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Utility of self-report and performance-based measures of risk for predicting driving behavior in young people

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ABSTRACT

Road-traffic injuries are the single biggest killer of young people worldwide. Our study sought to determine whether self-report and performance-based measures of risk could be administered online to predict driving risk in young people (aged 18–25, $n = 102$). We used a retrospective approach and compared self-reported driving behavior with outcomes on Eysenck's Impulsivity Inventory Impulsiveness subscale, Multidimensional Personality Questionnaire Harm Avoidance subscale, Iowa Gambling Task (IGT), and Balloon Analog Risk Task (BART). As hypothesized, higher levels of driving risk were associated with higher levels of impulsivity ($p < .001$), and lower levels of harm avoidance (indicating fearlessness; $p = .025$). These personality measures can be readily incorporated into an online tool for predicting driving risk. An unexpected finding was that the IGT and BART did not significantly predict driving risk ($p = .627$ and .379). This study contributes to the development of an online tool for predicting driving risk. In order to further develop this tool, future research should assess the utility of other performance-based measures in online driving assessment. Identifying cognitive and psychological characteristics that can predict driving behavior will help direct prevention efforts, such as added driver safety opportunities for youth at the highest crash risk.

1. Introduction

Road-traffic injuries are the single biggest killer of young people aged 18–25 worldwide ("Global status report on road safety," 2013), and are often attributable to risky driving in this age group ("Victoria's road safety action plan," 2013). Risky driving in youth is influenced by several key cognitive and psychological factors, including high levels of impulsivity (Constantinou, Panayiotou, Konstantinou, Loutsiou-Ladd, & Kapardis, 2011) and low levels of harm avoidance (Gulliver & Begg, 2007; Rhodes & Pivik, 2011). An *online* screening tool for predicting driving behavior could provide a convenient and cost-effective means (Riva, Teruzzi, & Anolli, 2003; Vallejo, Jordan, Diaz, Comeche, & Ortega, 2007; Yun, 2000) of detecting high-risk drivers and directing prevention efforts.

Self-report measures of risk-related personality traits have well-established associations with risky driving behaviors (Begg & Langley, 2004; Constantinou et al., 2011; Curran, Fuertes, Alfonso, & Hennessy, 2010; Gulliver & Begg, 2007). For example, higher scores on impulsivity and fearlessness self-report measures have been linked to increased levels of risky driving, including driving fast for thrills (Begg & Langley, 2004; Constantinou et al., 2011; Curran et al., 2010; Gulliver & Begg, 2007). Nonetheless, self-report methods have several limitations. For example, people may provide inaccurate reports due to the perceived negative consequences of reporting risky behaviors (Lejuez et al., 2002).

Performance-based measures, such as the Iowa Gambling Task (IGT) (Bechara, Damasio, Damasio, & Anderson, 1994) and Balloon Analog Risk Task (BART) (Lejuez et al., 2002), may be an important complement to self-report measures because they elicit actual risky behaviors and address the limitations of using only one method (Aklin, Lejuez, Zvolensky, Kahler, & Gwadz, 2005; Lejuez et al., 2002; Skeel, Neudecker, Pilarski, & Pytlak, 2007). These tasks assess situation-based characteristics of risk-taking not accounted for by self-report measures, including perceived risk, rewards, and punishments (Lejuez et al., 2002; Skeel et al., 2007). Risky performance on both the IGT and BART has been linked to risky driving behaviors (Lev, Hershkovitz, & Yechiam, 2008; Vaca et al., 2013). Because self-report and performance-based measures reveal different attributes related to risk, their combination could provide a more comprehensive assessment of driving risk.

Although many studies include both self-report and performance-based measures to assess *general* risk-taking (Aklin et al., 2005; Lejuez, Aklin, Zvolensky, & Pedulla, 2003; Pharo, Sim, Graham, Gross, & Hayne, 2011; Skeel et al., 2007), few studies have used this combination to specifically examine driving risk (Cheng, Ng, & Lee, 2012; Lev et al., 2008), and none have done so in young, novice drivers. Cheng et al. (2012) used insurance company records to compare motorcyclists with and without traffic offenses ($n = 59$ offenders, $n = 54$ non-

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offenders; mean age = 33.6) on both self-report and performance-based measures of risk-related constructs. Compared to non-offenders, offenders demonstrated riskier performance on the BART, but self-reported similar levels of impulsivity. Generalization of these findings to car drivers is not straightforward, however, because motorcyclists tend to drive more riskily (Nja & Nesvag, 2007). Lev et al. (2008) recruited 51 traffic offenders on site at a penalty course in Israel and 36 non-offenders through advertisements (mean age = 32.03), and compared them on self-report and performance-based measures of risk. Traffic offenders demonstrated riskier performance on the IGT (Lev et al., 2008). These studies demonstrate that self-report and performance-based measures can be combined to provide a more comprehensive driving risk assessment. How this approach may be useful in young drivers, however, has not been reported to date.

The aim of the present study was to determine whether self-report and performance-based measures of risk could be administered online to predict driving risk in young people. We used a retrospective approach and compared self-reported driving behavior with outcomes on Eysenck's Impulsivity Inventory Impulsiveness subscale, Multidimensional Personality Questionnaire Harm Avoidance subscale, IGT, and BART. We expected higher levels of driving risk would relate to more risky personality traits, including higher levels of impulsivity and lower levels of harm avoidance (indicating fearlessness). We also hypothesized that higher levels of driving risk would relate to more risky performance on the IGT and BART, as indicated by less advantageous deck selections (IGT) and more pumps on non-exploded balloons (BART).

2. Method

2.1. Participants

We recruited young adults aged between 18 and 25 using online advertisements, social media, and flyers posted at universities and other tertiary education facilities in Melbourne. Inclusion required residing in Victoria, fluency in English, having had their probationary license for at least 1 year or their full driver's license, and completion of the entire online assessment. This criteria were met by 105 participants, but three multivariate outliers were excluded (Tabachnick & Fidell, 2013). The resulting sample ($n = 102$) consisted of 35 males 67 and females, with a mean age of 21.38 ($SD = 1.65$; see Table 1 for further demographics). This study was approved by the institutional ethics committee.

Table 1
Sample demographics (n = 102).

Demographic variable	Number	Percent
Student status		
Studying	77	75.5
Not studying	25	24.5
Employment status		
Employed	75	73.5
Unemployed	27	26.5
Ethnicity		
Caucasian	86	84.3
Asian	11	10.8
Other	5	4.9
Driving experience		
1–2 years	29	28.4
2–3 years	24	23.5
3–4 years	16	15.7
Over 4 years	33	32.4
License status		
Probationary license	58	56.9
Full license	44	43.1

2.2. Measures

2.2.1. Driving risk measure

We constructed an 11-item questionnaire to quantify self-reported driving risk in young people, relevant to the Australian context. We adapted six items from the most relevant existing questionnaire, the Behavior of Young Novice Drivers Scale (BYNDS), also developed in Australia (Scott-Parker, Watson, King, & Hyde, 2012). The two key differences in our questionnaire compared to the BYNDS were: (1) we included five additional items to assess behaviors such as license suspension and sending/reading a text message/email while driving, and (2) we assigned "high-risk behaviors" six points and "less-risky behaviors" two points (see Table 2), whereas the BYNDS assigns one point to each "risky" response. Compared to less-risky behaviors, we defined high-risk behaviors as those with greater foreseeable danger, greater frequency, and a more deliberate disregard for Victorian road rules. For example, we classified "speeding more than 20 km above the limit" as "less-risky" because it is likely that this behavior is often committed accidentally due to time-of-day-dependent speed limits around Victorian school zones. To obtain a final risk score, we summed the values for all items, with a higher score indicating more risky driving behavior. Our measure has good internal consistency, with a Cronbach's alpha of .70. This measure allowed us to account for the differing severity of behaviors, and assess driving risk in terms of the culture-specific norms and road rules relevant to this sample.

2.2.2. Self-report measures

Eysenck's Impulsivity Inventory 19-item Impulsiveness subscale was used to assess participants' levels of impulsivity (Eysenck, Pearson, Easting, & Allsopp, 1985). Participants were asked to respond "Yes"/"No" to questions such as, "Do you often buy things on impulse?" Higher scores indicate greater levels of impulsivity. We found this subscale to have high internal consistency, with a Cronbach's alpha of .75. The Impulsiveness subscale has good convergent validity with both the Motor Impulsivity subscale of the Barratt Impulsivity Scale-10 and Dickman's Dysfunctional Impulsivity scale (Caci, Nadalet, Baylé, Robert, & Boyer, 2003).

To assess levels of harm avoidance, we used the Multidimensional Personality Questionnaire 28-item Harm Avoidance subscale (MPQ—Harm Avoidance) (Tellegen & Waller, 1982). Participants were presented with a series of statements relating to personal characteristics. Each item had a "safe" and "unsafe" answer, with one point awarded for each safe choice. Points were summed to yield a total score, with high scores indicating characteristics of harm avoidance and low scores indicating fearlessness. We found this subscale to have high internal consistency ($r = .83$). The MPQ—Harm Avoidance has good convergent validity with the PRF Harm Avoidance scale (Tellegen & Waller, 1982).

2.2.3. Performance-based measures

The Iowa Gambling Task (IGT) (Bechara et al., 1994) is a simulated gambling task designed to measure decisions made under risk and uncertainty. Participants started with $2000 "play" money and were required to make 150 selections from card decks labeled A, B, C, and D. Decks A and B delivered a gain of $100 per trial, but also yielded frequent large losses, resulting in overall net loss. Decks C and D delivered smaller gains of $50 per trial, but also yielded smaller losses, resulting in overall net gain. Participants were told to maximize profits, but they were not told which decks were better or why (Bechara, Damasio, Damasio, & Lee, 1999). Participants were required to learn from experience in terms of expected losses. Our software recorded choices from decks A and B as "disadvantageous", and choices from C and D as "advantageous". For analysis purposes, choices were grouped into six blocks of 25 selections. The variable we analyzed was the number of advantageous deck selections for each block, with fewer selections indicating more risky behavior. The IGT has demonstrated reliability and