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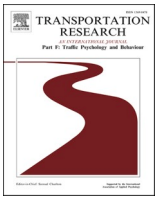

A cross-cultural perspective on risky young drivers' behavior: evidence from 12 countries

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ABSTRACT

Young drivers represent a high-risk group worldwide, with their overrepresentation in road trauma placing substantial pressure on health and economic systems. Their crashes are often linked to risky driving behaviors, accentuating the need for reliable instruments to assess these patterns. The Behavior of Young Novice Drivers Scale (BYNDS) was developed to comprehensively assess multiple dimensions of risky driving behavior in drivers aged 17–29 years; however, it has not yet undergone cross-cultural validation.

Aim: This study aimed to conduct a comprehensive cross-cultural validation of the BYNDS and examine differences in risky driving behaviors among young drivers from Low- and Middle-Income (LMIC) and High-Income (HIC) countries.

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Method: Data were collected from a cross-sectional sample of $n = 3{,}989$ young drivers aged $M = 22.25$ years, of whom 52 % were male and 48 % female. Participants completed the BYNDS, a 44-item behavioral questionnaire administered across 12 countries (48.6 % LMICs; 51.4 % HICs) spanning five continents.
Results: The findings indicate that the BYNDS supports a five-factor structure with good fit indices, strong factor loadings, and acceptable reliability, and invariance between countries of different income levels. Furthermore, the validated BYNDS-42 (comprising 42 items distributed across five factors) also showed the ability to distinguish between drivers with and without self-reported crashes or traffic fines.
Conclusion: This study provides robust evidence supporting the cross-cultural validity and reliability of the BYNDS, reinforcing its value as a tool for assessing young driver behavior. These findings offer empirically grounded insights that can inform behavioral interventions aimed at improving young drivers' road safety.

1. Introduction

Globally, more than half of all road crash fatalities –totaling 1.19 million annually– involve young people, with traffic crashes being the leading cause of death among individuals aged 15 to 29 years (European Commission, 2021; World Health Organization, 2023). Beyond their health impact, crashes involving young people (particularly young drivers) represent a major economic burden. In the United States, for example, motor vehicle injuries (both fatal and non-fatal) among individuals aged 15 to 19 years are estimated to cost about $13.1 billion annually, accounting for approximately 8% of the total yearly cost of traffic crashes (Centers for Disease Control and Prevention, 2019).

At the research level, extensive evidence suggests that the overrepresentation of young drivers in road crash statistics is largely attributed to a combination of inexperience and a tendency toward risky behaviors. This combination is linked to involuntary crash-related factors, such as recognition errors (e.g., poor visual scanning and hazard anticipation; Cassarino & Murphy, 2018), decision mistakes (e.g., following too closely; Traficante et al., 2024), and performance errors (e.g., loss of control; Curry et al., 2011).

In addition, most studies consistently link these adverse safety outcomes to deliberate risky behaviors, including speeding (Fernandes, Hatfield & Job, 2010; Sheykhfard et al., 2024), reckless driving (McNally & Bradley, 2014), driving under the influence of drugs and alcohol (Fernandes, Hatfield & Job, 2010; Horwood & Fergusson, 2000; Hasan et al., 2022), non-use of seat belts (Fernandes, Hatfield & Job, 2010), high-risk assumptions (Useche, 2025), and mobile phone use while driving (Oviedo-Trespalacios et al., 2017, 2019; Useche et al., 2025). These issues are particularly pressing in low- and middle-income countries (LMICs), where critical shortcomings in road safety systems (e.g., unsafe infrastructure, less safe vehicle fleets, and limited community engagement in road safety advocacy) exacerbate the problem of young novice drivers. Consequently, their overrepresentation in road crashes tends to be even more pronounced, and the outcomes of risky driving are more likely to result in severe injuries or fatalities (Huertas et al., 2020; Staton et al., 2016).

When it comes to measurement, self-report instruments are the most commonly used approach for understanding driving behaviors among both young and adult drivers. However, the number of properly validated and tested questionnaires suitable for studying highly vulnerable groups, such as young drivers, remains limited (Scott-Parker, 2017; Scott-Parker et al., 2014; Scott-Parker & Oviedo-Trespalacios, 2017). For instance, the Driver Behavior Questionnaire (DBQ) is widely used to examine adult driving behaviors, and cross-cultural studies have applied it in various contexts (e.g., Özkan et al., 2006; Useche et al., 2021, 2022). However, despite the existence of several versions, this instrument does not specifically address the driving behaviors of young individuals. To address this gap, the Behavior of Young Novice Drivers Scale (BYNDS) was developed (Scott-Parker & Proffitt, 2015).

On a practical level, although self-report scales have certain methodological limitations, they remain a cost-effective and logistically convenient alternative to objective naturalistic methods such as direct observation or digital monitoring (Taubman-Ben-Ari et al., 2016; Useche et al., 2019). Consequently, the accuracy of traffic safety research largely depends on the availability of reliable self-report instruments for measuring risk factors associated with traffic crashes.

1.1. Literature review

The BYNDS as a behavioral tool for young novice drivers.

To date, few instruments have been specifically designed to measure individual crash risk factors among young drivers, considering their distinct behaviors and common risk factors while driving. For instance, driving at night, carrying peer passengers, and driving on weekends have been shown to increase crash risk in this population (e.g., Williams, 2003). The Behavior of Young Novice Drivers Scale (BYNDS) was developed to comprehensively capture the different dimensions of risky driving behavior among individuals aged 17 to 29 (Scott-Parker and Proffitt, 2015).

Overall, the BYNDS operationalizes risky driving behaviors across five dimensions: *Transient violations* (Factor 1), which refer to deliberate actions that can occur multiple times within a single trip (e.g., driving over the speed limit); *Fixed violations* (Factor 2), representing stable transgressions over time or of longer duration (e.g., driving after using an illicit drug); *Misjudgments* (Factor 3), which encompass involuntary errors related to recognition, decision-making, and performance; *Risky exposure* (Factor 4), defined as

the frequency with which a driver encounters environmental (e.g., driving in the rain) or individual (e.g., driving while fatigued) conditions known to pose risks for young and novice drivers; and *Driver mood* (Factor 5), which reflects emotionally influenced driving (Scott-Parker et al., 2012).

Evidence from validation studies and concurrent associations.

Existing evidence on the factor structure of the BYNDS is relatively consistent. In particular, the misjudgments, risky exposure, and driver mood dimensions have been identified in all validation studies of the scale (Oviedo-Trespalacios & Scott-Parker, 2017, 2018; Scott-Parker & Proffitt, 2015; Šeibokaitė et al., 2020; Tosi et al., 2020), while the transient and fixed violations dimensions have also been confirmed (Scott-Parker et al., 2012; Scott-Parker & Proffitt, 2015).

Regarding concurrent validity of the scale, the BYNDS-based literature has found that risky driving behaviors, especially driver mood, and transient and fixed violations, are positively associated with self-reported traffic crashes and penalties (traffic fines), and the intention to violate traffic regulations (Scott-Parker et al., 2012; Scott-Parker & Proffitt, 2015).

Likewise, consistent antecedents of young peoples' risky driving behaviors include sex (higher risk for men; Alonso et al., 2021; Oviedo-Trespalacios & Scott-Parker, 2018), mental health status (McDonald et al., 2018; Scott-Parker et al., 2013; Senserrick and Williams, 2015), sensation seeking propensity (Scott-Parker et al., 2013), perceived risk, severity, and vulnerability (Harbeck, Glendon & Hine, 2017 and 2018), rewards or incentives (Harbeck, Glendon & Hine, 2018; Harbeck & Glendon, 2013), sensitivity to rewards (Scott-Parker et al., 2013), and the perception of risk behaviors in parents and peers (Scott-Parker, Watson, King & Hyde, 2014).

International applications, limitations, and rationale for this study.

The BYNDS has also been used to benchmark risky driving behavior across jurisdictions. Evidence suggests that, similar to other self-report behavioral questionnaires used with other road users, the BYNDS has shown to identify differences in risky behaviors young drivers in countries such as Australia, New Zealand, and Colombia (Li et al., 2022; O'Hern et al., 2025; Scott-Parker & Oviedo-Trespalacios, 2017). These countries show significant differences in the distribution of young people's risky driving behaviors, with Colombia reporting the highest levels. Consistent with these findings, research indicates that risky road behaviors –and, more broadly, the determinants of traffic crashes– are highly influenced by a wide range of both personal (Memarian et al., 2023; O'Hern et al., 2020; Useche et al., 2025) and context-specific factors (Atchley, Shi & Yamamoto, 2014; Lund & Rundmo, 2009; Özkan et al., 2006).

Further, the Behavior of Young Novice Drivers Scale has shown the potential to be a rigorous tool to measure and understand risky behavior at an international level. However, little is known about the validity of the BYNDS in different global regions and whether the tool and the identified factors are comparable between different geographic and cultural contexts. Likewise, previous BYNDS studies have used small samples (with around 400 participants), selected by convenience, which limit the potential use of available evidence on the young drivers' risk behaviors for large-scale decision-making on young novice driver road safety.

This study was conducted to address the need for psychometrically validated tools that can be applied in diverse cultural and socioeconomic settings. While several national validations of the BYNDS questionnaire have been reported (e.g., Oviedo-Trespalacios & Scott-Parker, 2017; Scott-Parker & Proffitt, 2015; Šeibokaitė et al., 2020; Jannusch et al., 2020; Tosi et al., 2020), cross-cultural evidence remains lacking. Moreover, by testing the BYNDS in a large sample of young drivers across 12 countries, this study provides evidence of its structural validity in heterogeneous contexts and allows meaningful comparisons between high-income and low-/middle-income countries. In doing so, it addresses global road safety priorities by offering a reliable instrument to assess young drivers' risky behaviors in a way that is comparable across regions and economies.

1.2. Study objective and hypothesis

The aim of this study was to conduct a detailed cross-cultural validation of the Behavior of Young Novice Drivers Scale (BYNDS). Previous research suggests that cultural differences influence risky road behaviors (Oviedo-Trespalacios et al., 2021; Scott-Parker,

Table 1
Country-based age and sex descriptive data (n = 3,989).

Country	Frequency	Percent	Age		Sex	
			Mean	SD	Female	Male
Argentina	270	5.7 %	22.11	2.32	51.5 %	48.5 %
Colombia	392	8.2 %	21.09	2.10	42.6 %	57.4 %
Mexico	421	8.8 %	23.08	3.19	32.8 %	67.2 %
Greece	91	1.9 %	22.26	1.91	52.7 %	47.3 %
Lithuania	468	9.8 %	20.81	1.68	55.6 %	44.4 %
Portugal	326	6.8 %	20.33	1.51	74.7 %	25.3 %
Spain	249	5.2 %	21.44	1.97	68.3 %	31.7 %
Malaysia	422	8.9 %	21.90	2.74	50.9 %	49.1 %
Saudi Arabia[1]	215	4.5 %	20.83	1.76	0.0 %	100 %
Nigeria	433	9.1 %	21.70	2.12	23.6 %	76.4 %
Australia	378	7.9 %	18.22	1.59	70.1 %	29.9 %
New Zealand	324	6.8 %	21.02	1.89	49.7 %	50.3 %
Total	**3,989**	**100 %**	**22.25**	**2.75**	**47.8 %**	**52.2 %**

Notes: [1]Women were underrepresented in the sample or did not participate in the study.

2017; Useche et al., 2022; Useche et al., 2024), highlighting the need for large-scale, multi-jurisdictional studies to ensure the validity of conceptual frameworks and questionnaires. This study expands on existing literature by examining the psychometric properties of the BYNDS in a large sample of young drivers from five regions: Europe, Latin America, Asia, Africa, and Oceania.

Beyond assessing the scale's cross-cultural validity, this study also explores the relationship between crashes, traffic sanctions, and young drivers' risky behaviors across different geographical contexts. A key contribution is the analysis of young drivers' behaviors based on their country's income level, which serves as a proxy for the sophistication of road safety systems and culture. In general, high-income countries report fewer road fatalities and injuries compared to low-income countries (Haghani et al., 2022; Useche et al., 2025).

2. Methods

2.1. Participants

Data was collected from 3,989 young drivers (52.2 % male drivers; 48 % females), aged 17 to 29 years, ($M = 22.25$, $SD = 2.75$). The data was retrieved from 12 countries. Overall, the mean number of crashes during the last three years was 0.61 ($SD = 1.33$). Regarding traffic fines, approximately 31 % of the participants self-reported to have received at least one traffic ticket during this same timeframe. Specific age descriptive data and sex distribution observed in each country are shown in Table 1.

2.2. Procedure and technical considerations

Data collection methods varied by country (see Table 2). Researchers in New Zealand conducted telephone interviews, while those in Greece, Portugal, Saudi Arabia, and Nigeria used paper-based surveys. In Argentina, Colombia, Mexico, Lithuania, and Malaysia, Google Forms were utilized, whereas Spain employed Qualtrics and Australia used Keysurvey, an e-survey platform for social research. Advertising methods also varied, primarily based on the type of data collection employed. In countries using paper-based surveys, advertising was mainly conducted in classrooms, with some social media promotion. For electronic surveys, advertising was predominantly through social media.

Only the researchers in New Zealand reached out to participants from previous studies or made 'cold calls' to gather new potential participants. Of the 12 countries involved, only two offered incentives to their respondents. Specifically, Australian researchers provided a random prize draw for petrol vouchers or cinema tickets, while Spanish researchers offered course credit.

2.3. Ethics

Ethical approval for the study was obtained from an institutional review board, in accordance with current regulations (IRB procedure number: F23836-USC). All participants were informed about the study aims, provided written consent before participating, and were assured that their responses were anonymous and confidential. Participation was voluntary, and respondents could withdraw at any stage without consequences.

2.4. Description of the questionnaire

The Behavior of Young Novice Drivers Scale (BYNDS) is a 44-item questionnaire designed to assess self-reported driving behaviors. It includes measures for transient (F1 – 13 items) and fixed (F2 – 10 items) rule violations, misjudgments (F3 – 9 items), risk exposure (F4 – 9 items), and driver mood (F5 – 3 items). Respondents rate each item on a 5-point Likert scale, ranging from 1 (never) to 5 (nearly all the time). The item scores are summed to create five subscale scores, which are then combined to generate a composite score.

In addition to driving behaviors, the questionnaire collects basic socio-demographic information (age and sex), asks about traffic fines (whether the respondent has received any fines since obtaining their license, regardless of the type), and inquiries about crash incident history (whether the respondent has been involved in at least one crash as a driver, regardless of severity).

2.5. Data processing (Statistical analysis)

A meticulous data curation process was conducted to ensure the uniform integration of data from the 12 participating countries. Descriptive analyses were performed to examine sample characteristics, and supplementary scales were scored accordingly. The factorial structure of the Behavior of Young Novice Drivers Scale (BYNDS) was assessed through a rigorous confirmatory procedure, employing competitive Confirmatory Factor Analyses (CFA) with successive forward-fitting steps, following an initial evaluation via Exploratory Factor Analysis (EFA) using maximum likelihood estimation—a statistical method designed to uncover the underlying structure of a large set of variables.

Given that rotated solutions can be theoretically sensitive (Ledesma et al., 2021; Useche et al., 2022) and that previous EFAs using Promax rotation have yielded robust results while supporting the questionnaire's fundamental assumptions (Oviedo-Trespalacios et al., 2017b), Promax rotation was selected for these exploratory analyses. Additionally, considering that the BYNDS had been previously applied following both theoretical and empirical approaches (see Oviedo-Trespalacios & Scott-Parker, 2017b; Scott-Parker, Watson & King, 2010; Scott-Parker, Watson, King & Hyde, 2012a; Scott-Parker & Proffitt, 2015; Šeibokaitė et al., 2020), confirmatory models were used to validate the hypothesized factor structure.

Table 2
Basic data collection features in the 12 countries covered by the study.

Country	Income group [a]	Participants	Language	Data collection method	Incentives	Recruitment strategies
Argentina	LMIC [b]	270	Spanish	Google forms	None	Social media
Colombia	LMIC	392	Spanish	Google forms	None	Social media & mailing list
Mexico	LMIC	421	Spanish	Google forms	None	Social media and classrooms
Greece	HIC [c]	91	Greek	Paper based Survey	None	Classrooms and personal approach to young people beyond the classroom.
Lithuania	HIC	468	Lithuanian	Google forms	None	Social media
Portugal	HIC	326	Portuguese	Paper based Survey	None	Classrooms and personal approach to young people beyond the classroom.
Spain	HIC	249	Spanish	Qualtrics	Course credit	Classrooms and social media
Malaysia	LMIC	422	Malay + English	Google forms	None	Classrooms and social media
Saudi Arabia	HIC	215	English	Paper based Survey	None	Classroom
Nigeria	LMIC	433	English	Paper Survey	None	Classrooms
Australia	HIC	378	English	Keysurvey	Random draws (petrol vouchers and/or cinema tickets)	Social media & mailing list
New Zealand	HIC	324	English	Telephone interview	None	None- recruited via previous participant lists of fieldwork company, random dialling, and cold calling

Notes for the Table: [a] Income group classification was extracted from the latest World Bank *Country and Lending Groups* report (World Bank, 2021); [b] LMICs = Low and Middle-Income Countries; [c] HICs= High-Income Countries.

These confirmatory models served as the *a priori* or baseline models for comparison (see section "3.1 Structural Models" for detailed model specifications). CFA offers several advantages for managing missing data, as well as for handling categorical and non-normally distributed variables (Finney & DiStefano, 2013). Moreover, a key advantage of competitive CFA is its ability to test multiple models under different theoretical assumptions, allowing for the identification of the most appropriate and parsimonious solution. In this study, model specification and estimation were conducted using SPSS AMOS software (version 29.0). Given the ordinal nature of the data and the violation of multivariate normality assumptions, Maximum Likelihood (ML) estimations were applied.

The cut-off criterion for considering an item's factor loading as adequate was set at $\lambda = 0.40$. This threshold was selected as it aligns with common practice (Ledesma et al., 2021; Ruiz-Hernández et al., 2020). Alongside reasonably low RMSEAs and adequate ordinal indicators (e.g., CFI, TLI, NFI), this cut-off has been shown to be statistically appropriate for the intended CFAs (Clark & Bowles, 2018). Factor loadings (λ) below 0.40 were considered low (Herrera-Sánchez et al., 2025; Knekta, Runyon & Eddy, 2019), and the corresponding items were consequently excluded.

As recommended in the expert literature, model fit was evaluated using multiple estimators and indices from different statistical families. Specifically, all applicable indices suggested for the estimation method were used: Chi-square (χ^2), minimum discrepancy ratio (CMIN/df), Confirmatory Fit Index (CFI), Normed Fit Index (NFI), Tucker-Lewis Index (TLI), and Root Mean Square Error of Approximation (RMSEA). Model fit was considered acceptable based on the following criteria: CFI/NFI/TLI values above 0.900, RMSEA below 0.080, and CMIN/df below 5.000 (Marsh, Hau & Wen, 2004; Ruiz-Hernández et al., 2020).

Additionally, model suitability was further assessed based on the strength and coherence of the estimates, as well as the absence of large or unnecessary modification indices. The reliability (internal consistency) of the scale and its items was evaluated using two indicators: (1) Cronbach's alpha coefficient (α) and (2) the Composite Reliability Index (CRI), an additional consistency measure ranging from 0 (no consistency) to 1 (total consistency), statistically derived from factor loadings and residuals observed in the confirmatory results. The use of CRI helps address some limitations of Cronbach's alpha as a sole measure of scale reliability (Raykov, 1998, 2001).

Furthermore, the concurrent validity of the BYNDS was examined using two Criterion Variables (CVs) whose relationships with young drivers' behaviors are supported by the literature (see section 2.3 *Description of the Questionnaire* for further details). To this end, Brown-Forsythe tests (robust mean comparisons) were conducted for all BYNDS subscales, using dichotomized values of each criterion variable (e.g., Crashed = 1, Non-crashed driver = 0) as categorical factors.

Finally, the cross-cultural validity of the Behavior of Young Novice Drivers Scale (BYNDS) was assessed by testing the final validated structure. In this regard, to examine whether the BYNDS structure generalizes across economic contexts, we conducted multigroup CFA in AMOS contrasting high-income countries (HIC) and low-/middle-income countries (LMIC). Items were modeled as continuous and estimated with maximum likelihood, with means and intercepts freely estimated. Factor means were fixed to zero in the reference group (HIC) and freely estimated in the LMIC group. Model fit was evaluated with χ^2/df, CFI, TLI, RMSEA, and SRMR, with invariance decisions based on changes in fit indices ($\Delta CFI \leq 0.010$ and $\Delta RMSEA \leq 0.015$) between nested models.

3. Results

3.1. Structural models

With the aim of understanding the factorial structure of the Behavior of Young Novice Drivers Scale (BYNDS), and after testing the raw fit of the model through Exploratory Factor Analysis (EFA), two competitive theoretical-based Confirmatory Factor Analyses (CFAs) were performed. First, we tested the original structure composed of five factors (Scott-Parker & Proffitt, 2015), and second, a unifactorial structure, in order to perform fit comparisons and determine the best possible theoretical structure for the scale. The model fit for the unifactorial solution was considerably inadequate, while the baseline five-factor model showed better fit indices (see Table 3).

A close inspection of this unconstrained five-factor model allowed us to identify a reduced set of very large modification indices that highlighted a relevant relationship between some items, as well as items with clear psychometric issues ($\lambda < 0.400$). The new simplified five-factor constrained model fitted the data reasonably well, with key indices reported in Table 4.

It is important to note that when this model fit is compared to a unifactorial solution with the same set of items, the final five-factor structure presents a much better fit without the need to delete an extensive number of items (only two questions from the FI scale with considerably low factor loadings, $\lambda < 0.400$, were deleted—namely, items FI2 and FI9). Factor loadings were generally adequate (all over $\lambda = 0.483$), as were the reliability scores obtained in the subsequent analysis (see 3.2 Internal Consistencies). Table 4 shows the

Table 3
Competitive analysis-based fit indices of the structural models.

Model	X^2	df[1]	*p*	CMIN/df[2]	RMSEA[3]	90 % CI for RMSEA		CFI[4]	NFI[5]	TLI[6]
						Lower	Upper			
Unifactorial solution	24198.755	735	<.001	32.923	0.082	0.081	0.083	0.750	0.745	0.678
Five-factor baseline model	18489.028	892	<.001	20.728	0.064	0.064	0.065	0.810	0.803	0.790
Five-factor constrained model (retained)	**2297.042**	**487**	**<.001**	**4.878**	**0.031**	**0.029**	**0.032**	**0.979**	**0.974**	**0.963**

Notes: [1]df = Degrees of freedom; [2]CMIN/df = Minimum discrepancy ratio between X^2/df; [3]RMSEA = Root Mean Square Error of Approximation; [4]CFI= Confirmatory Fit Index; [5]NFI= Normed Fit Index; [6]TLI = Tucker-Lewis Index.

Table 4
Item content, factor that the item belongs to, standardized factor loading (λ), standard error (S.E.) and item p-values in the retained model.

Item[1]	Item content	Factor	M	SD	λ	S.E.	C.R.	*p*
TR1	You drove over the speed limit in areas where it was unlikely there was a radar or speed camera	*F1: Transient rule violations* CRI[2] = 0.996	2.503	1.203	0.748	0.031	34.718	<.001
TR2	You went 10–20 km/h over the speed limit (e.g., 72 km/h in a 60 km/h zone, 112 km/h in a 100 km/h zone)		2.462	1.189	0.850	0.032	35.212	<.001
TR3	You deliberately sped when overtaking		2.640	1.274	0.634	0.029	29.359	<.001
TR4	You sped at night on roads that were not well lit		2.059	1.160	0.766	0.032	30.196	<.001
TR5	You went up to 10 km/h over the speed limit (e.g., 65 km/h in a 60 km/h zone, 105 km/h in a 100 km/h zone)		2.678	1.215	0.737	0.030	34.709	<.001
TR6	You went more than 20 km/h over the speed limit (e.g. 60 km/h in a 40 km/h zone, 120 km/h in a 100 km/h zone)		2.128	1.122	0.732	0.022	51.092	<.001
TR7	You raced out of an intersection when the light went green		2.273	1.194	0.608	0.022	40.985	<.001
TR8	You travelled in the right lane on multi-lane highways		2.265	1.177	0.495	0.029	35.309	<.001
TR9	You sped up when the lights went yellow		2.365	1.143	0.639	0.022	45.068	<.001
TR10	You went too fast around a corner		1.974	1.007	0.858	0.020	46.786	<.001
TR11	You did an illegal U-turn		1.855	1.038	0.935	0.024	34.589	<.001
TR12	You overtook someone on the left		1.812	1.034	0.866	0.021	30.713	<.001
TR13	You spoke on a mobile that you held in your hands		1.972	1.053	0.749	0.023	36.436	<.001
FI1	Your passengers did not wear seatbelts	*F2: Fixed rule violations* CRI = 0.991	1.970	1.168	0.652	0.028	34.714	<.001
FI3	You carried more passengers than could legally fit in your car		1.740	1.036	0.831	0.051	21.375	<.001
FI4	You did not always wear your seatbelt		1.715	1.155	0.821	0.03	33.463	<.001
FI5	You drove without a valid license as because you had not applied for one yet or it had been suspended		1.680	1.189	0.483	0.028	31.75	<.001
FI6	You did not wear a seatbelt if it was only for a short trip		1.881	1.256	0.824	0.054	25.850	<.001
FI7	If there was no red light camera, you drove through intersections on a red light		1.566	0.998	0.929	0.029	39.313	<.001
FI8	You carried more passengers than there were seatbelts for in your car		1.762	1.059	0.885	0.032	38.223	<.001
FI10	You drove a high-powered vehicle		1.856	1.154	0.546	0.083	8.996	<.001
MS1	You misjudged the speed when you were exiting a main road	*F3: Misjudgement* CRI = 0.994	1.840	0.948	0.753	0.038	35.439	<.001
MS2	You misjudged the speed of an oncoming vehicle		1.901	0.949	0.804	0.034	35.496	<.001
MS3	You misjudged the gap when you were turning right		1.753	0.962	0.830	0.03	40.834	<.001
MS4	You misjudged the stopping distance you needed		1.841	0.963	0.746	0.034	24.427	<.001
MS5	You turned right into the path of another vehicle		1.605	0.949	0.833	0.034	31.814	<.001
MS6	You misjudged the gap when you were overtaking another vehicle		1.671	0.960	0.813	0.021	50.548	<.001
MS7	You missed your exit or turn		2.202	0.927	0.525	0.021	53.586	<.001
MS8	You entered the road in front of another vehicle		1.847	0.962	0.722	0.021	47.765	<.001
MS9	You didn't always indicate when you were changing lanes		1.891	1.082	0.646	0.024	45.02	<.001
EX1	You drove on the weekend	*F4: Risky driving exposure* CRI = 0.993	3.757	1.219	0.710	0.022	50.313	<.001
EX2	You drove in the rain		3.324	1.112	0.821	0.022	31.585	<.001
EX3	You drove at peak times in the morning and afternoon		3.202	1.239	0.753	0.025	39.545	<.001
EX4	You drove at night		3.375	1.191	0.799	0.030	32.478	<.001
EX5	You drove at dusk or dawn		3.206	1.182	0.750	0.052	24.793	<.001
EX6	You carried your friends as passengers at night		2.979	1.268	0.693	0.025	42.551	<.001
EX7	You drove when you knew you were tired		2.525	1.110	0.741	0.030	36.343	<.001
EX8	Your car was full of your friends as passengers		2.649	1.245	0.658	0.027	41.155	<.001
EX9	You went for a drive with your mates giving you directions to where they wanted to go		2.503	1.081	0.524	0.027	38.593	<.001
DM1	Your driving was affected by negative emotions like anger or frustration	*F5: Driver mood* CRI = 0.990	2.101	1.033	0.795	0.029	35.709	<.001
DM2	You allowed your driving style to be influenced by what mood you were in		2.063	1.057	0.856	0.038	25.615	<.001
DM3	You drove faster if you were in a bad mood		2.047	1.135	0.821	0.030	31.839	<.001

Notes: [1]Original item number, as available in Scott-Parker & Proffitt (2015); [2]CRI= Composite Reliability Index of the scale.

content, descriptive data (average scores and standard deviations), standardized factor loadings, and significance levels of each item composing the BYNDS.

It is also notable that all factor loadings are large, positive, and statistically significant at their corresponding factors, as also shown in Fig. 1. The items removed due to poor performance included: "You drove after taking an illicit drug such as marijuana or ecstasy" and "You drove when you thought you may have been over the legal alcohol limit". This may be explained by the differences across jurisdictions in terms of drinking culture and stigma concerning these activities, which could decrease the reliability of responses. For example, drinking alcohol is a punishable offense in the Muslim countries that participated in the present study.

3.2. Internal consistency of BYNDS

Cronbach's alpha (α) estimates were all above the 0.700 cut-off criteria, which is the cut-off point with the greatest worldwide use and consensus in specialized literature. According to methodological sources (Morera & Stokes, 2016), this suggests adequate internal reliability, even though it must be double checked throughout another robust measure, such as scale Composite Reliability Indexes

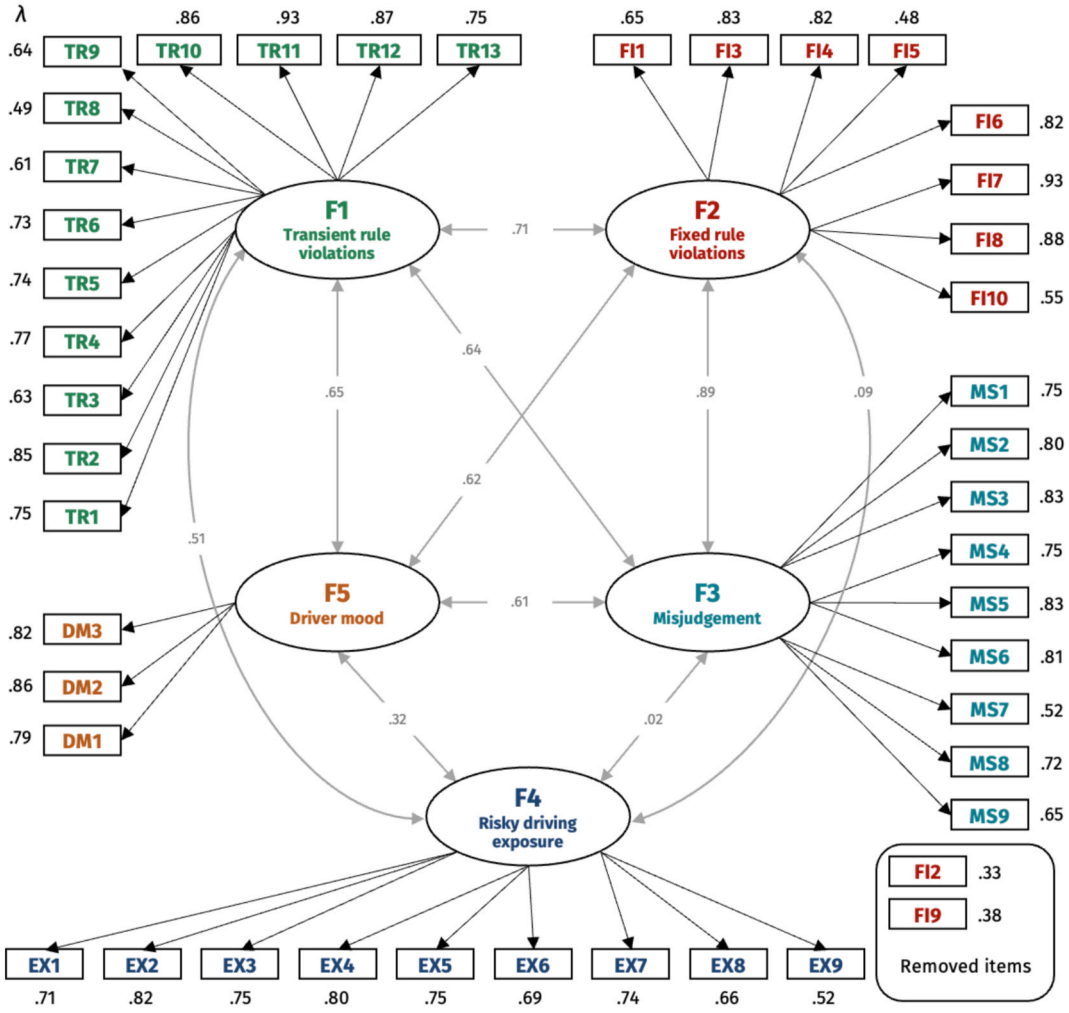


Fig. 1. Standardized parameter estimates and factor correlations. *Notes:* All standardized estimates were $p < 0.001$; the numbers within squares represent the original numbers of the items in the BYNDS (as shown in Table 4).

Table 5
Robust mean comparisons (Brown-Forsythe tests) for BYNDS factors between young drivers having received or not traffic fines (CV1) and having suffered or not driving crashes (CV2).

CV1: Traffic fines							
BYNDS Factor	**Mean (SD)**		**B-F [a]**	**η^2 [b]**	**df1**	**df2**	**Sig.**
	Yes [c]	**No [d]**					
F1: Transient rule violations	2.55(0.71)	2.30(0.75)	65.350	0.024	1	1417.399	<.001
F2: Fixed traffic violations	2.14(0.82)	1.81(0.86)	80.909	0.029	1	1397.837	<.001
F3: Misjudgement	2.08(0.77)	1.92(0.77)	20.756	0.008	1	1333.212	<.010
F4: Risky driving exposure	3.28(0.85)	2.99(0.83)	65.258	0.025	1	1317.567	<.001
F5: Driver mood	2.36(0.98)	2.08(0.97)	45.704	0.018	1	1328.982	<.001
CV2: Traffic crashes							
BYNDS Factor	**Mean (SD)**		**B-F [a]**	**η^2 [b]**	**df1**	**df2**	**Sig.**
	Yes [c]	**No [d]**					
F1: Transient rule violations	2.44(0.72)	2.29(0.74)	28.815	0.011	1	2300.945	<.001
F2: Fixed traffic violations	2.07(0.90)	1.77(0.80)	77.737	0.030	1	2042.479	<.001
F3: Misjudgement	2.08(0.81)	1.85(0.71)	54.029	0.021	1	2048.031	<.001
F4: Risky driving exposure	3.16(0.86)	3.03(0.85)	15.970	0.006	1	2189.984	<.001
F5: Driver mood	2.31(0.98)	2.02(0.97)	58.348	0.022	1	2189.809	<.001

Notes: [a] B-F = Brown-Forsythe test score – asymptotically F distributed. [b] η^2 = Eta-square (effect size); [c] Young drivers reporting having been fined (CV1) / crashed (CV2); [d] Young drivers reporting NOT having been fined (CV1) / crashed (CV2).

(CRIs).

The α scores obtained were: α = 0.870 for Transient rule violations (F1); α = 0.884 for Fixed rule violations (F2); α = 0.894 for Misjudgement (F3); α = 0.881 for Risky driving exposure (F4); and α = 0.863 for Driver mood (F5). Furthermore, the CRIs had very satisfying reliabilities for all the latent constructs. All CRIs ranged between 0.990 (F5 – lowest) and 0.996 (F1 – highest), as shown in Table 4.

3.3. Concurrent validity insights

The robust mean tests performed for testing the concurrent validity of the BYNDS showed overall significant differences in terms of traffic fines received (CV1) and traffic crashes suffered (CV2) for all factors, when comparing the mean scores reported in each factor by these groups of young drivers. In line with theoretical expectations, all scores were significantly greater among drivers having been fined at least once (CV1) when compared to young drivers not previously fined, and for drivers suffering at least one driving crash (CV2) when compared to young drivers without crash records, as shown in Table 5.

3.4. Cross-cultural validity

To test the cross-cultural validity of the Behavior of Young Novice Drivers Scale, the structure of the validated model was examined across the five regions included in the study (Table 6). Overall, the results showed acceptable goodness-of-fit in all regions, based on established parameters and cut-off criteria (see section 2.5 *Data processing*). Although the African sample presented slightly lower values for the Normed Fit Index (NFI) and Tucker–Lewis Index (TLI), both falling just below 0.900, other indices –including the minimum discrepancy ratio (CMIN/df), Root Mean Square Error of Approximation (RMSEA), and the Confirmatory Fit Index (CFI)– indicated an adequate fit for the current BYNDS structure.

The full set of descriptive statistics for the five BYNDS factors –Transient Violations (TR), Fixed Violations (FI), Misjudgments (MS), Risky Exposure (EX), and Driver Mood (DM)– are presented in Table 7. These data allow for direct comparisons across the five regions included in the study (i.e., Africa, Asia, Europe, Americas, and Oceania), offering an overview of both mean levels and variability in self-reported risky driving behaviors.

3.5. Country income-based comparisons

Finally, to investigate potential differences in the risky driving behaviors of young drivers by income level (*i.e.*, low and middle-income countries, or LMICs vs. high-income countries, or HICs), the data was split into two groups, in accordance with the World Bank in its latest *Country and Lending Groups* report (World Bank, 2021). From the 12 countries included in the study, five were classified as LMIC (n = 1,938; 48.6 %) and the other as HIC (n = 2,051; 51.4 %), as shown in the second column of Table 2.

To assess cross-group comparability, we conducted multi-group CFA contrasting LMIC (n = 1,938) and HIC (n = 2,051) participants. The configural model showed acceptable fit indices ($\chi 2_{(1614)} = 18{,}132.20$, CFI = 0.921, TLI = 0.910, RMSEA = 0.046, SRMR = 0.052), supporting a consistent five-factor structure across groups. Constraining factor loadings (metric invariance) resulted in negligible changes (ΔCFI = − 0.004; ΔRMSEA = +.001; ΔSRMR = +.002), thus metric invariance was supported.

However, additional constraints on intercepts (scalar invariance) led to a noticeable deterioration in fit (ΔCFI = − 0.012; ΔRMSEA = +.002; ΔSRMR = +.006), indicating that full scalar invariance did not hold. This suggests that while the latent constructs are comparable, mean differences between HIC and LMIC should be interpreted with caution, as they may partly reflect contextual or cultural response tendencies.

Once the invariance was tested, robust Brown-Forsythe (B-F) analyses were performed. Overall, participants from low and middle-income countries (LMICs) reported greater BYNDS (total) scores, and therefore more risky driving behaviors by young people, than those belonging to high-income countries (HICs; $F_{(1,3986.186)} = 10.388$; $p < 0.001$).

As for the five BYNDS subscales, three showed differences, with young drivers from LMICs reporting significantly higher scores in terms of *F2– Fixed Rule Violations* ($F_{(1,3882.953)} = 253.429$; $p < 0.001$), and *F3– Misjudgement* ($F_{(1,3930.316)} = 16.279$; $p < 0.001$). On the other hand, young drivers from HICs showed greater scores on *F4 – Exposure* ($F_{(1,3981.207)} = 32.286$; $p < 0.001$), compared to those from

Table 6
Fit indexes for the final BYNDS CFA model, and specific goodness-of-fit for each geographical region.

Region	X^2	df[1]	p	CMIN/df[2]	RMSEA[3]	90 % CI for RMSEA		CFI[4]	NFI[5]	TLI[6]
						Lower	Upper			
Full Sample	**2297.042**	**487**	**<.001**	**4.878**	**0.031**	**0.029**	**0.032**	**0.979**	**0.974**	**0.963**
Europe	1527.830			3.137	0.043	0.041	0.046	0.950	0.930	0.912
Americas	1381.162			2.836	0.041	0.039	0.044	0.954	0.932	0.918
Asia	1562.600			3.209	0.059	0.056	0.062	0.947	0.926	0.906
Africa	793.358			1.629	0.038	0.033	0.043	0.920	0.831	0.859
Oceania	1071.828			2.201	0.041	0.038	0.045	0.952	0.918	0.916

Notes: [1]df = Degrees of freedom; [2]CMIN/df = Minimum discrepancy ratio between X^2/df; [3]RMSEA = Root Mean Square Error of Approximation; [4]CFI= Confirmatory Fit Index; [5]NFI= Normed Fit Index; [6]TLI = Tucker-Lewis Index.

Table 7
Descriptive statistics for the BYNDS factors according to regions.

Factor	Region	N	Mean	SD[1]	S.E.[2]	95 % CI[3]	
						Lower	Upper
F1: Transient rule violations	Europe	1,134	2.32	0.69	0.02	2.28	2.36
	Americas	1,083	2.04	0.70	0.02	2.00	2.09
	Asia	637	2.73	0.81	0.02	2.67	2.79
	Africa	433	2.29	0.56	0.03	2.24	2.34
	Oceania	702	1.87	0.58	0.02	1.82	1.91
	Total	**3,989**	**2.23**	**0.74**	**0.01**	**2.21**	**2.25**
F2: Fixed traffic violations	Europe	1,134	1.40	0.45	0.01	1.37	1.42
	Americas	1,083	1.79	0.65	0.02	1.76	1.83
	Asia	637	2.69	1.03	0.03	2.59	2.75
	Africa	433	2.17	0.60	0.03	2.11	2.23
	Oceania	702	1.27	0.48	0.02	1.24	1.31
	Total	**3,989**	**1.77**	**0.80**	**0.01**	**1.74**	**1.80**
F3: Misjudgement	Europe	1,134	1.62	0.43	0.01	1.59	1.61
	Americas	1,083	1.68	0.57	0.02	1.64	1.71
	Asia	637	2.61	0.99	0.03	2.53	2.79
	Africa	433	2.15	0.56	0.03	2.10	2.20
	Oceania	702	1.54	0.43	0.02	1.51	1.57
	Total	**3,989**	**1.84**	**0.71**	**0.01**	**1.82**	**1.86**
F4: Risky driving exposure	Europe	1,134	3.30	0.80	0.02	3.25	3.35
	Americas	1,083	2.99	0.86	0.03	2.94	3.04
	Asia	637	2.94	0.90	0.03	2.87	3.01
	Africa	433	2.85	0.72	0.03	2.78	2.92
	Oceania	702	3.01	0.84	0.03	2.94	3.07
	Total	**3,989**	**3.05**	**0.85**	**0.01**	**3.03**	**3.08**
F5: Driver mood	Europe	1,134	2.00	0.88	0.02	1.94	2.05
	Americas	1,083	1.96	0.93	0.03	1.90	2.01
	Asia	637	2.54	1.13	0.03	2.45	2.63
	Africa	433	2.20	0.85	0.04	2.12	2.28
	Oceania	702	1.84	0.81	0.03	1.78	1.90
	Total	**3,989**	**2.07**	**0.95**	**0.01**	**2.04**	**2.10**

Notes: [1]SD= Standard deviation; [2]S.E.= Standard error; [3]CI= Confidence interval at the level 95 %.

LMICs. Fig. 2 displays the descriptive scores and graphical trends in each one of the aforementioned factors.

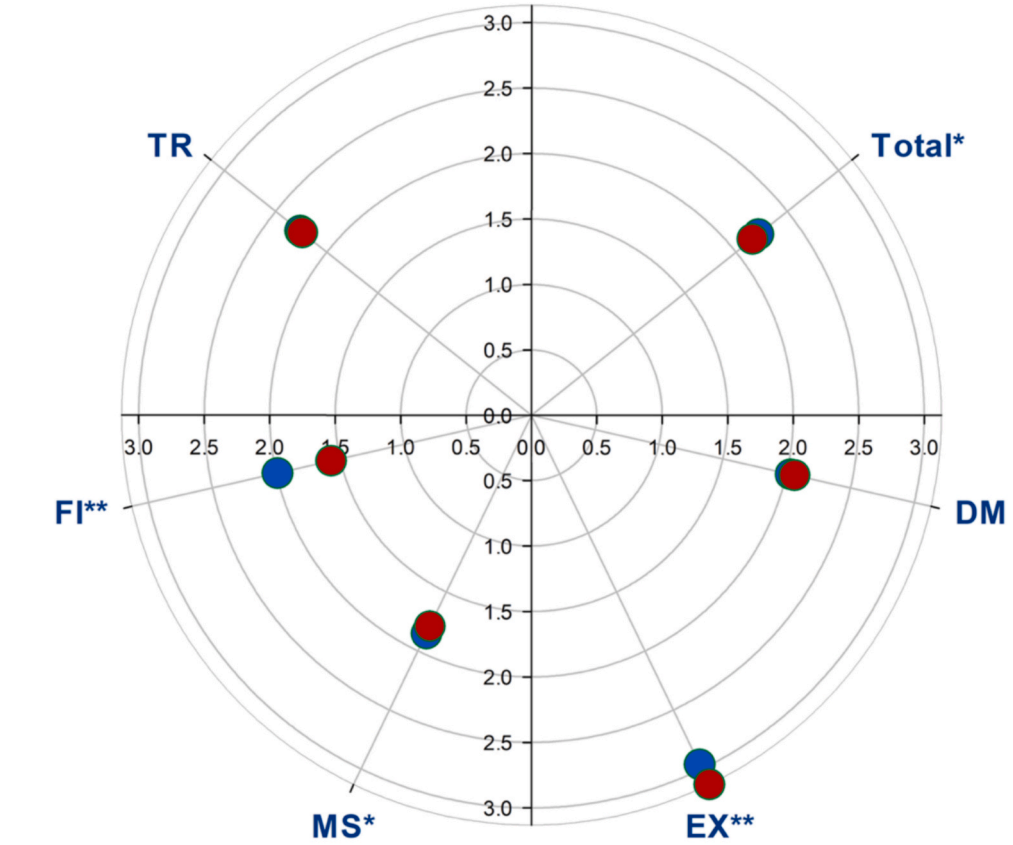
4. Discussion

This research aimed to cross-culturally validate the Behavior of Young Novice Drivers Scale, examining the utility of the scale across five regions: Europe, the Americas, Asia, Africa, and Oceania. The results of this wide empirical experience suggest that the BYNDS possesses several features, indexes, and outcomes that support its validity across different contexts.

From a practical perspective, having a cross-culturally validated measure of young novice drivers' risky behaviors represents an important step forward in understanding and addressing their persistent overrepresentation in global road trauma. Targeting this issue at scale requires psychometrically robust and efficient instruments such as the BYNDS. The present findings support a stable structure of risky driving behaviors typically reported by young drivers, consistent with previous comparative studies using the BYNDS and related self-report measures (e.g., Tosi et al., 2020). Across the five regions, young drivers most frequently reported transient and fixed rule violations, misjudgments, exposure to risky driving environments, and mood-affected driving. These patterns reinforce the continued need to consider young drivers as a priority group in road safety efforts.

Specifically, this multi-country comparison supports findings regarding young drivers' engagement in risky driving behaviors (e.g., Ng et al., 2013; Scott-Parker, Hyde et al., 2013). Previous research has shown that younger drivers are more likely to deliberately speed and use their mobile phone while driving (i.e., transient rule violations), with these behaviors being common across all regions (e.g., Dénommée et al., 2019; Oviedo-Trespalacios & Scott-Parker, 2019b; Sheykhfard et al., 2024). Fixed violations, which include young drivers showing leniency toward their passengers' behaviors and engaging in other risks, such as not using a seatbelt and running red lights, are also reflected in prior research (e.g., Scott-Parker, Watson et al., 2012b).

Developmental research in the driving domain has also supported the idea that decision-making facets of adolescence are reflected in behaviors observable during the novice licensing stage. In other words, many psychosocial factors (such as heightened emotions and peer pressure) might increase young drivers' likelihood to make risky decisions, thus assuming road risks with a greater frequency than adult drivers (Dahl, 2008; Steinberg, 2008). Precisely, decision-making represents a common developmental concern for young drivers. Consistent with these theoretical roots, our findings show that young drivers from 12 countries frequently report making decisions that expose them to contexts increasing their crash risk. For instance, some items related to decision-making showing relatively high means (Table 4) were those reported in Factor 2 (*Fixed Violations;* e.g., not wearing the seatbelt – item FI4) and Factor 4 (*Risky Driving Exposure;* e.g., driving by night – item EX4, or when feeling tired – item EX7), constituting behaviors whose relationship to crash likelihood and severity has been endorsed by many studies dealing with young drivers (Weiss et al., 2014; Rice, Peek-Asa &



	TR	FI	MS	EX	DM	Total
LMICs	2.26	1.99	1.85	2.96	2.03	2.218
HICs	2.24	1.57	1.79	3.13	2.06	2.158

** Difference is significant at the level < .001; * Difference is significant at the level < .050.

Fig. 2. Comparative graphical analysis of BYNDS scales (overall score and five factors of subscales) between young drivers of LMICs and HICs partaking in the study (as shown in Table 2). *Notes:* TR = *transient violations*; FI = *fixed violations*; MS = *misjudgements*; EX = *risky exposure*; DM = *driver mood*.

Kraus, 2003).

One of the relatively successful solutions aimed at improving decision-making processes previously proposed is graduated driver licensing (GDL), which has been introduced in some driving jurisdictions, such as Australia, New Zealand and the United States, to reduce young drivers' exposure to driving risks with a gradual increase in exposure over the licensing phases and as driving experience increases (Senserrick & Williams, 2015). For instance, driving at night and travelling with peer passengers were restrictions introduced within GDL given that research reflects an association between these variables and young drivers' increased crash risk (Cassarino & Murphy, 2018; Senserrick et al., 2021). However, risky driving exposure remains a persistent concern among young drivers, requiring more empirical insights to be explored, through applied tools such as the present BYNDS questionnaire. Ultimately, if exposure cannot be managed with policy restricting undesirable exposure to risk, more severe policies such increasing the minimum driving age should be considered. Of course, this cannot be done without ensuring a systemic improving of transport options such as public transport and active travel that minimise potential unintended consequences in terms of equity and social inclusion of the youth.

4.1. Might young drivers be really 'driven' by emotions?

Coherently with previous literature, the outcomes of this study also suggest that novice drivers' behaviors might be largely influenced by their emotions (Navon & Taubman–Ben-Ari, 2019; Taubman-Ben-Ari et al., 2016; Useche et al., 2025). In these regards, other studies suggest that the adolescent and young adult developmental phase is characterized by heightened emotions that can be

intensified in the presence of peers (Scott-Parker et al., 2013; Steinberg, 2008). Even without peer passengers, young drivers are prone to driving while emotionally charged (Scott-Parker, 2017). This vulnerability of the developmental phase is consequently an important element to understand when examining young peoples' driving risks.

Research across different regions has consistently shown that young drivers' inexperience contributes to higher rates of risky behaviors and misjudgments. This lack of driving experience is particularly marked among young drivers and constitutes a common element of their "risk profiles" (Khattak et al., 2021; Tosi et al., 2020). Driving error (i.e., undeliberate risky behavior) thus persists as a prominent issue in novice driving, with deficits in situation awareness identified as an overarching skill gap (Cassarino & Murphy, 2018; Scott-Parker, Wilks, & Huang, 2018). Recent research has emphasized that such higher-order skills should be taught to young drivers early, well before independent driving (Watson-Brown, Scott-Parker, & Senserrick, 2021). This represents an area where multi-country collaboration could prove particularly effective, as these skills are not influenced by cultural factors. However, to date there is no precedent for such initiatives with the potential to yield a meaningful international impact on road safety outcomes.

Moreover, our findings on crashes and traffic infringements indicate that young people reporting higher engagement in risky driving behaviors were also more likely to have been involved in a crash or to have received a traffic fine. This reinforces the well-established link between risky driving and crash risk (Scott-Parker et al., 2012, 2013; Taubman-Ben-Ari et al., 2016), while highlights the importance of continuing research on young driver safety to inform the development of effective countermeasures.

4.2. Cross-cultural applicability of BYNDS: A multi-country perspective

This manuscript explores the extent and nature of safety issues impacting young drivers internationally. In this context, key theoretically interpretable differences have been identified based on (*i*) the country and (*ii*) the income level (LMIC or HIC) of the countries included in the study.

A significant finding is the considerable safety disparity between regions, with low- and middle-income countries (LMICs) differing from high-income countries (HICs) in terms of three BYNDS factors: fixed violations, misjudgments, and risk exposure. In particular, the scores for fixed violations and misjudgments were higher among young drivers from LMICs. Additionally, the composite score of the BYNDS (interpreted as a general risk-likelihood measure) places novice drivers from LMICs at a higher risk compared to their counterparts. This observation aligns with findings from previous studies (Oviedo-Trespalacios & Scott-Parker, 2017; Perel et al., 2007) and systematic reviews (Alonso et al., 2025; Heydari et al., 2019).

Moreover, although the number of countries included in the study was non-representative, significant regional differences were observed. For instance, self-reported transient rule violations and fixed traffic violations were less frequently reported in high-income regions like Oceania (i.e., New Zealand and Australia) compared to low- and middle-income regions such as the Americas (i.e., Colombia, Mexico, and Argentina).

This trend is consistent with existing literature, which emphasizes the heightened risks road users in LMICs typically face, particularly when compared to their counterparts in HICs (Karanikas et al., 2024; Scott-Parker & Oviedo-Trespalacios, 2017; Useche et al., 2025). It can be hypothesized that the differences in fixed rule violations, misjudgments, and risk exposure may be exacerbated by infrastructural and environmental factors that facilitate risky behaviors among young drivers. For example, historical disparities in LMICs regarding vehicles, roads, traffic signals, and other relevant infrastructure could partially explain the increased risk exposure of young drivers from these countries, though further theoretical development is required (Scott-Parker & Oviedo-Trespalacios, 2017; Afshar et al., 2015).

An additional contribution of this study lies in testing the measurement invariance of the BYNDS across country income groups. The results supported configural and metric invariance between HIC and LMIC samples, indicating that the five-factor structure and the strength of the relationships between items and latent constructs are comparable across economic contexts. Scalar invariance, however, was not fully achieved, suggesting that mean-level comparisons should be interpreted with caution. This outcome aligns with previous cross-cultural research in traffic psychology, where partial differences in item intercepts are often attributed to contextual and cultural response patterns rather than flaws in the measurement model itself.

Interestingly, several studies suggest that the future of young driver safety will largely depend on how effectively the complexities of their risky behaviors –spanning multiple dimensions of risk– are addressed. For instance, technology-based solutions, Road Safety Education (RSE; Twisk et al., 2014), and enhanced licensing procedures –now gaining prominence in many countries– provide suitable and complementary strategies to reduce novice drivers' risks and improve overall road safety (Senserrick, Boufous, Olivier, & Hatfield, 2021). Importantly, there is also a growing call to explore more disruptive approaches, particularly harm-reduction models, when eliminating risky behaviors entirely is considered unfeasible (Senserrick, Boufous, et al., 2021; Senserrick, Oviedo-Trespalacios, et al., 2021), an area that warrants further research and consideration.

Finally, there is a pressing need to continue enhancing assessment tools like the BYNDS to target the most concerning behavioral issues among young drivers, both individually and within specific groups. The BYNDS highlights risk priorities that should be addressed in targeted interventions for different communities of young drivers.

5. Limitations of the study and further research

Although this study involved a large sample of young novice drivers from multiple countries and utilized a research tool with increasing evidence of validity and reliability (i.e., the Behavior of Young Novice Drivers Scale), some key limitations should be acknowledged. First, as highlighted in Table 2, recruitment processes varied across countries and territories, potentially introducing sampling bias. Different methods were employed, including social media, varied mailing lists, student recruitment, and press releases,

with only two countries offering incentives. Additionally, data collection was conducted both online and through paper-based surveys, which, despite the broad geographical coverage of the study, limits the generalizability of the findings to other populations. Gender-based differences and bias (Rojas-Quezada et al., 2024), and the lack of socio-demographic representativeness within countries may also limit the generalizability of the data, further restricting the applicability of the results beyond the current sample.

Moreover, common method biases (CMBs) and social norms linked to cultural differences may have influenced the behavioral data collected (Alonso et al., 2017; Vrij et al., 2025). Given the heightened susceptibility of participants to socially desirable responses or recall inaccuracies, self-reported data represent a potential limitation, as noted in previous studies (Deeb et al., 2024; Selaya et al., 2024). While efforts were made to assure participants of response anonymity, it is not possible to rule out the presence of response biases.

Regarding further research, this validated version of the BYNDS encourages international researchers to conduct demographic comparisons and apply this tool in risk assessment studies. Finally, it is worth noting that this is the first standardized measure of young drivers' risky behavior incorporating their most generalizable and prevalent road behaviors across countries from five continents. This represents a key step toward improving road safety outcomes for young drivers.

6. Conclusion

The present study offers a fresh cross-cultural perspective on the risky behaviors of young drivers. The Behavior of Young Novice Drivers Scale (BYNDS) is a theory-driven tool accurately assessing risky driving behaviors across diverse cultures from a human factors' standpoint. As such, the BYNDS can be employed in international studies to measure risky driving among young novice drivers and as a benchmarking tool for risky behaviors across various jurisdictions.

These findings also support the idea that while risky behaviors among young drivers share common patterns across regions, significant disparities exist depending on the region and the income status of countries. Overall, young drivers from high-income countries tend to exhibit relatively "better" road safety behaviors compared to those from low- and middle-income countries (LMICs).

Despite this, self-reports of risky behaviors remain a significant issue across all jurisdictions, emphasizing the continued importance of road safety initiatives, particularly when a shift to more sustainable and safer modes of transport (e.g., public transport) is not immediately feasible. Importantly, the equity gap in road safety outcomes between young novice drivers in LMICs and high-income countries needs to be addressed.

Future research should focus on reducing jurisdiction-based safety disparities and on implementing integrative strategies to mitigate young drivers' risks. Moreover, there is a pressing need for an international agenda aimed at enhancing young driver safety, as the rates of risky driving behaviors remain concerning in all the countries and territories examined in this study.

CRediT authorship contribution statement

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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