative influence (e.g., males consistently report greater sensitivity to reward, which is associated with more risky driving behaviour, e.g., Scott-Parker et al., 2013). In general similar rates of engagement in risky driving behaviours were reported by both genders. However it is noteworthy that male participants reported greater engagement in fixed violations in particular ( $M(SD)$  males = 15.96(6.4), females 13.9(4.1),  $p = .001$ ) and transient violations ( $M(SD)$  males = 27.0(7.2), females 25.5(7.3),  $p = .067$ ).

***Table 1. Descriptive statistics for BYNDS (sub)scales, including for each gender***

Subscale	Total (N=324)				Males (N=163)				Females (N=161)			
	M (SD)	Ran	Med	Mod	M (SD)	Ran	Med	Mod	M (SD)	Ran	Med	Mod
<b>Transient violations</b>	26.2 (7.3)	13-50	26	24	27.0 (7.2)	13-28	48	26	25.5 (7.3)	13-50	25	21
<b>Fixed violations</b>	14.9 (5.5)	10-47	13	10	15.9 (6.4)	10-47	14	13	13.8 (4.1)	10-28	13	10
<b>Misjudgement</b>	15.7 (5.5)	9-34	15	14	15.8 (4.3)	9-34	15	14	15.6 (3.9)	9-34	15	15
<b>Risky exposure</b>	29.5 (4.1)	9-45	31	33	29.1 (8.7)	9-45	30	30	29.8 (9.6)	9-45	31	40

<b>Driver mood</b>	5.8 (2.6)	3- 15	5	3	5.7 (2.5)	3- 15	5	3	5.9 (2.7)	3- 15	6	3
<b>Composite</b>	92.0 (20.6)	44- 160	93	89	93.4 (20.5)	46- 160	93	89	90.5 (20.7)	40- 149	92	84

M: Mean; SD: Standard deviation; Ran: Minimum – Maximum; Med: Median; Mod: Mode

### *Correlations*

Table 2 summarises the correlations amongst the BYNDS subscales and the composite scale. Transient violations were strongly associated with risky driving exposure, consistent with the Queensland finding (Scott-Parker et al., 2010) that young novice drivers were more likely to report breaking road rules during journeys made under higher risk circumstances. Transient violations were moderately associated with fixed violations (participants who are impaired throughout the journey – such as through intoxication – also break other road rules such as speed limits, further increasing their risk), driver misjudgement (drivers who did not follow road rules likely to make driving errors), and driver mood (drivers who did not follow road rules were vulnerable to the negative effects of their emotions). Fixed violations were moderately associated with driver misjudgement (impaired drivers likely to make driving errors); and driver mood was moderately associated with misjudgement and risky exposure (driving in response to emotions corresponds to more driving errors and more risky driving exposure). Risky exposure and driver mood were weakly associated with fixed violations, and risky exposure was also weakly associated with driver misjudgement.

*Table 2. Correlations amongst BYNDS (sub)scales*

	<b>Transient violations</b>	<b>Fixed violations</b>	<b>Misjudgement</b>	<b>Risky exposure</b>	<b>Driver mood</b>	<b>Composite</b>
<b>Transient Violations</b>	1					
<b>Fixed Violations</b>	0.41***	1				
<b>Misjudgement</b>	0.36***	0.43***	1			
<b>Risky Exposure</b>	0.61***	0.16**	0.16**	1		
<b>Driver Mood</b>	0.49***	0.27***	0.35***	0.41***	1	
<b>BYNDS Composite</b>	0.86***	0.60***	0.56***	0.79***	0.62***	1

\*\*p < .01; \*\*\* p < .001.

Table 3 summarises the correlations amongst the BYNDS subscales and the composite scale for each gender. The relationship between misjudgement and fixed violations was considerably stronger for male participants than female participants, suggesting that driving errors were considerably more likely to be made by impaired male drivers. In addition, the relationship between risky exposure and fixed violations was considerably stronger for female participants than male participants, suggesting that impaired driving was more likely to be made by female drivers in particularly risky driving circumstances.

*Table 3 – Correlations amongst BYNDS (sub)scales for each gender*

	<b>Transient violations</b>	<b>Fixed violations</b>	<b>Misjudgement</b>	<b>Risky exposure</b>	<b>Driver mood</b>	<b>Composite</b>
<b>Transient Violations</b>	1	0.40***	0.37***	0.67***	0.52***	0.88***

<b>Fixed Violations</b>	0.42***	1	0.30***	0.25**	0.24**	0.54***
<b>Misjudgement</b>	0.35***	0.52***	1	0.27***	0.41***	0.56***
<b>Risky Exposure</b>	0.55***	0.13**	0.06**	1	0.44***	0.86***
<b>Driver Mood</b>	0.46***	0.32***	0.31***	0.39***	1	0.64***
<b>BYNDS Composite</b>	0.85***	0.66***	0.56***	0.72***	0.61***	1

\*\* p < .01; \*\*\* p < .001. Males below the diagonal; females above the diagonal.

### *Exploratory factor analysis*

A summary of the exploratory factor analysis (EFA) of the 44 BYNDS items is available on request from the study authors. A principal component extraction identified five factors according to the scree plot, nine factors with an eigenvalue greater than one; and five factors explaining more than 4% of variance each. The Kaiser-Meyer-Olkin measure of sampling adequacy was acceptable at .899; and the Bartlett's test of sphericity was significant at  $p < .001$ . Given that the factors have been found to be related (see Scott-Parker et al., 2010), an oblique promax rotation with Kaiser Normalisation was undertaken. Consistent with the development of the BYNDS instrument (see Scott-Parker et al., 2010), five factors were extracted which accounted for 49.32% of variance in the risky driving behaviour of the participating young drivers. It is noteworthy that factor loadings in excess of .40 (i.e., 16% of the item's variance is accounted for by that factor) are considered more important.

Factor 1 accounted for 24.21% of variance, and is consistent with the BYNDS factor *risky exposure*. Factor 2 accounted for 11.29% of variance, and is consistent with the BYNDS factor *fixed violations*. Factor 3 accounted for 5.86% of variance, and is consistent with the BYNDS factor *misjudgement*. One item – “You didn't always indicate when you changed lanes” – did not load highly on this factor. This is consistent with the revised BYNDS (Scott-Parker et al., 2012). Confirmatory factor analyses required removal of this item from this subscale to improve goodness-of-fit. In the case of the New Zealand sample, this item loaded on the fixed violations scale, which is inconsistent with the nature of the behaviour being measured. Factor 4 accounted for 4.21% of variance, and is consistent with the BYNDS factor *transient violations*. Two items did not load on this factor: “You did an illegal U-turn”; “You spoke on a mobile that you held in your hands”. This is not consistent with the revised BYNDS (Scott-Parker et al., 2012), with both of these items retained in the revised BYNDS. The first item loaded upon the fixed violations subscale in the New Zealand sample, which is again inconsistent with the nature of the behaviour being measured. The second item loaded on the risky exposure subscale, which suggests that mobile phone use is being undertaken in particularly risky driving circumstances such as at night and carrying passengers. Factor 5 accounted for 3.75% of variance, and is consistent with the BYNDS factor *driver mood*.

Exploratory factor analysis of the 44 BYNDS items was also completed separately for each gender. For males, a principal component extraction identified five factors according to the scree plot and 26 factors with an eigenvalue greater than one. The Kaiser-Meyer-Olkin measure of sampling adequacy was acceptable at .833; and the Bartlett's test of sphericity was significant at  $p < .001$ . Five factors were extracted which accounted for 50.08% of variance in the risky driving behaviour of the participating male young drivers. Factor 1 accounted for 22.90% of variance, and is consistent with the BYNDS factor *transient violations*. Interestingly the illegal U-turn item did not load highly on this factor, and the illegal U-turn item and the item “You spoke on a mobile that you held in your hands” loaded

on the fixed violations subscale. Factor 2 accounted for 12.99% of variance, and is consistent with the BYNDS factor *fixed violations*. “You drove a high powered vehicle” had a low loading on this factor, and a similarly low loading (negative) on the fourth factor, driver mood. Factor 3 accounted for 5.55% of variance, and is consistent with the BYNDS factor *misjudgement*. The item “You didn’t always indicate when you changed lanes” did not load on this factor, rather loading on the transient violations factor. Factor 4 accounted for 4.48% of variance, and is consistent with the BYNDS factor *driver mood*. Every item loaded with a negative value, suggesting that this scale can be understood to represent ‘driving whilst being unaffected by own mood’. Factor 5 accounted for 4.26% of variance, and is consistent with the BYNDS factor *risky exposure*.

For females, a principal component extraction identified five factors according to the scree plot and 26 factors with an eigenvalue greater than one. The Kaiser-Meyer-Olkin measure of sampling adequacy was acceptable at .857; and the Bartlett’s test of sphericity was significant at  $p < .001$ . Five factors were extracted which accounted for 50.48% of variance in the risky driving behaviour of the participating female young drivers. Conversely to males, for the female participants’ factor 1 accounted for 26.21% of variance, and is consistent with the BYNDS factor *risky exposure*. Factor 2 accounted for 8.79% of variance, and is consistent with the BYNDS factor *fixed violations*. Similar to males, You drove a high powered vehicle did not load on this factor, rather it had a low loading on the fourth factor, transient violations, which is inconsistent with the nature of this factor. Factor 3 accounted for 6.90% of variance, and is consistent with the BYNDS factor *misjudgement*. The item – “You didn’t always indicate when you changed lanes” – loaded with a very small value on this factor (.25), and also loaded on the fixed violations factor. Factor 4 accounted for 4.79% of variance, and is consistent with the BYNDS factor *transient violations*. The following items did not load on this factor: “You raced out of an intersection when the light went green” (two very low loadings on factor 2 and 5); “You sped up when the lights went yellow” (low loading on factor 1); “You did an illegal U-turn” (high loading on factor 2); and “You overtook a car on the left”, “You spoke on a mobile that you held in your hands”, “You went too fast around a corner” (low negative loadings on factor 5). Factor 5 accounted for 3.80% of variance, and is consistent with the BYNDS *driver mood*. Again consistent with the male EFA, every item loaded with a negative value. This suggests this scale can be understood to represent ‘driving whilst being unaffected by own mood’.

### ***Predicting self-reported crash involvement***

Logistic regression analyses were undertaken to determine if self-reported crash involvement could be predicted by any of the five BYNDS subscales. Given the considerable role of age and gender in young and novice driver crash risk, these two variables were entered in the first step (coded as categorical variables; younger/older, male/female). The five BYNDS subscales were entered in the second step. The final model explained 20.7% of variance in self-reported crash involvement (Nagelkerke  $R^2$ ), with age ( $p = .007$ ) and risky driving exposure ( $p < .001$ ) emerging as significant predictors such that being older and undertaking more risky driving exposure was predictive of self-reported crash involvement. Logistic regression analyses were undertaken separately for males (Nagelkerke  $R^2 = .236$ ), and females (Nagelkerke  $R^2 = .232$ ). For males, risky driving exposure ( $p = .027$ ) was predictive of self-reported crash involvement (with age and transient violations approaching significance,  $p = .062$  and  $.068$  respectively). For females, age ( $p = .043$ ) and risky driving exposure ( $p < .001$ ) were predictive of self-reported crash involvement.

### **General Discussion**



The BYNDS was developed using the responses of a licensed sample of young drivers in Queensland, Australia. As noted in the Introduction, it appears that a substantial proportion of youth in New Zealand may be engaging in unlicensed driving (and other high-risk driving activities such as unsupervised learner driving). Thus the representative sampling of Study 1 – capturing the input of eight (40% of the sample) unlicensed drivers – facilitated the culturally-appropriate refinement of the wording of the 44 items within the BYNDS for a particularly high-risk young driver population. The refined BYNDS was applied in a larger sample of young drivers, with sufficient sampling of males and females to allow gender-based analyses including exploratory factor analyses. The relatively robust factor structure of the internally-reliable BYNDS found in the quantitative research of Study 2, operationalising the refined phrasing as developed in the pilot research of Study 1, suggests that applications of self-report instruments such as the BYNDS in cultures and thus populations other than those in which they were developed requires such a multi-stage pilot and testing approach.

It appears that, unsurprisingly, that the different police enforcement behaviour in New Zealand has impacted upon the breadth of self-reported risky driving behaviours of the young and novice drivers sampled in Study 2. It is also noteworthy that young and novice drivers appear to be ‘disengaged’ from some of their risky driving behaviours: Study 1 participants advised that they adjusted their driving speed according to the speed travelled by drivers in close proximity, and that they were not aware of the actual speed they were travelling at, rather than selecting a driving speed according to the speed limit and maintaining this speed in their vehicle. As such, whilst targeted enforcement of risky behaviours including driving whilst intoxicated by drugs and/or alcohol is warranted, general enforcement of speed limits are likely to yield road safety for road users of all ages. In addition, it is recommended that interventions consider targeting when the young driver is making their journeys, with whom, and in what state (particularly fatigued driving).

Drivers were asked to disclose if they had ever crashed as a driver. It is reasonable to conclude that the accuracy of responses to this question would be greater than if participants were asked to constrain their responses to a crash in a pre-determined time range (e.g., the last three months). A further consideration is the use of self-report instruments in road safety research. Incidents of risky driving behaviour captured within police reports (e.g., offences and infringement statistics) require the breadth of risky driving behaviours to not only be detected, but also sanctioned, and it is unlikely this is the case. In addition, crash reports are unlikely to accurately and completely reflect the breadth of risky driving behaviours that contributed to reportable crashes. As such, the BYNDS provides a more complete, cost-effective, and socially acceptable and accessible option for identifying the breadth and nature of risky driving behaviours actually undertaken by the young drivers in New Zealand. Improvements in young driver road safety in New Zealand, which can be both captured and quantified by comparing pre-intervention baseline measures to post-intervention behaviours, can also be captured by the BYNDS self-report instrument.

## Conclusions

The overrepresentation of young drivers in road crashes is a pervasive problem not only in New Zealand, but around the world. Administrative data and road safety research in New Zealand suggest that young drivers place themselves at greater risk by not complying with GDLS restrictions, with a considerable proportion of young drivers engaging in unlicensed driving. To effectively intervene in this young driver problem, a multi-agency program of intervention has begun, with the piloting and application of the BYNDS in the New Zealand young driver context as the first step. The 5-factor structure of the BYNDS was supported,

with young drivers reporting considerable risky driving exposure, moderate performance of transient violations and mood-related driving, and fewer fixed violations and driving misjudgements. Risky driving exposure was predictive of self-reported crash involvement for both males and females, suggesting targeted intervention regarding when, and the circumstances under which, the young driver is on the road. The next step in the multi-agency project is to develop an intervention targeting young drivers and their high-risk driving behaviours, applying the intervention and measuring its efficacy by using the BYNDS scale.

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**Appendix 1: Original and reworded items – Behaviour of Young Novice Drivers (BYNDS) Scale**

Subscale	Original BYNDS item	Item used in Study 2
Transient violations	You drove over the speed limit in areas where it was unlikely there was a radar or speed camera	You drove over the speed limit in areas where it was unlikely there would <i>be a speed camera or a policeman with a speed radar</i>
	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)	You went 10-20km/hr over the speed limit (e.g., 62 km/hr in a 50 k zone, 112 km/hr in a 100 k zone)
	You deliberately sped when overtaking	You sped <i>on purpose</i> when overtaking
	You sped at night on roads that were not well lit	You sped at night on roads that were not well lit
	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)	You went up to 10 km/hr over the speed limit (e.g., 62 km/hr in a 50 k zone, 112 km/hr in a 100 k zone)
	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)	You went more than 20 km/hr over the speed limit (e.g., 72 km/hr in a 50 k zone, 102 km/hr in a 80 k zone)
	You raced out of an intersection when the light went green	You raced out of an intersection when the light went green
	You travelled in the right lane on multi-lane highways	You drove in the right <i>hand</i> lane <i>on the motorway, when not overtaking</i>
	You sped up when the lights went yellow	You sped up when the lights went <i>orange</i>
	You went too fast around a corner	You went too fast around a corner
	You did an illegal u-turn	You did an illegal u-turn
	You overtook a car on the left	You overtook a car on the left- <i>hand side</i>
	You spoke on a mobile that you held in your hands	<i>While driving</i> , you spoke on a mobile that you held in your hands
	While driving you sent or read a text message (new item)	
Fixed violations	Your passengers didn't wear seatbelts	Your passengers didn't wear seatbelts
	You drove after taking an illicit drug such as marijuana or ecstasy	You drove after taking an <i>illegal</i> drug such as marijuana or ecstasy
	You carried more passengers than could legally fit in your car	<i>You drove with too many passengers in your car (i.e. more passengers than you are legally allowed to carry)</i>
	You didn't always wear your seatbelt	You didn't always wear your seatbelt
	You drove without a valid licence because you hadn't applied for one yet or it had been suspended	You drove without a valid licence because you hadn't applied for one yet or it had been suspended
	You didn't wear a seatbelt if it was only for a short trip	You didn't wear a seatbelt if it was only for a short trip
	If there was no red light camera, you drove through intersections on a red light	<i>You drove through an intersection on a red light</i>
		You drove through an intersection on a red light when there were no Police around
You carried more passengers than there were seatbelts for	You carried more passengers than there were seatbelts for in your car	

	in your car	
	You drove when you thought you may have been over the legal alcohol limit	You drove when you thought you may have been over the legal alcohol limit
	You drove a high-powered vehicle	You drove a high-powered vehicle ( <i>such as those with a V8 engine, eg a Holden Commodore or Ford Falcon</i> )
Misjudgement	You misjudged the speed when you were exiting a main road	<i>You made a mistake with the speed you were travelling at when you were exiting a main road; you were going too fast or too slow for the situation</i>
	You misjudged the speed of an oncoming vehicle	<i>You got the wrong idea about the speed of a vehicle coming towards you. (i.e. you thought it was going slower or faster than it really was)</i>
	You misjudged the gap when you were turning right	<i>You got the wrong idea about the size of the gap between you and oncoming traffic, when you were turning right</i>
	You misjudged the stopping distance you needed	<i>You made a mistake with the distance you would need to stop</i>
	You turned right into the path of another vehicle	You turned right, into the path of an <i>oncoming</i> vehicle
	You misjudged the gap when you were overtaking another vehicle	<i>When overtaking another vehicle, you got the wrong idea about the size of the gap between you and the oncoming traffic</i>
	You missed your exit or turn	You missed your exit or turn
	You entered the road in front of another vehicle	You entered the road in front of another vehicle, <i>without leaving them much space</i>
	You didn't always indicate when you were changing lanes	You didn't always indicate when you were changing lanes
Risky exposure	You drove on the weekend	You drove on the weekend
	You drove in the rain	You drove in the rain
	You drove at peak times in the morning and afternoon	You drove at rush hour in the morning and afternoon
	You drove at night	You drove at night
	You drove at dusk or dawn	<i>You drove early in the morning before it was fully light, or in the evening when it was starting to get dark.</i>
	You carried your friends as passengers at night	You carried your friends as passengers at night
	You drove when you knew you were tired	You drove when you knew you were tired
	Your car was full of your friends as passengers	Your car was full of your friends as passengers
	You went for a drive with your mates giving directions to where they wanted to go	You drove with your mates giving <i>you</i> directions to where they wanted to go
Driver mood	Your driving was affected by negative emotions like anger or frustration	Your driving was affected by negative emotions like anger or frustration
	You allowed your driving style to be influenced by what mood you were in	You allowed the way you drive to be influenced by what mood you were in
	You drove faster if you were in a bad mood	You drove faster if you were in a bad mood

Non-peer review stream

Scott-Parker