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The sex disparity in risky driving: A survey of Colombian young drivers

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Abstract

Objective: The overrepresentation of young drivers in poor road safety outcomes has long been recognised as a global road safety issue. In addition, the overrepresentation of males in crash statistics has also been recognised as a pervasive young driver problem. Whilst progress in road safety evidenced as a stabilisation and/or reduction in poor road safety outcomes has been made in developed nations, less-developed nations contribute the greatest road safety trauma, and developing nations such as Colombia continue to experience increasing trends in fatality rates. The aim of the research was to explore sex differences in self-reported risky driving behaviours of young drivers, including the associations with crash-involvement, in a sample of young drivers attending university in Colombia.
**Methods:** The Spanish version of the Behaviour of Young Novice Drivers Scale (BYNDS-Sp) was applied to a sample of 392 students (225 males) aged 16-24 years attending a major university in an online survey. Appropriate comparative statistics and logistic regression modelling were used when analysing the data.

**Results:** Males reported consistently more risky driving behaviours, with approximately one-quarter of all participants reporting risky driving exposure. Males reported greater crash-involvement, with violations such as speeding associated with crash-involvement for both males and females.

**Conclusion:** Young drivers in Colombia appear to engage in the same risky driving behaviours as young drivers in developed nations. In addition, young male drivers in Colombia reported greater engagement in risky driving behaviour than young female drivers; a finding again consistent with the behaviours of young male drivers in developed nations. As such, the research findings suggest that general interventions such as education, engineering, and enforcement should target transient rule violations such as speeding and using a handheld mobile phone while driving for young drivers in Colombia. Future research should investigate how these interventions could be tailored specifically for the Colombian cultural context, including how their effects can be evaluated, prior to implementation.

**Keywords**

Sex differences; young drivers; risk taking; BYNDS; crashes; risk exposure
INTRODUCTION

Road trauma is a major public health concern with epidemic occurrence of fatalities and injuries arising from road crashes. The World Health Organization (WHO) (2015) estimates that every year, 1.24 million people die worldwide from road trauma. Additionally, on a daily basis, at least 140,000 people are injured on the world’s roads, and 15,000 of these are disabled for life (Sharma 2008). The incidence of road trauma clearly differs based on each country’s level of economic development. The road crash burden is disproportionately high in low- and middle-income countries which register 91% of all fatalities (World Health Organization 2013). Within Latin America specifically, more than 130,000 fatalities and 6 million serious injuries result from road crashes every year (Bezerra et al 2015). Despite a plethora of education, engineering, and enforcement-based interventions, it is projected globally that deaths attributable to road trauma in 2030 will be 2.4 million fatalities (World Health Organization 2013).

While the prioritisation of vulnerable road user groups such as young drivers is vital for their reduction in the road crash burden more generally, it is noteworthy that a breadth of social and financial resource limitations particularly in developing nations impacts upon the nature - and thus the efficacy - of education, engineering, and enforcement-based interventions. Although road safety is a complex problem involving consideration of infrastructure, engineering, economic, social and political elements which frequently balance competing demands of mobility and safety (Canoquena & King 2015, Scott-Parker et al 2015a), the overrepresentation of young drivers in road crashes is both consistent and persistent worldwide (Chen et al 2012). Road trauma is the leading cause of death among young people aged 15–29 years (World Health Organization 2015), with 7,550 young passenger vehicle drivers aged 16 to 24 years old fatally injured in the U.S. in 2013 alone, and 75% of teen passenger deaths arising from crashes in which they were driven by another young driver (Insurance Institute for Highway Safety (IIHS) 2013). The increased crash risk experienced by all young drivers is attributed more generally to age-related factors (e.g., neurobiological immaturity, see (Steinberg 2005)), and the influence of psychosocial factors (Miller & Taubman - Ben-Ari 2010, Scott-Parker et al 2009), which can increase risk-taking behaviours and driving inexperience-related factors (e.g., underdeveloped hazard perception and reaction skills, see (Summala 1987)). Despite a plethora of interventions,
there has been no consistent progress in this issue around the world and the need for urgent action has been emphasised (Jones et al 2015). Moreover, the majority of peer-reviewed young driver-focused research has been undertaken within ‘WEIRD’ (western, educated, industrialised, rich, and democratic) countries (Scott-Parker & Senserrick 2013, Scott-Parker & Senserrick 2016). Given the heterogeneity of road traffic systems worldwide, it is essential that cultural differences are considered in order to maximize any intervention benefits.

In Latin America, and more specifically Colombia, little attention has been paid to risky sub-groups of drivers, such as young drivers. Although at the time of this research project, no studies have been conducted specifically exploring young drivers’ risky behaviours in Colombia, it is well known in Colombia that traffic laws are rarely enforced or followed, contributing to risky driver habits (Jeon et al 2006, Norza-Céspedes et al 2014). In Colombia in 2012 the most common causes of fatal crashes among drivers of all ages, as documented within police reports (in descending order) were speeding (25%), drink-driving (13%), lane excursion (12%), road rule violations (6%), and unsafe following distances (5%) (Norza-Céspedes et al 2014). While these statistics are for drivers of all ages, it is reasonable to conclude that young drivers may also engage in these behaviours. This supposition is supported by numerous studies that have linked these behaviours with increased crash risk in young drivers around the world, not only in developed countries such as Australia (Harbeck & Glendon 2013, Scott-Parker et al 2012b) and the United States (Simons-Morton et al 2005, Simons-Morton et al 2015) but also in middle-income countries such as Guatemala (Rodríguez-Guzmán et al 2014), and Romania (Gheorghiu & Felonneau 2013). Most importantly, as noted previously, the lack of research regarding young driver behaviours in developing countries such as Colombia prevents researchers and practitioners from designing and implementing culturally-appropriate countermeasures.

Likewise, sex differences in young drivers’ risky behaviour in Colombia are also seldom reported in the scientific literature. Other jurisdictions have confirmed sex differences in driving practices related directly to safety, such as greater proportions of young female drivers using seat belts and driving with valid licences; and greater proportions of young male drivers using alcohol, driving in the presence of peer passengers, violent behaviour while driving, and driving whilst fatigued (Hennessy & Wiesenthal 2001, McKnight & McKnight 2003, Tsai et al 2008). In
Latin America, males present consistently higher death rates due to traffic injuries than females in every age group, including as young drivers (Diez-Roux & Bahlla 2012). Likewise, studies in Colombia have confirmed that young male drivers are overrepresented in drink-driving (Bonilla-Escobar et al 2015, Posada et al 2000). It can be seen from Figure 1, which illustrates the total and sex-distribution of all driver deaths aged 14 to 26 years from 2004 to 2012 in Colombia, that the proportion of males remains consistently around 93% throughout this period. These findings further support the supposition that sex-related factors play an important role in the road trauma of young drivers. While greater driving exposure, as indicated by duration and/or frequency of driving, is likely to explain partially these sex differences, there is strong evidence suggesting that the sex gap in risky driving, including poor driving outcomes such as crashes, is narrowing worldwide (Sivak 2013). However, there remains a dearth of information regarding risky driving behaviour differences according to sex, which may contribute to the findings depicted in Figure 1, in Colombia.

Study Aim

The aim of the research was to explore sex differences in self-reported risky driving behaviours of young drivers, including the associations with crash-involvement, in a sample of young drivers attending university in Colombia.

METHOD

Participants

Three hundred and ninety-two participants accessed the anonymous questionnaire. The age of participants was: \( n = 39 \) aged 16-18 years, 12 males; \( n = 348 \) aged 19-24 years, 211 males; \( M = 21.09, SD = 2.10, \) median = 21 years. The age of males and females did differ significantly (t-test, \( p < .05 \)). The mean age for females was \( M = 20.8, SD = 2.2 \) years and for males was \( M = 21.4, SD = 2.0 \) years. Overall the period the driver’s licence had been held was \( M = 3.5, SD = 2.2 \) years, with a range of less than 1 year to 9.5 years. The duration licensed differed significantly according to sex (t(384)= 5.7, \( p < .05 \)). The mean time with licence for females was \( M = 2.8, SD = 1.9 \) years and for males was \( M = 4.1, SD = 2.2 \) years. Participants reported driving \( M = 95.8, \)
\[ SD = 98.4 \text{ kilometres per week. No significant differences were found by gender in the self-reported kilometres driven per week (} t(350.1)= 1.79, p > .05). \]

Note that the small proportion of young drivers aged 16-18 years is not unexpected since this age-group of drivers in Colombia is small. Inclusion criteria were (a) native Spanish speaking and (b) have driven a motor vehicle in the past month. Similar to other low- and middle-income countries, vehicle ownership is low in Colombia and vehicles are accessible typically only to persons from middle- (usually limited to one vehicle per family) and high-income families (Roque & Masoumi 2016), suggesting that young drivers are a particularly privileged group. For this reason, participants were recruited in universities and other higher education centres which were more likely to have students from middle- and high-income families (Melguizo et al 2016), thus the participants were more likely to represent the typical Colombian young driver.

**Materials**

The Spanish version (BYNDS-Sp) of the Behaviour of Young Novice Drivers Scale (BYNDS) (Scott-Parker et al 2012b) was operationalised in this study. The Spanish version was obtained and adapted to the Colombian transport system using a back-translation methodology. Six road safety practitioners, transport engineers and survey design experts participated in the process (additional information regarding the psychometric properties of the scale are reported in Oviedo-Trespalacios and Scott-Parker (Under review). The BYNDS was developed specifically to investigate the risky behaviour of young and inexperienced drivers, and the instrument was developed in the Queensland, Australia, driving context. The BYNDS explores transient and fixed driving violations, risky driving exposure, driving misjudgements, and driving whilst influenced by mood (1 = never, 5 = almost always) (see Appendix Table A1 for example items). In order to include particularities of the Colombia’s road transport system, items MS3, MS5, TR8 and TR12 were modified from ‘right’ to ‘left’. For example, “You travelled using the right lane” was changed to “You travelled using the left lane”. One self-reported question assessed if they have been involved in a crash as a driver (0 = no, 1 = yes); if yes, they were asked the
number of times. Participants also responded to items asking if they had their own vehicle and/or have access to a vehicle (no, yes); how many journeys they made per week (free response) and the approximate number of kilometres and duration of time spent driving on the road each week (free response).

Procedure

We implemented a cross-sectional internet-based survey in the Colombian-Caribbean Region. The advertisement provided a brief description of the study and a hyperlink to an online informed consent form. The Google Forms survey was disseminated using electronic mail through university mailing lists from two universities, and required 25-35 minutes to complete. The emails were sent from the student’s affairs offices. Ethics approval was obtained from the Universidad del Norte’s Human Research Ethics Committee (123-3-MAR-2015) and the University of the Sunshine Coast Human Research Ethics Committee (E/15/027).

Statistical analysis

The analysis of self-reported driving behaviours was conducted according to sex. BYNDS-Sp responses were grouped into three categories: "Never", "Occasionally or sometimes", and "Usually or almost always", with the frequencies and percentages recorded. Next, the original values were averaged per item and the effect sizes of sex differences calculated per item. To study sex differences in the BYNDS’s items, T-test with Bonferroni correction ($p < 0.001$) was selected over its non-parametric counterpart following the arguments of Norman (2010) (with correction for unequal variances where needed). In scale level analysis, internal consistency Cronbach’s alpha ($\alpha$) was used to investigate the reliability of the BYNDS-Sp subscales and composite scale. Similarly, descriptive statistics—including mean, standard deviation, minimum, and maximum — were calculated for each subscale for the total and by sex. To examine the associations between BYNDS-Sp subscale scores and self-reported crashes, two stepwise binary logistic regression models were tested using these outcomes as the dependent variable: “none” (0) and “at least one” (1); and the average score for each subscale (subscale items summed and divided by the number of items in the subscale) as the independent variables: transient rule
violation, fixed rule violations, misjudgements, risky driving exposure, driver mood, and risky driving behaviour (composite BYNDS-Sp). We performed stratified analyses, with separate models for males and females, that were found to give the best fit to the data using penalized log likelihood criteria (see Guo and Trivedi (2002)). To investigate potential bias in maximum likelihood estimation caused by low self-reported crash occurrences, models were re-fitted and compared using Firth’s penalised likelihood procedure (Firth 1993, Heinze et al 2013). Analyses were undertaken in Statistical Package for the Social Sciences (SPSS) version 22 and STATA 13.1.

RESULTS

Self-reported driving behaviours, by sex

The participants’ responses to the individual BYNDS-Sp items were examined. Appendix Table A2 summarises the participants’ self-reported driving behaviours, by sex and by individual BYNDS-Sp item. As can be seen, for both male and female participants, one quarter or more of the participants reported usually or almost always engaging in risky driving exposure, including driving in the rain, on weekends, at night, during peak hour, dawn or dusk, and carrying friends as passengers at night, and with friends who were carried as passengers telling the young driver where to go. For male participants only, one quarter or more reported usually or almost always speeding, including speeding in areas in which they were unlikely to be detected, when overtaking, speeding up to 10km/hr above the posted limit, and racing out of intersections on green lights.

T-tests were undertaken to identify any significant differences between the individual self-reported driving behaviours of male and female participants. Appendix Table A2 also summarises the descriptive statistics (mean, standard deviation) for each item, by sex. As can be seen, in all instances male participants self-reported engaging in more of the risky driving behaviours captured within the BYNDS-Sp. However, just a handful of items achieved a statistically significant difference after Bonferroni correction for multiple tests: Transient rule
violations (TR1, TR2, TR3, TR5, TR6, TR7, TR8, and TR9), Fixed rule violations (FI6, FI8, FI9, and FI10), Misjudgements (MS1), and Risky driving exposure (EX1, EX4, and EX5).

**BYNDS-Sp subscales and composite scores, by sex**

The descriptive statistics of the subscales and composite BYNDS-Sp were calculated for the whole participant sample, and separately by sex. As can be seen in Table 1, the subscales exhibited satisfactory internal consistency in all instances (Cronbach’s alpha ranging from 0.84 to 0.95). Similarly, the composite scale had a very high internal consistency (Cronbach’s alpha = 0.95). Also, shown in Table 1 are the average total scores and standard deviations, number of items, and the range for the subscales and composite by sex. Additionally, a t-test for independent samples of males and females was conducted for the five subscales and the composite scale, with males exhibiting consistently higher scores on all subscales and the composite scale. Males, compared with females, reported significantly greater engagement in risky driving as measured by the transient rule violations subscale and the BYNDS-Sp composite scale.

**Self-reported crash involvement, by sex**

A total of 216 crashes were reported (57% by males) by the participants. In the total sample by sex, approximately 38% (n = 85) of males were involved in road traffic crashes in contrast to 28% (n = 47) of females. No statistically differences by sex were found in the proportion of drivers who self-reported at least one crash (Fisher's exact test, p = 0.052). Male participants also reported being involved in more total road crashes (total crashes = 142, range 1 to 5, \( M = 1.71 \), mode = 1.0, median = 1.0) than female participants (total crashes = 74, range 1 to 5, \( M = 1.61 \), mode = 1.0, median = 1.0). Poisson regression was used (over dispersion was not an issue for the data) but no statistical differences were found in the number of crashes reported by males and females.

Given that differences in terms of age and duration licensed were found between males and females, additional multivariable regressions were conducted focusing only on the influence
of demographic characteristics (sex, age, and duration licensed, and their interactions) in risky behaviour. The results revealed that being male ($\beta = 8.76; p = 0.002$) and a longer duration of licensure ($\beta = 2.030; p = 0.001$) were associated with greater self-reported risky behaviour in young drivers ($p < 0.001$).

**BYNDS-Sp associations with self-reported crash involvement, by sex**

Separate logistic regression models for males and females were used to explore associations between self-reported crash involvement (as the dependent variable) and the five subscales: transient rule violations, fixed rule violations, misjudgements, risky driving exposure, and driver mood (as independent variables). For their theoretical importance, age, time with driving licence, and kilometres driven per week were included. A forward stepwise logistic regression analysis using maximum likelihood estimation method was operationalised, and the coefficients of the independent variables and the constant were evaluated using the Wald test. The goodness of fit of the regression models was verified using the method proposed by Agresti (2013), which considers comparisons of groups of observed and fitted values though $X^2$ and $G^2$ statistics. Neither males nor females models showed lack of fit with ($p > 0.1$). This method has been suggested due to the presence of continuous or nearly continuous predictors that do not have approximate chi-squared distributions. The significance values are also shown in Table 2. The percentage of the cases correctly classified by the model was 62.2% for males and 72.4% for females.

The regression model that resulted from the stepwise selection, and the odds ratio estimates for self-reported crashes, are shown in Table 2. The results revealed that for male participants ($n = 223$), self-reported crashes were associated with transient rule violations and time with licence, whilst for female participants ($n = 164$), self-reported crashes were associated with transient rule violations.

Male drivers who self-reported on average recurrent involvement in transient rule violations had higher odds of being involved in a collision. When the transient rule violation increased by one unit, with time driving with licence remaining constant, the odds of self-reporting a crash are approximately 48% higher (OR = 1.48, 95% CI = 1.01–2.17). The time
driving with licence increased the odds of self-reporting a collision. Specifically, for every additional year of having a valid licence, young male drivers had 1.23 times the odds of reporting a collision (OR = 1.23, 95% CI = 1.07–1.39). Similarly, female drivers who self-reported on average recurrent involvement in transient rule violations had higher odds of being involved in a collision. Results suggest that for every extra unit in the transient violations score, the odds of self-reporting a collision increased by 75% (OR = 1.75, 95% CI = 1.08–2.85).

Associated probabilities of self-reported crashes were calculated for males and females. The results summarised in Figure 2 shows that at any level of transient rule violations, if time driving with licence is not considered, males are more likely to report a crash compared to females. The impact of years driving with a licence influences the probability of reporting crashes in young male drivers. As observed in Figure 3, it is clear that the greater exposure afforded by having a valid driving licence increases the probability of reporting a crash at any frequency of self-reported transient rule violations. Based on the logistic regression, associated probabilities of self-reported crashes were calculated in the lower, median and upper quartile (see Table 3). Poisson regression was used (over dispersion was not an issue) to study the impact of BYNDS-Sp’s subscales upon the number of crashes self-reported by the young driver participants. However, no significant associations were identified.

**DISCUSSION**

The current study investigated sex differences in risky driving behaviours in young drivers in the Colombian Caribbean Region. Risky driving behaviours were collected using the Spanish version of the BYNDS (BYNDS-Sp). While in general, young drivers in this Colombian sample reported high levels of involvement in risky driving behaviour, young male drivers consistently reported greater engagement in risky driving behaviours, and transient rule violations including speeding in particular. In the current study, 65% of participants mentioned speeding 10–20 km/h over the speed limit at least occasionally and 62% of participants stated they drive more than 20 km/h over the speed limit at least occasionally. As will be discussed below, the great engagement in speeding is likely a product of factors related to enforcement and social influences. In addition, it is important to keep in mind that the level of sophistication of roads in Colombia is not comparable to developed countries, and the interaction of speeding and under-developed and
inadequate infrastructure contributes to more severe consequences (Huicho et al. 2012). Young male drivers consistently reported a higher frequency of speeding (68%-84%) compared to females (55%-59%). Although the differences in speeding between males and females are significant in this sample, the high prevalence of this behaviour is of considerable importance because of its link with greater injury severity (Abu-Zidan & Eid 2015) and must be part of road safety initiatives for both groups.

The significantly greater engagement by males in self-reported risky behaviour is consistent with police records in Colombia showing that males comprised nearly 80% of detected traffic offenders (Norza-Céspedes et al. 2014). The overrepresentation of males in both archival records and our self-reported findings suggests that countermeasures should target more precisely the riskier (male) group. While the idea of implementing sex based interventions is intuitively sound, efficient in reaching the most vulnerable group, and appears to be based in evidence (e.g., Scott-Parker et al. 2015b in addition to our findings), few sex-based campaigns have been developed in the realm of road safety generally, and in young driver road safety specifically. One young driver road safety-specific example in the Australian context is the ‘Pinkie’ advertising campaign in the Australian state of New South Wales. This campaign targeted speeding young male drivers through asserting the link between this risky behaviour and small genitalia (Watsford 2008). Pinkie was a highly popular campaign, and it appears that sex-based interventions merit further consideration particularly as recent Australian research by Kaye et al. (2015) found considerable differences in the perception of road safety messages between young male and female drivers. These differences in perception in turn compromise the effectiveness of road initiatives.

Approximately half of the participants in the Colombian sample reported at least occasionally committing driving misjudgements (46%-64%). Drivers address driving task demands using their capability, which is a function of competence and personal human factors (Fuller et al. 2008). This is particularly manifest in young drivers who may lack a fully developed set of control or manoeuvring skills (Summala 1987). In the current study, we found a similar proportion of misjudgements in young male and female drivers, including misjudging stopping distances, gaps when turning across traffic, and the speed of oncoming vehicles. These results
are perhaps not unexpected since all young drivers in Colombia progress through the same licensing (and therefore, training) program. Furthermore, serious concerns regarding irregularities in the implementation and lack of governmental control in this process have been raised (Martínez Beltran 2013).

There were also statistically significant differences in the self-reported engagement in drink driving amongst young female and male drivers. In Colombia, in 2012, a total of 496 deaths were attributed to drink driving (Norza-Céspedes et al 2014), despite Colombia having strict drink-driving laws that specify three levels of offence and sanctions. In the current study one third of participants reported driving over the legal alcohol limit. These rates of drink driving are well in excess of findings in Australia (14% of young drivers aged 18-20 years in South-east Queensland, see Scott-Parker et al (2014b)) and New Zealand (23% of young drivers aged 16-25 years, see Scott-Parker and Oviedo-Trespalacios (2017)), both jurisdictions in which alcohol limits are strictly enforced. Previous research in Colombia has stated the need for strong leadership and coordination to address the drink-driving problem (Castano 2012), and our results confirm the relevance of this road safety problem.

The findings in this study supported other research that has found that young male drivers engage more frequently in risky driving behaviours compared to young female drivers. A caution must be given regarding this finding in the Colombian context, however, noting the considerable differences in the sex of our participants according to their age. To date, little research has attempted to understand the behaviours or the characteristics of young drivers in Colombia, and future research regarding the personal characteristics of Colombian drivers (noting that a substantially larger proportion of our younger participants were female, while a substantially larger proportion of our older participants were male) merits consideration. Furthermore, country-specific characteristics such as military service could influence the age to start driving. Specifically, military service of at least one year duration is compulsory (if not enrolled in formal education immediately after high-school) for young males aged 18 years, while it is not compulsory for young females. Future research could further delineate any influence of military service by exploring the young driver’s military experience and their driving behaviour.
Regarding self-reported crashes, no significant differences in self-reported rates of crash involvement between young male and female drivers were detected. While not able to be compared to other young driver-focused studies in Colombia due to a dearth of information regarding Colombian young drivers, this result is consistent with previous general population studies in Colombia (O’Bryant 2008). Perhaps, given that males and females showed similar risk of being involved in a crash, the considerable extent and variety of sex differences found in a breadth of self-reported risky driving behaviours may explain the increased chance of incurring a fatal injury for males, as noted in Figure 1. Further research is needed to confirm this association. The current study also explored the BYNDS-SP’ subscales’ associations with self-reported crashes by sex. Transient rule violations were associated with self-reported crashes by young male and female drivers. This is not surprising given that the principal cause of road crashes in Colombia is due to speeding (a risky behaviour captured within the transient violations subscale) (Norza-Céspedes et al 2014). However, the association between duration of licensure and crashes is seen only in males. A potential explanation is that there were more males who had a licence for a longer period and therefore there may have been more power to detect an effect. In theory, this finding has considerable practical implications; particularly when significant sex differences were found in respect to the duration of licence in the current sample, suggesting that multifaceted intervention is required. Specifically, future research should explore the relationship between duration of licensure and the nature and prevalence of risky driving behaviours in Colombia and in other jurisdictions, with previous research suggesting that young drivers become more risky in their driving behaviour over time due to factors such a fewer parental restrictions (see Scott-Parker et al (2012a) and McCartt et al (2003)).

More generally, the findings regarding the considerable engagement by a notable proportion of Colombian young driver participants in risky driving behaviours, ranging from speeding to not wearing seatbelts, can be explained to some extent by two main theoretical perspectives used to investigate factors influencing risky behaviour of young drivers: Deterrence theory and Akers’ social learning theory. Firstly, according to deterrence theory, the individuals' decision to commit offences is based on utilitarian calculations of the benefits of performing the crime (utility) and punishments or sanctions for the crime (disutility), which can be transitioned
to enforcement from a road safety perspective (Watson & Freeman 2007). As assessed by the WHO (2013), using a scale of 0 (none) to 10 (good), the enforcement of road use legislation in Australia \((M = 7.4; \ SD = 0.9)\) and New Zealand \((M = 8.2; \ SD = 0.8)\) is rated more highly than such enforcement in Colombia \((M = 3.8; \ SD = 1.9)\). Moreover, it has been observed in Colombia that police officers in official vehicles do not follow road rules, a study of driving behaviour and road safety in Colombia finding that the general perception in the country is that transit police officers are corrupt and rarely enforce road regulations (IPSOS Napoleon Franco 2012). The influence of such differential police enforcement upon the risky driving behaviour of males and females in Colombia remains unknown at this time.

Secondly, the highly validated Akers’ social learning theory asserts that behaviour is learned via imitation and then influenced by differential enforcement, with the attitudes and behaviours of the individual influenced by the attitudes and behaviours of those with whom the individual interacts (Akers et al 1979). Applied to road safety, social and non-social sources of reward, attitudes and behaviours are likely to increase the frequency of risky driving behaviours (Fleiter et al 2010, Scott-Parker et al 2012c). Such mechanisms influencing road user behaviour arguably play an important role in Colombia, a country in which one of every two drivers reports committing traffic infractions, and two out of every three drivers disagrees with the traffic rules (IPSOS Napoleon Franco 2012). Furthermore, 56% of Colombians believe they are extremely unlikely to be involved in a road crash during the next year (Corporación Fondo de Prevención Vial 2012). Similarly, ineffective legislation and low and haphazard enforcement translate to pragmatic driving practices and greater exposure to risk factors. Anecdotally, Colombian drivers generally do not indicate or yield to oncoming traffic, with drivers tending to edge out into traffic and change lanes constantly. While the differential influence of such variables upon the driving behaviour of young males and young females in Colombia remains unknown, it seems reasonable to conclude that the road safety problem – and the young driver road safety problem specifically – in Colombia has both bureaucratic and psychosocial elements that require further exploration for the development of countermeasures.

**Limitations and recommendations**
Several important limitations need to be considered. Firstly, self-report data are frequently subject to potential influence of social desirability or distorted memories. However, recent research suggests that self-report data is consistent with actual police records in Australia (Ivers et al. 2009) and objective driving observations (Zhao et al. 2012). Participants completed the questionnaires anonymously and had nothing to gain by giving biased responses. Moreover, the consistency of the findings with the findings reported in the handful of published Colombian studies gives us confidence regarding the data validity. Notwithstanding these assertions, further research in this area is needed including observational and/or experimental studies. Secondly, the analyses regarding risky behaviour was focused upon measures in the BYNDS-Sp. There are a multitude of other factors that could exert a significant effect upon risk taking behaviour and were not included in the questionnaire, including vehicle characteristics of the drivers (Horswill & Coster 2002), the purpose of the trip (Chliaoutakis et al. 1999, Scott-Parker et al. 2015b), and driver characteristics (such as sensation seeking propensity (Prato et al. 2010) and capacity for self-regulation (Oviedo-Trespalacios et al. 2017a, Oviedo-Trespalacios et al. 2017b)). Nevertheless, further studies must be conducted to validate self-reported crashes with objective records (af Wåhlberg et al. 2011). Thirdly, the present study was undertaken to test the specific hypothesis that the BYNDS-Sp is associated with self-reported crashes. Longitudinal studies are necessary to study causation and risk. Fourthly, the driving context in Colombia lacks extensive scholarly research and documentation which make it difficult to generalise the findings beyond the participant population. Fifthly, the relatively small sample size and characteristics of the participants (all of whom attended a university) further prevent us from generalising the findings to all Colombian young drivers. However, most of these students are likely from middle and high income families, allowing access to a vehicle and therefore access to driving, a phenomenon which is relatively uncommon in low income Colombian families. Additionally, we could distinguish sex differences which differ by a practically-small extent, such as in driving exposure, suggesting that interventions should more generally target these risky driving behaviours, rather than simply the risky driving behaviour of males in these circumstances. Sixthly, to discuss our data, we used Akers’ social learning theory and deterrence theory but other theoretical models should be considered as well. Finally, the contribution of risk factors to
all crashes (including fatal crashes) remains unknown as only information regarding involvement in non-fatal cases is reported. In addition, while best practice learner driver training tools such as the GDE framework (Hatakka et al. 2002) have been proffered, much remains unknown about the capacity to increase skills and therefore reduce risks through learner driver training more generally. Interventions such as graduated driving licensing (GDL) reduce risk for new drivers primarily through managing their exposure to risk (e.g., longer training periods, driving restrictions during the earliest period of independent licensure) (Scott-Parker et al. 2014a). The understanding of injury causation in the Colombian context could be enhanced by examining the impact of GDE-framed training within a GDL program, with young driver behaviour, including driving misjudgements, as an indicator of the impact of such training.

**Practical implications**

To the authors’ knowledge, this is the first investigation of the self-reported risky behaviours of young drivers in Colombia. The current research is long overdue, given that we are more than halfway through the Decade of Action for Road Safety, and that developing nations continue to carry the greatest road safety death and injury burden worldwide. The findings regarding the self-reported risky behaviour of young drivers in the developing nation of Colombia echo the findings regarding the self-reported risky behaviour of young drivers in developed nations. That is, Colombian young drivers engage in a breadth of risky driving behaviours some of which were found to be associated with greater on-road crash risk. Transient rule violations such as speeding by young drivers were associated with involvement in self-reported crashes. Therefore, it appears that young drivers around the world are relatively similar in their road safety risks, suggesting that effective interventions which have been implemented in developed nations (such as traffic law enforcement) are likely to be effective in the Colombian context. Notwithstanding this assertion, however, cultural considerations unique to nations such as Colombia and which may impact upon the implementation and evaluation of such interventions should be considered and addressed, prior to implementation. In addition, the findings regarding the self-reported risky behaviours of young male drivers in comparison to young female drivers in Colombia similarly
is consistent with findings from developed nations. That is, there was an increased propensity for males to take risks and to drive in a riskier manner, compared to females. As such, it appears that sex-based interventions merit further consideration given the robust nature of these phenomena in both developed and developing nations.
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Table 1. BYNDS-Sp scale and subscale reliability, and mean (SD), minimum and maximum, by sex.\(^a\)

<table>
<thead>
<tr>
<th>Factors</th>
<th>Alpha Cronbach</th>
<th>No. of items</th>
<th>Total</th>
<th>Males</th>
<th>Females</th>
<th>T-test (significance)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>(\Sigma)</td>
<td>(SD)</td>
<td>Min.</td>
<td>Max.</td>
</tr>
<tr>
<td>Transient rule violation</td>
<td>0.89</td>
<td>13</td>
<td>29.03</td>
<td>9.79</td>
<td>13</td>
<td>65</td>
</tr>
<tr>
<td>Fixed rule violations</td>
<td>0.85</td>
<td>10</td>
<td>17.82</td>
<td>6.85</td>
<td>10</td>
<td>44</td>
</tr>
<tr>
<td>Misjudgements</td>
<td>0.88</td>
<td>9</td>
<td>16.51</td>
<td>6.10</td>
<td>9</td>
<td>41</td>
</tr>
<tr>
<td>Risky driving exposure</td>
<td>0.88</td>
<td>9</td>
<td>26.59</td>
<td>7.75</td>
<td>9</td>
<td>43</td>
</tr>
<tr>
<td>Driver mood</td>
<td>0.84</td>
<td>3</td>
<td>6.60</td>
<td>2.95</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>Risky driving behaviour (BYNDS-Sp)</td>
<td>0.95</td>
<td>44</td>
<td>96.54</td>
<td>27.44</td>
<td>44</td>
<td>192</td>
</tr>
</tbody>
</table>

\(^{a}\)Significant differences after Bonferroni correction, \(p < 0.01\).

\(^{a}\)Items in the scales were summed, and the summed scores were averaged across participants.
Table 2. Logistic regression analyses of history of at least one self-reported crash using BYNDS-Sp subscales, by sex

<table>
<thead>
<tr>
<th></th>
<th>Males (n=223)</th>
<th>Females (n=164)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>β</td>
<td>Std. error</td>
</tr>
<tr>
<td>Step 6 (Final)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transient rule violation</td>
<td>0.40</td>
<td>0.20</td>
</tr>
<tr>
<td>Time driving with licence</td>
<td>0.20</td>
<td>0.07</td>
</tr>
<tr>
<td>Constant</td>
<td>-2.29</td>
<td>0.57</td>
</tr>
</tbody>
</table>
Table 3. Predicted probabilities of self-reported crash at the quartiles for the three predictor variables

<table>
<thead>
<tr>
<th>Percentile (Value)</th>
<th>Predicted probability</th>
<th>Percentile (Value)</th>
<th>Predicted probability</th>
<th>Percentile (Value)</th>
<th>Predicted probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td></td>
<td>Females</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time with driving licence†</td>
<td>Transient rule violation ‡</td>
<td>Transient rule violation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25%</td>
<td>(2.33)</td>
<td>25%</td>
<td>(1.85)</td>
<td>25%</td>
<td>(1.46)</td>
</tr>
<tr>
<td>50%</td>
<td>(4.00)</td>
<td>50%</td>
<td>(2.38)</td>
<td>50%</td>
<td>(1.92)</td>
</tr>
<tr>
<td>75%</td>
<td>(5.33)</td>
<td>75%</td>
<td>(2.92)</td>
<td>75%</td>
<td>(2.38)</td>
</tr>
</tbody>
</table>

† The average transient rule violation, \( M = 2.41 \), was included in this calculation.

‡ Average time with driving licence, \( M = 4.05 \), was included in this calculation.
Figure 1. Trends of drivers’ deaths aged 14-26 years by sex – Colombia 2004-2012

Figure 2. Predicted probabilities for self-reported collisions in relation to the average score of the BYNDS-Sp’s Transient Violations subscale, by sex
Figure 3. Males predicted probabilities for self-reported collisions in relation to the average score of the BYNDS-Sp’s Transient Violations subscale, by time driving with licence.