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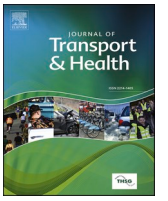

Updating the Driver Behaviour Questionnaire (DBQ): A new Spanish adaptation and validation

María T. Sánchez-López [a], Pablo Fernández-Berrocal [a], Mariaelena Tagliabue [b], Alberto Megías-Robles [a,*]

[a] Department of Basic Psychology, University of Málaga, Spain
[b] Department of General Psychology, University of Padua, Italy

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ABSTRACT

Introduction: The Driver Behaviour Questionnaire (DBQ) is a widely adopted instrument for assessing aberrant driving behaviour across multiple countries and cultural contexts. Despite its widespread use, it has been rarely applied in Spanish-speaking populations. This study aimed to develop and validate an updated Spanish version of the DBQ through a large, gender- and age-balanced community sample. The instrument was revised, and new items addressing contemporary driving behaviours related to mobile phone use while driving were added.
Method: The sample consisted of 2292 Spanish drivers (53.2% men; mean age = 35.55 years; age range: 18-79 years).
Results: Confirmatory factor analysis of the updated DBQ, including the items on phone use behaviour, continued to support the adequacy of the original four-factor model. The four factors demonstrated satisfactory internal consistency and temporal stability. The questionnaire also showed good convergent validity, as evidenced by its associations with the Dula Dangerous Driving Index and the Driving Anger Expression Inventory. Differences in DBQ factors were observed according to gender, age, and cultural background.
Conclusions and practical applications: This updated Spanish version of the DBQ is a reliable and valid tool for assessing aberrant driving behaviour within the Spanish population, serving as a useful resource for analysing driving patterns and guiding the development of effective road safety policies and interventions.

1. Introduction

Road traffic crashes are among the leading causes of death worldwide. According to the latest WHO global report on road safety, approximately 1.19 million people died and between 20 and 50 million sustained non-fatal injuries as a result of road crashes in 2021 (World Health Organization, 2023). In Spain, despite significant improvements in road safety during the 1990s and 2000s, the number of road fatalities remains unacceptably high and has been relatively stable over the last decade, at around 1800 fatalities per year (DGT, 2025). Previous literature confirms that human factors are the primary contributors to road traffic crashes, highlighting driver-related behaviours such as speeding, distraction, and alcohol consumption (Dingus et al., 2016; Petridou and Moustaki, 2000;

* Corresponding author. University of Málaga Faculty of Psychology, Department of Basic Psychology, Campus Teatinos, s/n, 29071, Málaga, Spain.
E-mail address: amegias@uma.es (A. Megías-Robles).

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Razzaghi et al., 2019; Rolison et al., 2018). Understanding driver behaviour is therefore crucial for designing effective prevention and intervention strategies to reduce road mortality. One of the most widely used assessment instruments in driving behaviour research is the Driver Behaviour Questionnaire (DBQ; de Winter et al., 2015; Reason et al., 1990). In the present study, we aimed to adapt and validate the DBQ for the Spanish population, updating the instrument to reflect contemporary risk factors.

The original version of this self-report scale was developed and validated by Reason et al. (1990) to assess aberrant driving behaviours in the United Kingdom. The scale was designed to distinguish between two distinct classes of driving behaviour: Errors and Violations. Errors are defined as "failures of planned actions to achieve their intended consequences" (e.g., not checking the rear-view mirrors before manoeuvring when it is necessary to do so), while Violations are "deliberate deviations from those practices believed necessary to maintain safe driving" (e.g., exceeding the speed limit). Additionally, Reason et al. (1990) identified a third factor, predominantly characterised by items reflecting errors related to trivial slips and lapses, which are commonly associated with attention or memory failures. These were defined as "unwitting deviations of action from intention" (e.g., realising that you are driving toward point B when you intended to go toward point A or hitting a previously unseen object while reversing).

Over the last three decades, numerous variants of the questionnaire have been derived from the original version, establishing it as a valuable instrument for studying driver behaviour and predicting road crashes (see de Winter and Dodou, 2010). One of the most widely used versions of the questionnaire is the 28-item DBQ, which is based on a four-factor structure that includes Errors, Lapses, "Ordinary" violations, and Aggressive violations as factors (Gras et al., 2006; Lajunen et al., 2004; Mesken et al., 2002; Smorti and Guarnieri, 2016; Sullman et al., 2002). This structure retains the distinction between Errors and Lapses while further differentiating between "Ordinary" violations and Aggressive violations. Aggressive violations, like "Ordinary" violations, involve deliberate deviations from safe driving practices, but are specifically motivated by expressions of anger and hostility toward other drivers (e.g., honking the horn at another driver who is going too slowly).

One reason for the variability among DBQ versions, including differences in the number of items and factor structures, is the need to account for situational and cultural differences when assessing driving behaviour (de Winter and Dodou, 2016; Hussain et al., 2019; Lajunen et al., 2004). Variations in traffic regulations and attitudes toward the violation of these regulations, such as speed limits, alcohol consumption, and mobile phone use while driving, are evident across countries (Lajunen et al., 2004; Meesmann et al., 2025; Nordfjærn et al., 2011) and have also been documented in Spain (Meesmann et al., 2022; Ortuña, 2021). In this regard, the DBQ has been adapted and validated in numerous countries, including Australia (Stephens and Fitzharris, 2016), China (Shao et al., 2020), France (Guého et al., 2014), Finland and the Netherlands (Lajunen et al., 2004), Ghana (Dotse and Rowe, 2021), Greece (Kontogiannis et al., 2002), Qatar and the United Arab Emirates (Bener et al., 2008), Italy (Smorti and Guarnieri, 2016), and Turkey (Özkan and Lajunen, 2005), among others. Despite its popularity and extensive support in the literature, the DBQ has been rarely used in Spain or Spanish-speaking countries. A search of the Web of Science (WOS) database using the terms "DBQ" and "Spanish" yielded only four results (Escamilla et al., 2023; Gras et al., 2006; Herrero-Fernández et al., 2024; Useche et al., 2021). Currently, only one peer-reviewed study has validated the DBQ in a Spanish sample (Gras et al., 2006). While this validation was adequate, we believe it is necessary to take a step further in studying the psychometric properties of the DBQ and update the questionnaire to reflect new risk behaviours that have emerged in recent years. In this study, we wanted to explore alternative factorial structures and to assess the validity of the DBQ using a more representative sample of drivers in Spain, spanning all age groups and accounting for gender differences, while also updating the questionnaire and refining the adaptation of certain items.

Although the DBQ covers a wide range of risky driver behaviours, traditional versions of the questionnaire need to be adapted to reflect the impact of technological advances, particularly mobile phone usage while driving (Cordazzo et al., 2016; Freeman et al., 2008; Parishad et al., 2023). Mobile phone use has become deeply ingrained in daily life, making it a central part of our routine activities. Research indicates that the use of these devices while driving is a significant source of distraction, linked to a decline in driving performance and an increased risk of road crashes (Boboc et al., 2022; Lipovac et al., 2017; Oviedo-Trespalacios et al., 2016; Phuksuksakul et al., 2021). In particular, Boboc et al. (2022) highlight that phone use while driving causes not only manual (physical) distraction but also visual and cognitive distraction, diverting attention to information irrelevant to the primary driving task. These distractions impair driving performance by affecting lateral lane position, average speed, and brake reaction times, all considered typical indicators of unsafe driving. Similarly, Phuksuksakul et al. (2021) demonstrated that texting while driving impairs lateral position control, increases steering deviation and steering speed, slows reaction times, and raises the likelihood of near misses, all of which elevate the risk of road crashes.

The present study aimed to adapt and validate a Spanish version of the DBQ, based on the 28-item version (Lajunen et al., 2004; Mesken et al., 2002),[1] and to extend the questionnaire by adding items that address mobile phone use while driving. The goal was to obtain a reliable, effective, and updated tool for assessing aberrant driving behaviour in Spanish-speaking populations. In addition, we also examined potential differences in DBQ scores according to age, gender, and cultural background, given the well-documented influence of these variables on driving behaviour (Åberg and Rimmö, 1998; de Winter and Dodou, 2010; Di Stasi et al., 2020; Gianfranchi et al., 2017; Lajunen et al., 2004; Megías-Robles et al., 2022; Özkan et al., 2006b; Ramos-Moreno et al., 2025; Ventsislavova et al., 2021).

[1] In the study by Lajunen et al. (2004), an item related to drinking and driving was omitted due to cultural differences and concerns about social desirability bias regarding the perception of alcohol consumption in Finland.

2. Method

2.1. Participants

A community sample of 2292 Spanish drivers participated voluntarily in this study. Participants ranged in age from 18 to 79 years ($M = 35.55$; $SD = 14.54$), comprising 1220 men (53.2%), 1064 women (46.4%), and 8 individuals identifying as "other gender" (0.4%). Recruitment was conducted through advertisements at the University of Málaga and the University of Granada, as well as through a snowball sampling technique with the assistance of students from the University of Málaga. Participants needed to hold a valid driving licence to meet the study's eligibility criterion, but were not required to drive regularly. All participants were informed that their responses would remain anonymous and were treated in accordance with the Helsinki Declaration (World Medical Association, 2009). The study received ethical approval from the Research Ethics Committee of the University of Málaga (approval number: 14–2019-H).

2.1.1. Procedure

The translation and back-translation of the DBQ questionnaire were conducted in accordance with the International Test Commission (2017) guidelines. First, the original scale by Lajunen et al. (2004) was translated into Spanish. Although Gras et al. (2006) provided a Spanish adaptation, we chose to work from the original English version, as we identified several items requiring modifications. A bilingual translator (Spanish/English), a native English speaker from the UK, then performed a back-translation into English. Finally, the authors and the translator reviewed and compared the original and back-translated versions to ensure conceptual equivalence. Discrepancies were resolved by consensus. Linguistic, psychological, and cultural differences were carefully taken into consideration. The final version of the Spanish DBQ is shown in Table A1 in the Appendix.

Those interested in participating in the study contacted the authors by email and were subsequently provided with a link to complete the questionnaires online through the LimeSurvey platform (www.limesurvey.org). All participants completed the Spanish version of the DBQ and provided socio-demographic information, including gender, age, and confirmation of holding a valid driving licence. To assess the convergent validity of the DBQ, a subsample of participants completed the Driving Anger Scale (DAS) and the Dula Dangerous Driving Index (DDDI), which measure driving anger and the propensity for dangerous driving behaviours, respectively. Specifically, 691 participants completed the DAS and 740 completed the DDDI. Additionally, a subsample of 200 participants was randomly selected for the assessment of test–retest reliability, of whom 134 completed the second assessment. These participants were contacted via email and invited to complete the DBQ online four weeks after their initial assessment.

2.2. Instruments

The Driver Behaviour Questionnaire (DBQ; Lajunen et al., 2004; Reason et al., 1990) is a self-report measure designed to assess aberrant driving behaviours. For the Spanish adaptation, we used the 28-item short version developed by Lajunen et al. (2004) and Mesken et al. (2002), based on earlier work by Parker et al. (1995) and Lawton et al. (1997).[1] The items are divided into four specific subscales: Errors, Lapses, "Ordinary" violations, and Aggressive violations. Participants report how often they engage in these behaviours using a 6-point Likert scale (0 = "never"; 1 = "hardly ever"; 2 = "occasionally"; 3 = "quite often"; 4 = "frequently"; 5 = "nearly all the time"). For this study, we updated the questionnaire by adding two items concerning mobile phone use while driving: "Talk on a mobile phone (without hands-free function) while driving" and "Use a mobile phone for instant messaging or other applications (e.g., WhatsApp, taking photos or videos, social media, email) while driving". These new items, based on the Distracted Driving Scale (DDS; Engelberg et al., 2015), were included within the "Ordinary" violations subscale and placed at the end of the questionnaire so that researchers interested in using only the original 28 items could easily exclude them in future studies. The original DBQ has shown acceptable internal consistency across its four subscales (Cronbach's alpha values between 0.69 and 0.79) and satisfactory construct validity (Lajunen et al., 2004).

The Spanish version of the Driving Anger Scale (DAS; Deffenbacher et al., 1994; Herrero-Fernández, 2011) is a short self-report questionnaire composed of 14 items that assess the degree of anger elicited by specific driving situations. The scale includes three subscales: Impeded progress by others (e.g., "Someone is slow in parking and holds up traffic"), Reckless driving (e.g., "Someone runs a red light or stop sign"), and Direct hostility (e.g., "Someone makes an obscene gesture toward you about your driving"). Participants respond on a 5-point Likert scale where 1 = "not at all" and 5 = "a lot of anger". The DAS has demonstrated adequate psychometric properties, with Cronbach's alpha values ranging from 0.66 to 0.87. Internal consistency in our sample was good (Cronbach's alpha for the total score and subscales ranged from 0.77 to 0.89).

The Spanish adaptation of the Dula Dangerous Driving Index (DDDI; Dula and Ballard, 2003; Sánchez-López et al., 2024) is a self-report questionnaire composed of 28 items that assess the tendency to engage in dangerous driving behaviours. The scale includes three subscales: Aggressive driving (e.g., "I verbally insult drivers who annoy me"), Risky driving (e.g., "When passing a car/truck on a two-lane road, I will barely miss oncoming cars"), and Negative emotional driving (e.g., "When I get stuck in a traffic jam, I get very irritated"). Participants report how frequently they perform certain driving behaviours on a 5-point Likert scale, where 1 = "never" and 5 = "always". This questionnaire has demonstrated good internal consistency, with Cronbach's alpha values ranging from 0.82 to 0.93, as well as satisfactory construct validity (Sánchez-López et al., 2024). In our sample, the DDDI showed good internal consistency (Cronbach's alpha values for the total score and subscales ranged from 0.80 to 0.92).

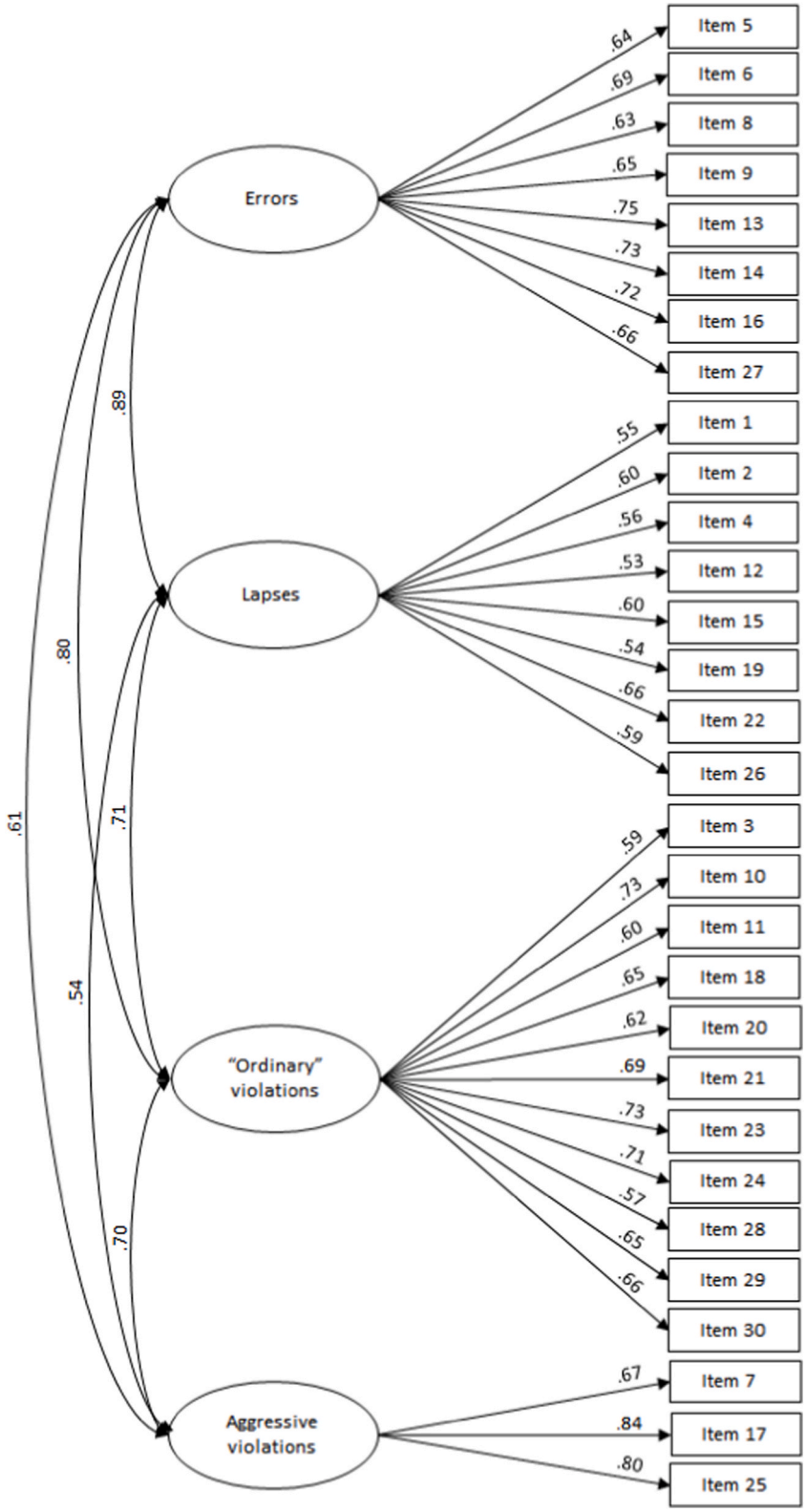

Fig. 1. Path diagram of the confirmatory factor analysis for the four-factor model. Standardised factor loadings for each item and correlations among factors are presented.

2.3. Data analysis

A Confirmatory Factor Analysis (CFA) was first conducted to verify the original four-factor structure of the DBQ. Given the ordinal nature of the items, we employed the diagonally weighted least squares (DWLS) estimation method (Li, 2016). Chi-square ($\chi 2$), comparative fit index (CFI), goodness of fit index (GFI), root mean square error of approximation (RMSEA), and standardised root mean square residual (SRMR) were used to assess model fit (McDonald and Ho, 2002; Wang and Wang, 2012). Composite Reliability (CR) and Average Variance Extracted (AVE) were calculated to assess the reliability and validity of the factors (Hair et al., 2019). In line with previous literature (de Winter and Dodou, 2010; Lajunen et al., 2004; Martinussen et al., 2013a), we also tested several alternative models to determine whether they provided a better fit than the original four-factor solution. Specifically, we evaluated: (1) a one-factor model; (2) a two-factor model combining Errors and Lapses into a single factor (Errors), and "Ordinary" and Aggressive violations into another (Violations); and (3) a second-order model retaining the original four-factor structure but introducing a higher-order level distinguishing between Errors and Violations (similar to the two-factor model).

Second, the internal consistency of the four DBQ factors was evaluated using Cronbach's alpha coefficients, while their temporal stability was assessed through test-retest analyses employing the intraclass correlation coefficient (ICC). To examine convergent validity, Pearson correlations were conducted between the DBQ scores and those from the DAS and DDDI questionnaires.

After confirming the validity and reliability of the Spanish DBQ, descriptive analyses were conducted to examine scores for each of the factors as well as individual items, with particular attention given to the newly added items related to mobile phone use while driving. Gender differences were analysed using independent t-tests; the "other gender" category was excluded from these comparisons due to its small sample size. To explore age-related differences, both linear and quadratic regression analyses were performed. Finally, cultural differences between our Spanish sample and the British, Finnish, and Dutch driver samples reported by Lajunen et al. (2004) were examined using independent t-tests.

Analyses were conducted using JASP (version 0.19.3) and *lavaan* (version 0.6-19) for the confirmatory factor analysis, and IBM SPSS Statistics (version 23.0) for all other analyses.

3. Results

3.1. Confirmatory factor analysis (CFA)

Before conducting the CFA, the Kaiser-Meyer-Olkin test (KMO = 0.95) and Bartlett's Sphericity test ($\chi 2 = 31199.40$, $p < .001$) confirmed sampling adequacy for factor analysis.

The CFA for the four-factor model, based on the structure proposed by Lajunen et al. (2004), revealed a good fit to our data ($\chi 2(399) = 3977.01$, $p < .001$; CFI = 0.98, GFI = 0.99, RMSEA = 0.06, SRMR = 0.05). The path diagram of the model is shown in Fig. 1. All factor loadings were statistically significant ($p < .001$). Composite reliability (CR) indicated good internal consistency for all factors: Errors (0.88), Lapses (0.80), "Ordinary" violations (0.89), and Aggressive violations (0.82). Average variance extracted (AVE) indicated adequate convergent validity for Aggressive violations (0.60), moderate values for Errors (0.47) and "Ordinary" violations (0.43), and a low value for Lapses (0.34). Although the Lapses factor demonstrated good CR, several of its items had relatively weak standardised factor loadings, which contributed to the lower AVE. Refinement of some items may therefore help to improve the convergent validity of this factor.

Alternative factorial structures supported by prior research were also tested to assess whether they offered a better fit than the original four-factor model (see Data analysis section). All three alternative models showed good fit indices: the one-factor model ($\chi^2(405) = 6735.59$, $p < .001$; CFI = 0.96, GFI = 0.97, RMSEA = 0.08, SRMR = 0.07), the two-factor model ($\chi^2(404) = 4868.58$, $p < .001$; CFI = 0.97, GFI = 0.98, RMSEA = 0.07, SRMR = 0.06), and the second-order model ($\chi^2(400) = 3977.37$, $p < .001$; CFI = 0.98, GFI = 0.99, RMSEA = 0.06, SRMR = 0.05). Chi-square difference tests revealed significant differences in model fit between the original four-factor model and both the one-factor and two-factor models ($ps < .001$), with the four-factor model showing a superior fit. The second-order model showed no significant differences from the four-factor model ($p = .55$); however, due to its greater simplicity, the four-factor model was preferred.

3.2. Internal consistency

The four DBQ factors demonstrated good internal consistency. Cronbach's alpha coefficients were $\alpha = .83$ for Errors, $\alpha = .76$ for Lapses, $\alpha = .86$ for "Ordinary" violations, and $\alpha = .75$ for Aggressive violations. These values were higher than those reported in previous versions of the DBQ (Lajunen et al., 2004).

3.3. Test-retest reliability

Test-retest reliability, assessed using the intraclass correlation coefficient (ICC), indicated moderate stability for Errors (ICC = 0.58, 95% CI [0.46, 0.68]) and Lapses (ICC = 0.68, 95% CI [0.57 0.76]) and good reliability for "Ordinary" violations (ICC = 0.83, 95% CI [0 0.77 0.87]) and Aggressive violations (ICC = 0.87, 95% CI [0.82 0.91]), with coefficients interpreted according to Koo and Li (2016). These findings confirm that the instrument is stable over time.

3.4. Convergent validity

To assess convergent validity, DBQ scores were correlated with those from the DAS and DDDI questionnaires (see Instruments section for details). Pearson correlation analyses revealed statistically significant associations between the DBQ and both the DAS and DDDI, for total scores and individual subscales ($ps < 0.01$). As expected, higher DBQ scores were associated with greater driving anger and a higher propensity for dangerous driving behaviours. Pearson correlation coefficients are reported in Table 1.

3.5. Descriptive analysis of DBQ items and factors, and cross-cultural comparison

After confirming the questionnaire's validity and reliability, we examined descriptive statistics for both individual items and the four DBQ factors (see Table 2; descriptive statistics together with item descriptions are shown in Table A2 in the Appendix). Overall, the mean scores were low, ranging from 0.38 to 1.83. Specifically, the mean score for Errors was 0.77 (SD = 0.55), for Lapses 1.16 (SD = 0.59), for "Ordinary" violations 1.11 (SD = 0.68), and for Aggressive violations 1.06 (SD = 0.87). These values suggest that, in general, such behaviours are infrequent among drivers. Items 7, 11, 19, and 28 were associated with the most frequently reported behaviours, each showing mean scores above 1.5, indicating occasional occurrence. Notably, two of these items (11 and 28) refer to exceeding speed limits, marking them as the most frequently reported violations.

As part of our aim to update the DBQ by incorporating risk behaviours related to mobile phone use while driving, we observed that the two newly added items addressing this content showed scores within the range of the rest of the violation items. In fact, their mean scores were equal to or higher than those of six of the nine original "Ordinary" violation items. Furthermore, according to the CFA (see Fig. 1), the factor loadings of these items were adequate (0.57 and 0.58). These results support and highlight the need to include mobile phone use behaviours in the questionnaire.

Finally, we compared the scores from our Spanish sample with those reported in the original study by Lajunen et al. (2004), which included British, Finnish, and Dutch drivers.[2] T-tests revealed significantly higher scores (all $p < .001$) for the Spanish sample

Table 1
Evidence of convergent validity based on Pearson correlations between DBQ factors and DAS and DDDI (total scores and subscales).

Questionnaire	Errors	Lapses	"Ordinary" violations	Aggressive violations
DAS Impeded progress by others	0.37**	0.30**	0.36**	0.35**
DAS Reckless driving	0.14**	0.13**	0.13**	0.22**
DAS Direct hostility	0.23**	0.20**	0.22**	0.28**
DAS Total	0.31**	0.26**	0.30**	0.34**
DDDI Aggressive driving	0.49**	0.40**	0.58**	0.70**
DDDI Risky driving	0.56**	0.44**	0.75**	0.50**
DDDI Negative emotional driving	0.40**	0.42**	0.52**	0.56**
DDDI Total	0.55**	0.48**	0.71**	0.65**

Note: DAS = Driving Anger Scale; DDDI = Dula Dangerous Driving Index. $p < .05$*; $p < .01$**.

Table 2
Means and standard deviations (SD) for the DBQ items and factors.

Item	Mean (SD)	Item	Mean (SD)
Item 1	0.97 (0.83)	Item 18	0.91 (0.94)
Item 2	1.19 (0.99)	Item 19	1.61 (1.12)
Item 3	0.74 (0.91)	Item 20	1.24 (1.16)
Item 4	1.18 (0.96)	Item 21	1.03 (1.13)
Item 5	0.96 (0.95)	Item 22	1.28 (0.88)
Item 6	1.15 (0.85)	Item 23	1.01 (0.94)
Item 7	1.62 (0.19)	Item 24	1.02 (0.95)
Item 8	0.98 (0.86)	Item 25	1.14 (1.11)
Item 9	0.60 (0.81)	Item 26	1.02 (1.01)
Item 10	0.93 (0.77)	Item 27	0.85 (0.84)
Item 11	1.63 (1.26)	Item 28	1.83 (1.30)
Item 12	1.37 (0.97)	Item 29	0.90 (1.01)
Item 13	0.38 (0.70)	Item 30	1.02 (1.09)
Item 14	0.59 (0.77)	Errors	0.77 (0.55)
Item 15	0.66 (0.87)	Lapses	1.16 (0.59)
Item 16	0.66 (0.76)	"Ordinary" violations	1.11 (0.68)
Item 17	0.43 (0.89)	Aggressive violations	1.06 (0.87)

[2] For the purposes of this analysis, the "Ordinary" violations factor in our Spanish sample was computed excluding the two newly added items related to mobile phone use and the item on drinking and driving, as the latter was omitted in Lajunen et al.'s (2004) version of the DBQ.

Table 3
T-tests examining gender differences (*t* value and Cohen's d effect sizes) for the four DBQ factors. Means and standard deviations (SD) are reported for the total sample, as well as separately for men and women.

			Gender differences	
	Mean (SD) for men	Mean (SD) for women	*t*-value	Cohen's *d*
Errors	0.80 (0.56)	0.74 (0.54)	2.68*	0.11
Lapses	1.11 (0.57)	1.22 (0.61)	−4.51**	−0.19
"Ordinary" violations	1.23 (0.70)	0.98 (0.62)	9.20**	0.39
Aggressive violations	1.13 (0.91)	0.99 (0.81)	3.90**	0.16

*$p < .05$, **$p < .001$.

($M_{Errors} = 0.77$; $M_{Lapses} = 1.16$; $M_{Or\_violations} = 1.20$; $M_{Ag\_violations} = 1.06$) compared to the British ($M_{Errors} = 0.50$; $M_{Lapses} = 0.97$; $M_{Or\_violations} = 0.98$; $M_{Ag\_violations} = 0.71$), Finnish ($M_{Errors} = 0.51$; $M_{Lapses} = 0.87$; $M_{Or\_violations} = 0.94$; $M_{Ag\_violations} = 0.53$), and Dutch ($M_{Errors} = 0.63$; $M_{Lapses} = 0.79$; $M_{Or\_violations} = 0.94$; $M_{Ag\_violations} = 0.49$) samples.

3.6. Gender and age differences

T-tests examining gender differences revealed statistically significant differences between men and women across all DBQ factors ($p < .05$). Men scored higher on "Ordinary" violations, Aggressive violations, and Errors, while women scored higher on Lapses (see Table 3). Effect sizes for these gender differences were small to moderate, ranging from 0.11 to 0.39. Regarding age, regression analyses revealed a significant quadratic relationship for "Ordinary" violations ($\beta = -0.37$, $p = .01$) and Aggressive violations ($\beta = -0.59$, $p < .001$). Scores for both factors initially increased with age, peaking at age 23 for "Ordinary" violations and age 39 for Aggressive violations, after which they began to decline. No significant linear or quadratic relationships with age were found for the remaining DBQ factors.

4. Discussion

The present study aimed to develop an updated Spanish version of the DBQ for Spanish-speaking drivers. We selected the 28-item version developed by Lajunen et al. (2004), one of the most widely supported and cross-culturally validated adaptations in the literature, for translation and adaptation. Additionally, two new items related to mobile device use while driving were incorporated to ensure the instrument reflects contemporary driving behaviours. Psychometric analyses conducted on a community sample of 2292 Spanish drivers demonstrated that this updated version of the Spanish DBQ exhibits adequate reliability and validity, with psychometric properties comparable to those reported for the original version.

The CFA confirmed a good fit for the four-factor model, consistent with the findings of Lajunen et al. (2004), comprising Errors, Lapses, "Ordinary" violations, and Aggressive violations. Additional CFAs indicated that this four-factor model provided a better fit than the one- and two-factor models. Although the fit indices for the second-order model did not differ significantly from those of the four-factor model, the latter was preferred for its simplicity. These findings align with previous research supporting the four-dimensional structure of the DBQ (Gras et al., 2006; Lajunen et al., 2004; Mesken et al., 2002; Smorti and Guarnieri, 2016; Sullman et al., 2002) and provide further evidence for the theoretical framework originally proposed by Reason et al. (1990). Nevertheless, it should be noted that the Lapses factor exhibited relatively weak factor loadings, suggesting that revising some of its items may help to improve its psychometric properties.

In terms of reliability, both internal consistency and temporal stability were adequate across the four factors. Cronbach's alpha values ranged from 0.74 to 0.92, indicating good internal consistency. These values were comparable to, and in some cases exceeded, those reported in previous versions of the questionnaire (e.g., Bener et al., 2008; Gras et al., 2006; Lajunen et al., 2004; Martinussen et al., 2013a,b; Reason et al., 1990; Stephens and Fitzharris, 2016). Test–retest reliability, assessed over a four-week interval, was moderate to good, with intraclass correlation coefficients (ICCs) ranging from 0.58 to 0.87, indicating temporal stability.

Regarding convergent validity, our findings suggest the DBQ is a valid instrument for assessing aberrant driving behaviour. Positive correlations were found between the DBQ and both the DAS and the DDDI (total scores and subscales), indicating that higher self-reported DBQ scores were associated with greater driving anger and a higher tendency to engage in dangerous driving behaviours. These associations reflect common behavioural and emotional reactions captured by the DAS and DDDI, such as frustration when blocked by a slow-moving vehicle or engaging in risky manoeuvres like frequent lane changes to avoid traffic congestion. These findings are consistent with previous studies showing that aberrant driving tendencies are linked to increased driving-related anger (Demir et al., 2016; Youssef et al., 2023) and a higher likelihood of risky behaviours and traffic crashes (Gianfranchi et al., 2017; Grasso and Tagliabue, 2022; Megías-Robles et al., 2022; Richer and Bergeron, 2012; Sánchez-López et al., 2024). For example, Grasso and Tagliabue (2022) demonstrated that higher DBQ Violations and Lapses scores predicted faster driving, more frequent speeding, and longer time spent over speed limits in simulated driving tasks.

One of the main objectives of this study was to update traditional versions of the DBQ by incorporating items that reflect the influence of contemporary risk factors, specifically mobile phone use while driving (Freeman et al., 2008; Parishad et al., 2023). Our results showed that the two newly added items addressing this content yielded mean scores comparable to, and in many cases higher than, those of the other items related to driving violations. Moreover, the CFA indicated that the factor loadings of these items were

adequate within the "Ordinary" violations factor. These findings support the inclusion of mobile phone use items in the questionnaire, particularly within the "Ordinary" violations category, as this behaviour represents a deliberate and intentional action that drivers generally recognise as prohibited under traffic safety regulations (Lajunen et al., 2004; Reason et al., 1990). Such findings are in line with previous studies showing that mobile device use while driving is a major source of distraction, linked to reduced driving performance and an increased risk of road crashes (Boboc et al., 2022; Lipovac et al., 2017; Oviedo-Trespalacios et al., 2016; Phuksuksakul et al., 2021).

Finally, we examined differences in DBQ scores based on gender, age, and culture. Men, compared to women, reported engaging in more violations—both ordinary and aggressive—as well as more errors. In contrast, women reported a greater tendency to experience lapses associated with attentional and memory-related failures while driving. Regarding age-related differences, a quadratic relationship was observed, with the tendency to commit "Ordinary" and Aggressive violations initially increasing with age, peaking at 23 years for "Ordinary" violations and at 39 years for Aggressive violations, after which both gradually declined. These findings are consistent with previous literature indicating that men tend to exhibit more deliberate dangerous driving behaviours (Åberg and Rimmö, 1998; Megías-Robles et al., 2022; Navas et al., 2019; Reason et al., 1990; Sánchez-López et al., 2024; Ventsislavova et al., 2021), and that such behaviours decrease with age, particularly after emerging adulthood (see the meta-analysis by de Winter and Dodou, 2010). Interestingly, the finding that women reported fewer driving errors than men represents a pattern not typically observed in the literature (de Winter and Dodou, 2010; Gianfranchi et al., 2017). It is important to note that some versions of the DBQ combine Errors and Lapses into a single factor or assign items differently across factors, which may contribute to inconsistencies in findings between studies.

The literature has also reported notable cultural differences in driving behaviour (de Winter and Dodou, 2016; Di Stasi et al., 2020; Özkan et al., 2006a). In the current study, our Spanish sample scored significantly higher on all four DBQ factors compared to the British, Finnish, and Dutch samples analysed by Lajunen et al. (2004), suggesting a riskier driving style and a higher incidence of errors. However, it should be noted that the samples used in each country differed in age range, mean age, and gender distribution—variables that, as previously shown, influence DBQ scores. Therefore, cross-cultural differences should be confirmed using samples matched on key demographic characteristics.

Some methodological limitations of the present study should be considered in future research. First, the study was conducted online, which limited control over assessment conditions. Second, convergent validity was assessed using the DAS and DDDI questionnaires, which are related to risky and aggressive behaviours but do not specifically capture driving errors and lapses. Future studies should therefore assess convergent validity using additional instruments that more directly target these behaviours (Roca et al., 2013). Moreover, incorporating more objective measures, such as driving simulator data and official records of traffic accidents and fines, would strengthen convergent validity and address potential biases inherent in self-report measures, including social desirability and subjectivity.

In conclusion, this study advances DBQ research by developing and validating a new Spanish version of the instrument using a large, gender- and age-balanced community sample, and by incorporating contemporary items specifically addressing mobile phone use while driving. The resulting Spanish adaptation represents a reliable, valid, and up-to-date tool for assessing aberrant driving behaviour within the Spanish population and facilitates cross-cultural comparisons across countries. The present validation further supports the robustness of the DBQ's four-factor structure, which is preserved even with the inclusion of the items related to mobile phone use, distinguishing between "Ordinary" violations, Aggressive violations, Errors, and Lapses. This categorisation is one of the DBQ's key strengths, offering valuable insights into behavioural patterns associated with crash risk. Assessing and analysing these patterns can inform traffic safety authorities, driver education programmes, and researchers by helping to identify high-risk behaviours and to design more effective, targeted interventions and prevention strategies aimed at reducing road traffic crashes and fatalities.

CRediT authorship contribution statement

María T. Sánchez-López: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Pablo Fernández-Berrocal:** Writing – review & editing, Supervision, Methodology, Conceptualization. **Mariaelena Tagliabue:** Writing – review & editing, Methodology, Conceptualization. **Alberto Megías-Robles:** Writing – review & editing, Writing – original draft, Supervision, Methodology, Funding acquisition, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

All co-authors have approved the submission, and we confirm that there are no conflicts of interest to declare.

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Appendix

Table A1
Final version of the updated Spanish version of the DBQ.

Para cada ítem, por favor, indica con qué frecuencia has experimentado la situación descrita. Basa tus respuestas en lo que recuerdes de tu conducción durante el último año.

0	1	2	3	4	5
Nunca	Casi nunca	Ocasionalmente	Bastante a menudo	Muy frecuentemente	Casi siempre

1. Has chocado con algo que no habías visto previamente al conducir marcha atrás. (L)
2. Tenías la intención de ir a un destino A, pero de repente te has encontrado dirigiéndote a otro destino B sin darte cuenta. (L)
3. Has conducido cuando sospechabas que podías estar superando el límite legal de alcohol en sangre permitido. (VO)
4. Estabas en el carril equivocado al aproximarte al acceso a una rotonda o cruce. (L)
5. Mientras estabas en cola esperando para girar a la izquierda y así poder incorporarte a una vía principal, has prestado tanta atención al flujo de vehículos de la carretera principal que has estado a punto de golpear al coche de delante. (E)
6. No te has dado cuenta de que había peatones cruzando la calle cuando has girado desde una vía principal hacia una calle lateral. (E)
7. Has tocado el claxon para expresarle tu enfado a otro/a conductor/a. (VA)
8. Te has olvidado de mirar el retrovisor antes de iniciar la marcha, cambiar de carril, etc. (E)
9. Has frenado bruscamente en una carretera resbaladiza o girado el volante en la dirección incorrecta cuando tu vehículo estaba derrapando. (E)
10. Has salido de un cruce de tal forma que el/la conductor/a con prioridad de paso se ha visto obligado/a a detenerse para dejarte pasar. (VO)
11. No has respetado el límite de velocidad en una zona residencial. (VO)
12. Has activado algo, por ejemplo, los faros, cuando en realidad querías activar otra cosa, por ejemplo, el limpiaparabrisas. (L)
13. Al girar a la derecha casi impactas contra un/a ciclista que avanzaba por tu derecha. (E)
14. No has respetado una señal de "ceda el paso" y por ello casi colisionas con los vehículos que tenían prioridad de paso. (E)
15. Has intentado arrancar desde un semáforo saliendo en tercera marcha. (L)
16. Has intentado adelantar un vehículo sin darte cuenta de que su conductor/a estaba señalizando que iba a girar a la izquierda. (E)
17. Te has enfadado con otro/a conductor/a y lo/a has perseguido con la intención de recriminarle su comportamiento (VA)
18. Has decidido permanecer hasta el último momento en un carril de la autovía que sabías que se acababa un poco más adelante, momento en el cual te has visto forzado/a a cambiar de carril. (VO)
19. Has olvidado dónde habías dejado el coche en el aparcamiento. (L)
20. Has adelantado por la derecha a un vehículo que conducía lento. (VO)
21. Has acelerado bruscamente al salir de un semáforo con la intención de superar al conductor o a la conductora que tenías al lado. (VO)
22. No has interpretado bien la señalización y eso te ha llevado a equivocarte de salida en una rotonda. (L)
23. Has circulado tan cerca del vehículo que tenías delante que hubiera sido difícil frenar a tiempo en caso de emergencia. (VO)
24. Has cruzado una intersección a pesar de saber que el semáforo ya se había puesto rojo. (VO)
25. Te enfureces por culpa de cierto tipo de conductores/as y muestras tu enfado hacia ellos/as por cualquier medio que te sea posible. (VA)
26. Te has dado cuenta de que no recuerdas con claridad la carretera por la que acabas de estar circulando. (L)
27. Has subestimado la velocidad de un vehículo que se aproximaba hacia ti en sentido contrario cuando estabas realizando un adelantamiento. (E)
28. No has respetado el límite de velocidad en una autovía. (VO)
29. Has hablado por teléfono (sin la función de manos libres) mientras estabas conduciendo. (VO)
30. Has usado el teléfono móvil para aplicaciones de mensajería instantánea u otro tipo de aplicaciones (por ejemplo, WhatsApp, cámara de fotos o video, redes sociales, correo electrónico, etc.) mientras estabas conduciendo. (VO)

Nota: E = Errores; L = Lapsus; VO = Violaciones "ordinarias"; VA = Violaciones agresivas.
La puntuación de cada subescala se calcula como el promedio de las puntuaciones de los ítems que la componen.

Table A2
Means and standard deviations (SD) for each DBQ item.

Item	Item description (English and Spanish)	Mean (SD)
1	Hit something when reversing that you had not previously seen. (L) Has chocado con algo que no habías visto previamente al conducir marcha atrás.	0.97 (0.83)
2	Intending to drive to destination A, you "wake up" to find yourself on the road to destination B. (L) Tenías la intención de ir a un destino A, pero de repente te has encontrado dirigiéndote a otro destino B sin darte cuenta.	1.19 (0.99)
3	Drive even though you realize that you may be over the legal blood-alcohol limit. (OV) Has conducido aun sabiendo que podías estar superando el límite legal de alcohol en sangre permitido.	0.74 (0.91)
4	Get into the wrong lane approaching a roundabout or a junction. (L) Estabas en el carril equivocado al aproximarte al acceso a una rotonda o cruce.	1.18 (0.96)
5	Queuing to turn left onto a main road, you pay such close attention to the main stream of traffic that you nearly hit the car in front. (E) Mientras estabas en cola esperando para girar a la izquierda y así poder incorporarte a una vía principal, has prestado tanta atención al flujo de vehículos de la carretera principal que has estado a punto de golpear al coche de delante.	0.96 (0.95)
6	Fail to notice that pedestrians are crossing when turning into a side street from a main road. (E) No te has dado cuenta de que había peatones cruzando la calle cuando has girado desde una vía principal hacia una calle lateral.	1.15 (0.85)
7	Sound your horn to indicate your annoyance to another road user. (AV) Has tocado el claxon para expresarle tu enfado a otro/a conductor/a.	1.62 (0.19)
8	Fail to check your rear-view mirror before pulling out, changing lanes, etc. (E) Te has olvidado de mirar el retrovisor antes de iniciar la marcha, cambiar de carril, etc.	0.98 (0.86)
9	Brake too quickly on a slippery road or steer the wrong way in a skid. (E) Has frenado bruscamente en una carretera resbaladiza o girado el volante en la dirección incorrecta cuando tu vehículo estaba derrapando.	0.60 (0.81)

(*continued on next page*)

Table A2 (*continued*)

Item	Item description (English and Spanish)	Mean (SD)
10	Pull out of a junction so far that the driver with right of way has to stop and let you out. (OV) Has salido de un cruce de tal forma que el/la conductor/a con prioridad de paso se ha visto obligado/a a detenerse para dejarte pasar.	0.93 (0.77)
11	Disregard the speed limit on a residential road. (OV) No has respetado el límite de velocidad en una zona residencial.	1.63 (1.26)
12	Switch on one thing, such as the headlights, when you meant to switch on something else, such as the wipers. (L) Has activado algo, por ejemplo, los faros, cuando en realidad querías activar otra cosa, por ejemplo, el limpiaparabrisas.	1.37 (0.97)
13	On turning left nearly hit a cyclist who has come up on your inside. (E) Al girar a la derecha casi impactas contra un/a ciclista que avanzaba por tu derecha.	0.38 (0.70)
14	Miss "Give Way" signs and narrowly avoid colliding with traffic having right of way. (E) No has respetado una señal de "ceda el paso" y por ello casi colisionas con los vehículos que tenían prioridad de paso.	0.59 (0.77)
15	Attempt to drive away from the traffic lights in third gear. (L) Has intentado arrancar desde un semáforo saliendo en tercera marcha.	0.66 (0.87)
16	Attempt to overtake someone that you had not noticed to be signalling a right turn. (E) Has intentado adelantar un vehículo sin darte cuenta de que su conductor/a estaba señalizando que iba a girar a la izquierda.	0.66 (0.76)
17	Underestimate the speed of an oncoming vehicle when overtaking. (AV) Te has enfadado con otro/a conductor/a y lo/a has perseguido con la intención de recriminarle su comportamiento.	0.43 (0.89)
18	Stay in a motorway lane that you know will be closed ahead until the last minute before forcing your way into the other lane. (OV) Has decidido permanecer hasta el último momento en un carril de la autovía que sabías que se acababa un poco más adelante, momento en el cual te has visto forzado/a a cambiar de carril.	0.91 (0.94)
19	Forget where you left your car in a car park. (L) Has olvidado dónde habías dejado el coche en el aparcamiento.	1.61 (1.12)
20	Overtake a slow driver on the inside. (OV) Has adelantado por la derecha a un vehículo que conducía lento.	1.24 (1.16)
21	Race away from traffic lights with the intention of beating the driver next to you. (OV) Has acelerado bruscamente al salir de un semáforo con la intención de superar al conductor o a la conductora que tenías al lado.	1.03 (1.13)
22	Misread the signs and exit from a roundabout on the wrong road. (L) No has interpretado bien la señalización y eso te ha llevado a equivocarte de salida en una rotonda.	1.28 (0.88)
23	Drive so close to the car in front that it would be difficult to stop in an emergency. (OV) Has circulado tan cerca del vehículo que tenías delante que hubiera sido difícil frenar a tiempo en caso de emergencia.	1.01 (0.94)
24	Cross a junction knowing that the traffic lights have already turned against you. (OV) Has cruzado una intersección a pesar de saber que el semáforo ya se había puesto rojo.	1.02 (0.95)
25	Become angered by a certain type of a driver and indicate your hostility by whatever means you can. (AV) Te enfureces por culpa de cierto tipo de conductores/as y muestras tu enfado hacia ellos/as por cualquier medio que te sea posible.	1.14 (1.11)
26	Realize that you have no clear recollection of the road along which you have just been travelling. (L) Te has dado cuenta de que no recuerdas con claridad la carretera por la que acabas de estar circulando.	1.02 (1.01)
27	Underestimate the speed of an oncoming vehicle when overtaking. (E) Has subestimado la velocidad de un vehículo que se aproximaba hacia ti en sentido contrario cuando estabas realizando un adelantamiento.	0.85 (0.84)
28	Disregard the speed limit on a motorway. (OV) No has respetado el límite de velocidad en una autovía.	1.83 (1.30)
29	Talk on a mobile phone (without hands-free function) while driving. (OV) Has hablado por teléfono (sin la función de manos libres) mientras estabas conduciendo.	0.90 (1.01)
30	Use a mobile phone for instant messaging or other applications (e.g., WhatsApp, taking photos or videos, social media, email) while driving. (OV) Has usado el teléfono móvil para aplicaciones de mensajería instantánea u otro tipo de aplicaciones (por ejemplo, WhatsApp, cámara de fotos o video, redes sociales, correo electrónico, etc.) mientras estabas conduciendo.	1.02 (1.09)

Note: E = Errors; L = Lapses; OV = "Ordinary" violations; AV = Aggressive violations.

Data availability

Data will be made available on request.

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