



# Trait driving anger and driving styles among Colombian professional drivers

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## ABSTRACT

This study analyzes the association between trait driving anger and driving styles in a sample of Colombian professional drivers. Additionally, the internal and external validity of the Deffenbacher's Driving Anger Scale (DAS-14) was examined in the study population. The DAS-14 and the Spanish Version of the Multidimensional Driving Style Inventory (S-MDSI) were administered to 492 urban bus and taxi operators. Average trait driving anger scores in the study population were similar to those reported in previous validation studies from Spain, Argentina, China, and Malaysia. After deleting three cross-loaded items, confirmatory factor analyses revealed a three-dimensional latent structure for the DAS-14, similar but not equal to the previous Spanish speaking validations. This factorial structure fits the data reasonably well. Finally, linear regression analyses revealed that the three factors of the DAS-14 (impeded progress by others, illegal driving, and direct hostility) significantly predict adaptive and maladaptive driving styles. Overall, the results of this study suggest that the DAS-14 is a reasonably reliable measure of driving anger traits among professional drivers, and it also provides relevant insights for the prevention of risky driving styles in this occupational group.

## 1. Introduction

Abundant empirical evidence suggests that most traffic accidents, which are one of the major causes of unnatural death worldwide (Evans, 2014; Novoa et al., 2011), result from risky behaviors performed by road users, especially drivers (Af Wählberg et al., 2011; Hassen et al., 2011; Scott-Parker and Oviedo-Trespalacios, 2017; Sümer, 2003). At an individual level, risky driving behaviors have been associated with different factors such as stress (Useche et al., 2017; Kontogiannis, 2006), fatigue (Lal and Craig, 2001; May and Baldwin, 2009), attitudes, and personality traits (Tao et al., 2017; Mallia et al., 2015; Nabi et al., 2007; Chliaoutakis et al., 2002), among which driving anger stands out because of its high prevalence in the general population, and its frequent study in road safety literature (Berdoulat et al., 2013; Dahlen and White, 2006).

Anger can be defined as an emotion characterized by feelings of tension, annoyance, irritation, fury, and rage (Spielberger et al., 1983). In driving situations, anger is commonly associated with stimuli perceived as threats to the individual's personal safety, or to other relevant personal goals and values, such as honesty and respect towards the law (Roseman and Smith, 2001). It is known that driving anger is more intense for high trait anger drivers, who are more likely to experience high levels of anger

in common driving situations, such as rush hour traffic, impeding events, discourtesy, and distracted behavior performed by other drivers (Deffenbacher et al., 2016).

Furthermore, anger-prone drivers tend to perceive the actions of other road users as hostile (Matthews, 2001), and they are more likely to report aggressive expressions (e.g. hostile gestures) and risky behaviors on the road (e.g. speeding, tailgating) than low trait-anger drivers (Kaiser et al., 2016; Sagar et al., 2013; Malta et al., 2005; Sümer, 2003; Shinar, 1998). Indeed, high trait driving anger is correlated with aggressive driving behaviors, impaired attention, risk perception, and decision making (Bogdan et al., 2016; Deffenbacher et al., 2001; Ge et al., 2015; Herrero-Fernández, 2013; Li et al., 2014; Lu et al., 2013; Roidl et al., 2013; Sârbescu, 2016; Stephens et al., 2016; Taubman-Ben-Ari et al., 2016), which in turn increases the probability of being involved in traffic accidents (Wickens et al., 2016; Zhang and Chan, 2016; Zhang et al., 2015).

### 1.1. Trait driving anger and driving styles

In the vehicle-driving context, "driving style" is defined as the way drivers choose to drive or habitually drive, including their driving speed,

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headway, attentiveness and assertiveness (Taubman-Ben-Ari et al., 2016). Driving style is a key concept for road safety because it allows to classify drivers by their behavioral and perceptual traits. According to Taubman-Ben-Ari and Skvirsky (2016), there are adaptive driving styles, such as careful, patient, and distress-reduction driving; and maladaptive styles, such as angry, risky, anxious, and dissociative (or distracted) driving.

Previous research has associated adaptive driving styles with healthy personality traits such as self-esteem, sense of coherence, differentiation of self (Miller and Taubman-Ben-Ari, 2010; Taubman-Ben-Ari et al., 2004), agreeableness, conscientiousness, openness (Taubman-Ben-Ari and Yehil, 2012), and conformity to authority (Taubman-Ben-Ari and Katz-Ben-Ami, 2013). On the other hand, maladaptive driving styles are associated with personality traits such as sensation seeking (Holman and Havârneanu, 2015; Poó and Ledesma, 2013; Taubman-Ben-Ari et al., 2004), trait anxiety (Miller and Taubman-Ben-Ari, 2010; Poó and Ledesma, 2013), neuroticism (Taubman-Ben-Ari and Yehil, 2012), aggression (Poó and Ledesma, 2013), and extraversion (Taubman-Ben-Ari et al., 2004).

Despite the abundant evidence on the association between trait driving anger and road safety outcomes (Taubman-Ben-Ari et al., 2016), to the best of our knowledge, only Holman and Havârneanu (2015), and Padilla et al. (2018) have examined the association between trait driving anger and driving styles. However, Holman and Havârneanu (2015) operationalize trait driving anger as a general construct, without taking into account the different dimensions of anger predisposition (e.g., anger at illegal driving, traffic obstructions, drivers hostility, police control); and Padilla et al. (2018) used driving styles and anger predisposition (at illegal driving, obstructed traffic and hostile gestures) to predict recidivism in traffic offences, but only addressing tangentially (with Pearson correlations) the association between trait driving anger and driving styles. Therefore, evidence on the association between trait driving anger and driving styles remains weak.

Theoretically, the association between anger predisposition and driving styles can be supported in the appraisal-tendency approach (Lerner and Keltner, 2001). Consistently with the cognitive theories of emotions (Lazarus, 1991), the appraisal-tendency approach suggests that just as emotional responses are the result of an environmental appraisal process, emotional experiences also activate appraisal predispositions in different cognitive dimensions, such as predictability, control, and the attribution of responsibility for events (Smith and Ellsworth, 1985). In other words, emotions and cognitive appraisals are fed back to each other. For instance, the more anger we feel, the higher the likelihood of attributing the responsibility for the anger triggering events to other people; and the greater the perception that others are responsible for the anger-triggering events, the more anger we feel (Quigley and Tedeschi, 1996).

Likewise, anger predisposes the individual to perceive situations as predictable, understandable, and under individual control. Consequently, anger is associated with feelings of invulnerability and low risk perception, risky and impaired decision-making, and reckless behavior (e.g., Lowenstein and Lerner, 2003). Thus, taking into account the perceptual and behavioral components of driving styles, this study hypothesizes that trait-driving anger is positively associated with maladaptive driving (angry, risky, anxious, and dissociative styles) and negatively associated with adaptive driving (careful, patient, and distress-reduction styles).

## 1.2. The current study

The Deffenbacher's Driving Anger Scale (DAS) is one of the most frequently used measurements for assessing trait driving anger (Deffenbacher et al., 2016). The original version of the DAS (long form) consists of 33 items, with a latent structure of six correlated dimensions: hostile gestures (3 items), illegal driving (4 items), police presence (4 items), slow driving (5 items), discourtesy (9 items), and traffic obstructions (7

items).

Additionally, Deffenbacher, Oetting and Lynch (1994) developed a short version of the DAS, in order to provide a more parsimonious measurement of trait driving anger. The short DAS consists of 14 items, selected from each one of the six DAS original subscales based on their high correlations with the complete scale (Deffenbacher et al., 1994). The 14-item version of the DAS has attracted increasing attention due to its high reliability and short completion time (Deffenbacher et al., 1994; Sullman and Stephens, 2013). However, most evidence on the associations between the DAS-14 and risky driving come from the USA (Moore and Dahlen, 2008) and Europe (Kováčová et al., 2014). Evidence from Asian countries exists as well, as is the case of China (Zhang et al., 2018) and Malaysia (Sullman et al., 2014, 2015). But very little research on trait anger driving has been conducted in countries from other regions, such as Latin America (Deffenbacher et al., 2016).

Exceptionally, Escanés and Poó (2018) validated the short version of the DAS in a sample of Argentinian drivers. This study revealed a five-dimensional factorial structure (infringements by another driver, progress impeded, hostile gestures, police presence, and poor road infrastructure), consistent with the findings of the two previous Spanish validations of the scale (Egea-Caparrós et al., 2012; Herrero-Fernández, 2011). Nevertheless, the cultural singularities and differences in the road infrastructure of Latin American countries limit the generalization of the DAS-14 validity to other Spanish-speaking populations.

Although anger is a universal emotion, anger-triggering situations heavily depend on the cultural context (Yasak and Esiyok, 2009). For instance, previous studies have found that the presence of police units provokes anger in drivers from the USA, Spain, and New Zealand, but not in British drivers (Yasak and Esiyok, 2009). Furthermore, validation studies have found different factor structures for the DAS-14 (e.g. Deffenbacher et al., 1994; Herrero-Fernández, 2011; Egea-Caparrós et al., 2012; Sullman and Stephens, 2013), suggesting that the dimensions of trait driving anger may also be context-dependent. For this reason, the present investigation, firstly, examines the psychometric characteristics of the DAS-14 in the Colombian drivers' population.

Colombia has almost 6 million vehicles and scores the ninth highest traffic-accident death rate (18.5 per 1,000 inhabitants) in the Americas region (WHO, 2018). In addition, the last 10 years have witnessed a sustained increase in fatalities due to traffic accidents (Alarcón et al., 2018). Recent evidence associates negative safety outcomes in Colombia with angry, anxious, risky, and high-speed driving styles (Norza-Céspedes et al., 2014). However, it remains unknown whether this driving styles are anger-related.

In particular, this study focuses on professional taxi and bus drivers, a population with higher levels of exposure to traffic situations associated with anger. Furthermore, the driving styles of these professional drivers not only determine their own safety, but also their passengers', and other road users'. Little research has examined trait driving anger in professional drivers so far (Feng et al., 2016). Therefore, in addition to evaluating the psychometric characteristics of DAS, this study examines whether the Short DAS items actually provoke anger in this particular population, and whether there exists an association between trait driving anger and the driving styles of Colombian bus and taxi drivers.

## 2. Methods

### 2.1. Participants

A total of 492 Colombian professional drivers participated in the study (60.4% were taxi drivers and 39.6% were bus drivers; 92.7% were male and 7.3% female). The sample was selected through a convenience method from two bus and one taxi companies (response rate 92%) in Bogotá, Colombia. The participants' age ranged from 18 to 70 years, with an average of 39 years ( $SD = 10.8$ ). All participants drove 8 hours on a daily basis, during 6 days of the week, in urban areas of the city of Bogotá. The average professional driving experience was 13.6 years.

Regarding the drivers' education level, 32.4% of the participants reported only primary or no education, 53.7% had finished high school, 7.7% had finished junior college and 6.2% had obtained a university degree.

## 2.2. Instruments and measurements

### 2.2.1. Trait driving anger

The Spanish version of the DAS-14, translated from the original English version by [Herrero-Fernández \(2011\)](#), was administered to the sample. This short version of the Deffenbacher's Driver Anger Scale describes 14 anger-triggering situations (e.g. "someone runs a red light or stop sign"). Participants were required to report how much anger they felt when facing each driving situation of the DAS-14, using a 5-point Likert scale (1 = not at all; 2 = a little; 3 = some; 4 = much; 5 = very much). The scores for each subscale of the DAS-14 were calculated by averaging the corresponding items, according to the latent structure identified in this study. Also, an overall trait driving anger score was calculated by averaging the 14 items of the scale.

### 2.2.2. Driving styles

Driving Styles were assessed using the Spanish Version of the Multi-dimensional Driving Style Inventory (S-MDSI) ([Poó et al., 2013](#)). The S-MDSI is composed of six subscales (one for each driving style): risky (9 items,  $\alpha = 0.70$ ), angry (6 items,  $\alpha = 0.74$ ), dissociative driving (9 items,  $\alpha = 0.69$ ), careful (6 items,  $\alpha = 0.81$ ), anxious (4 items,  $\alpha = 0.76$ ), and distress-reduction (5 items,  $\alpha = 0.71$ ). The scores for each driving style were calculated by averaging the corresponding items.

Additionally, the study questionnaire collected information on demographics (age, sex, socio-economic status, and education) and working conditions of the participants (daily work-related driving hours, and professional driving experience).

## 2.3. Procedure and ethics

The participants were recruited during a period of approximately eight months. The data collection was conducted through a paper version of the questionnaire, at the participant's workplace, during their rest periods. An informed consent statement was signed before answering the questionnaire. Participants were granted anonymity, and a general report on the study results was offered to them and their transport companies in order to encourage participation. No other incentives were offered for participation in the study.

To carry out this study, the Social Science in Health Research Ethics Committee of the University of Valencia was consulted, certifying that our research responded to the general ethical principles, currently relevant to research in Social Sciences, and certifying its accordance with the Declaration of Helsinki; this issued a favorable opinion to carry out the study (IRB approval number H1517828884105).

## 2.4. Statistical analysis

Confirmatory Factor Analyses (CFA) were used in order to examine the Short DAS factorial structure. In particular, previously documented structures of one and three factors were tested and compared. According to [Schreiber et al. \(2006\)](#), the fit of the models was evaluated using the  $\chi^2/df$  ratio, Comparative Fit Index (CFI), Standardized Root Mean Square Residual (SRMSR), and Root Mean Square Error of Approximation (RMSEA). These indicators were calculated using IBM AMOS 24.0. The structural models were considered as a good fit to the data when  $\chi^2/df < 5$ , CFI  $> 0.90$ , SRMSR  $< 0.08$ , and RMSEA  $< 0.08$  ([Byrne, 2006](#)). In case of a poor fit, modification indexes were observed in order to identify additional parameters that improved the goodness of fit of the models. Covariances were permitted to be freely estimated and items that loaded  $\geq 0.40$  on two or more factors (cross-loading items) were eliminated in the modified models ([Byrne, 2006](#)). Furthermore, descriptive statistics and Pearson correlations between the study variables were calculated.

The association between trait driving anger and driving styles was examined by using hierarchical regression analysis.

## 3. Results

[Table 1](#) summarizes the mean values and standard deviations of the scores for each item of the DAS-14. All situations of the scale provoked considerable amounts of anger, according to the 1.5 cut point defined by [Lajunen et al. \(1998\)](#). The situation that provoked the highest amount of anger was item 3 ("Someone backs right out in front of you without looking"), followed by the situations in item 4 ("Someone runs a red light or stop sign"), 6 ("Someone speeds up when you try to overtake him/her"), and 8 ("You are stuck in a traffic jam"). The overall DAS-14 score was 2.37 ( $SD = 1.14$ ), which is comparable to previous research findings ([Deffenbacher et al., 2016](#)).

### 3.1. Confirmatory factor analysis

Confirmatory Factor Analyses (CFA) were performed in order to test whether the Colombian professional drivers' driving anger data fitted the one or three factor structures of the DAS-14 (see [Table 2](#)). The original one-factor structure showed poor fit to the data, even after allowing correlations between three pairs of error terms (E5 - E12, E5-E8, E4-E1), according to the IBM AMOS modification indexes. On the other hand, the three-dimensional structure found in this study was similar, but not equal to the ones proposed by [Herrero-Fernández \(2011\)](#), [Zhang et al. \(2015\)](#), and [Zhang et al. \(2018\)](#). In particular, eight items (items 5, 6, 7, 8, 11, 12, and 14) were loading a factor named "impeded progress by others", given that this items describes situations in which the driver cannot advance or circulate because of other road actors (police, cyclists, and motor vehicles); four items (items 1, 3, 4, and 13) were loaded on a factor named "illegal driving", given that the situations described in this items are violations of the road safety regulations; and two items (9 and 10) were loaded on a factor named "Direct hostility", since this items describes explicit hostile behaviors directed at the driver.

Just one goodness-of-fit index (SRMSR) of the 14-DAS three-factor structure reached an acceptable level. However, when the error terms of items 5 and 12, 5 and 8, and 4 and 1 were allowed to be correlated, and items 2 ("A slow vehicle on a mountain road will not pull over and let people by"), 13 ("A truck kicks up sand or gravel on the car you are driving"), and 14 ("You are driving behind a large truck and you cannot see around it") were deleted due to their cross-loading on "Impeded progress by others" and "Illegal driving" factors, the three-dimensional structure provides a reasonably good fit to the data (see [Table 2](#)).

In addition, the elimination of these items makes sense because items

**Table 1**  
Descriptive statistics for the DAS-14 items.

Items from the DAS-14	M	SD	Subscale <sup>a</sup>
Item 1	2.26	1.11	ID
Item 2	2.31	1.02	*IP, ID
Item 3	2.66	1.05	ID
Item 4	2.60	1.13	ID
Item 5	2.20	1.21	IP
Item 6	2.48	1.15	IP
Item 7	2.30	1.05	IP
Item 8	2.47	1.12	IP
Item 9	2.42	1.18	D
Item 10	2.25	1.16	D
Item 11	2.38	1.15	IP
Item 12	2.16	1.20	IP
Item 13	2.41	1.18	*IP, ID
Item 14	2.32	1.22	*IP, ID

Notes: <sup>a</sup>ID = illegal driving, IP = impossibility to move because of the obstructed traffic, and D = direct hostility (classification according to the confirmatory factor analysis. See [Table 3](#)). \* Items 2, 13, and 14 were deleted due to their cross-loading in IP and ID factors.

**Table 2**  
Summary of goodness-of-fit indices for the DAS-14 factor structures.

Model	$\chi^2/df$	CFI	SRMSR	RMSEA	90% CI for RMSEA
1-factor model	6.74	0.836	0.066	0.108	0.099-0.117
1-factor model-modified	6.13	0.857	0.062	0.102	0.093-0.111
3-factor model	6.11	0.851	0.063	0.106	0.097-0.116
3-factor model-modified	3.29	0.952	0.040	0.071	0.058-0.084

13 and 14 involve interactions with large trucks, which have restricted circulation areas in the city of Bogotá, and item 2 describes an unlikely situation for urban public transport drivers (there is just one mountain road in the city). Fig. 1 shows the modified 3-factor structure of the 14-DAS and the parameter estimates of the model. The factorial load of all items was >0.5, and the correlations between the three factors of the scale were very similar those reported by Herrero-Fernández (2011), Zhang et al. (2015), and Zhang et al. (2018).

Table 3 summarizes the mean scores of the 14-DAS and its three subscales, and the Pearson correlations between them. All subscales of the 14-DAS evoked considerable amounts of anger, according with the 1.5 cut point defined by Lajunen et al. (1998). A repeated measure ANOVA showed that the amount of anger evoked by the three subscales of the 14 DAS was significantly different ( $F_{(2, 491)} = 24.683; p = 0.00$ ).

In particular, Bonferroni post hoc comparisons revealed that the amount of anger evoked by illegal driving was significantly higher than those of impeded progress by others (dif I-J = 0.181,  $p = 0.00$ ) and direct hostility (dif I-J = 0.178,  $p = 0.00$ ). There was no significant difference between the amount of anger evoked by impeded progress and direct hostility (dif I-J = 0.003,  $p = 1.00$ ). Regarding Pearson correlations, the three factors of the 14-DAS were moderately inter-correlated, and highly correlated with the total scale. Age was negatively correlated with trait driving anger, but driving experience was not correlated with the 14-DAS.

Regarding the convergent validity of DAS-14, Table 3 shows that the subscales "impeded progress" and "illegal driving" had slightly low levels (<0.5) of average variance extracted (Fornell and Larcker, 1981). However, the composite construct reliability (Werts et al., 1974) of the three subscales was greater than the cutoff point of 0.70 (Nunnally, 1994). Moreover, in support of the DAS-14 discriminant validity, the square root of AVE of each DAS-14 subscale (impeded progress = 0.7, illegal driving = 0.714, direct hostility = 0.693) was higher than the covariances

**Table 3**  
Means and Pearson correlations between the study variables, composite reliabilities (C.R.), and average variance extracted of the DAS-14 subscales.

	Mean	SD	CR	AVE	2	3	4	5	6	7	8	9	10	11	12	13
<i>Demographics</i>																
1. Age	39.2	10.9			.013	.709**	-.064	-.048	-.017	-.014	.029	-.044	-.061	-.128**	-.085	-.094*
2. Sex	0.9	0.3				.060	-.153**	-.139**	-.089*	-.138**	-.070	-.055	.098*	.015	-.001	
3. Driving experience	13.6	9.6					-.033	-.080	-.002	-.052	-.020	-.091*	-.060	-.070	-.039	-.066
<i>Driving styles</i>																
4. Careful	3.6	0.8						-.043	-.534**	.003	-.570**	-.109*	-.217**	.026	-.135**	-.153**
5. Angry style	2.6	0.7							.535**	.619**	.419**	.516**	.436**	.390**	.352**	.460**
6. Dissociative style	2.2	0.8								.543**	.749**	.494**	.521**	.299**	.389**	.492**
7. Anxious style	2.7	0.6									.445**	.521**	.413**	.303**	.361**	.421**
8. Risky style	2.1	0.8										.438**	.423**	.181**	.282**	.373**
9. Distress reduction	2.6	0.7											.302**	.263**	.184**	.305**
<i>Trait-driving anger</i>																
10. Impeded progress	2.3	0.8	0.84	0.49										.682**	.662**	.960**
11. Illegal driving	2.5	0.8	0.73	0.51											.489**	.827**
12. Direct hostility	2.3	1.0	0.71	0.48												.759**
13. DAS-14	2.4	0.7														

Notes: <sup>a</sup> Female = 1, Male = 2; \* $p < 0.05$ ; \*\* $p < 0.01$ .

between it and any other constructs in the model (Fornell and Larcker, 1981).

Table 4 summarizes the hierarchical regression with driving styles as the criterion variables, and the DAS-14 subscales as the predictors. Together, the variables included in the models significantly explained 12% of the variance ( $F_{(5, 489)} = 13.162, p < 0.001$ ) in the case of careful driving style; 9% of the variance ( $F_{(5, 489)} = 9.469, p < 0.001$ ) in the case of distress reduction style; 24% of the variance ( $F_{(5, 489)} = 30.271, p < 0.001$ ) in the case of angry style; 29% of the variance ( $F_{(5, 489)} = 39.072, p < 0.001$ ) for dissociative style; 18% of the variance ( $F_{(5, 489)} = 21.590, p < 0.001$ ) for anxious style; and 20% of the variance for risky style ( $F_{(5, 489)} = 23.916, p < 0.001$ ).

Regarding the specific effects of the DAS-14 subscales, it was found that after controlling for the effects of age and sex, impeded progress by others was negatively associated with careful style, and positively associated with distress reduction, angry, dissociative, anxious, and risky styles. Illegal driving was negatively associated with risky and dissociative styles, and positively associated with careful, distress reduction, and angry styles; and direct hostility was positively associated with angry, dissociative, and anxious styles.

#### 4. Discussion

This study investigated the factor structure of the DAS-14 in a sample of Colombian professional drivers, and the associations between the different dimensions "trait driving anger" and "driving styles". CFA revealed that the participants' trait driving anger data fit a three-dimensional structure, similar, but not identical, to those reported by Herrero-Fernández (2011), Egea-Caparrós et al. (2012), Zhang et al. (2015) and Zhang et al. (2018). In particular, it was found that the three dimensions of 14-DAS distinguish between driving anger evoked by "impeded progress by others", "illegal driving", and "direct hostility" of other drivers. These dimensions differ not only in the levels of anger they evoke, but in the magnitude and direction of their associations with specific driving styles. Taken together, these results suggest that trait driving anger is a complex concept, composed of heterogeneous variables, which can be associated in different ways with the drivers' behavior (Nesbit et al., 2007).

All 14-DAS items evoked considerably high levels of anger in Colombian professional drivers, keeping in mind that all these scores exceed the cut-off point defined by Lajunen et al. (1998). However, the

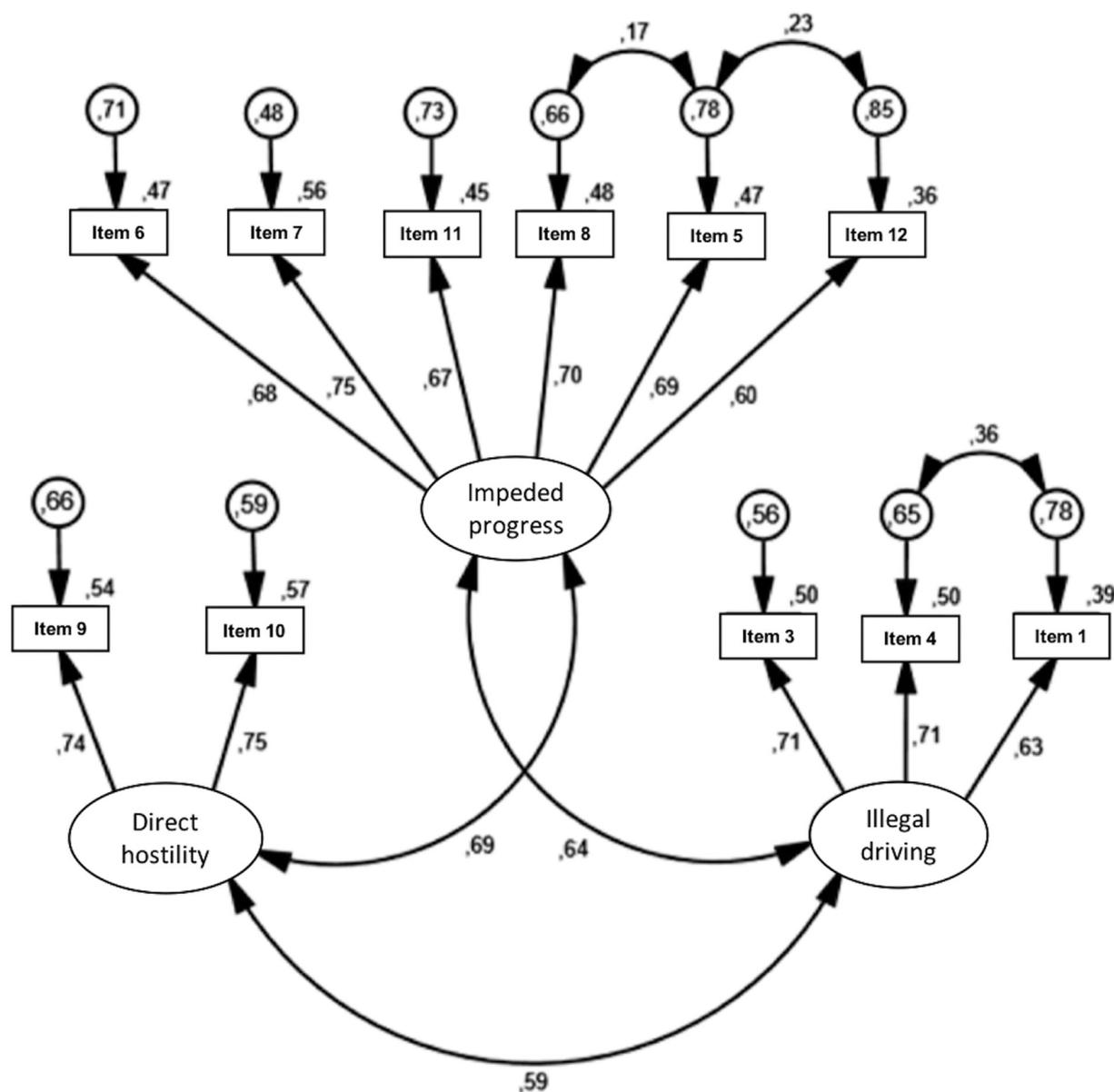


Fig. 1. The modified three-factor structure of DAS, with factorial loads represented through straight arrows and multiple squared correlations in the upper right corner of the observed variables. Covariances are represented by curved arrows. Circles represent error terms. All estimates are significant at  $p > 0.005$  level.

Table 4  
Standardized regression coefficients ( $\beta$ ) and changes in  $R^2$  ( $\Delta R^2$ ) of the models predicting driving styles.

Predictors	Driving styles					
	Careful	Distress reduction	Angry	Dissociative	Anxious	Risky
<i>Step 1</i>						
Age	-0.65	-0.043	-0.046	-0.015	-0.012	0.031
Sex	0.61	-0.069	-0.152**	-0.139**	-0.088	-0.138**
$\Delta R^2$	0.008	0.007	0.025**	0.020**	0.008	0.020**
<i>Step 2</i>						
Impeded progress	-0.381**	0.193**	0.285**	0.483**	0.232**	0.452**
Illegal driving	0.315**	0.128*	0.149**	-0.096*	0.062	-0.163**
Direct hostility	-0.032	0.002	0.103*	0.121*	0.186**	0.066
$\Delta R^2$	0.112**	0.089**	0.213**	0.268**	0.174**	0.178**

average trait driving anger and the scores obtained for each one of the DAS-14 subscales suggest that Colombian professional drivers are moderately prone to anger, compared to drivers from the US, UK, Turkey, and Spain (Deffenbacher et al., 2016). Interestingly, the propensity to

anger of the participants in this study is similar to that of countries such as China and Japan, which are culturally less prone to the expression of negative emotions (Eid and Diener, 2009). This is probably because the very high levels of exposure to potentially anger-provoking situations of

professional drivers may cause an "inoculation" effect, or at least reduce the drivers' reactivity to anger triggering situations. Several previous studies have found that the amount of anger experienced by drivers is negatively associated with the level of exposure to frustrating traffic conditions (Lajunen and Parker, 2001; Sullman, 2006; Villieux and Delhomme, 2010). In addition, experienced drivers are more likely to deal with frustrating situations and thus adjust their objectives and itineraries to the actual traffic situations (Lajunen et al., 1998).

Consistently with the already existing evidence on the DAS (for a summary, see Deffenbacher et al., 2016), this study found that, although age was negatively associated with the total score of the scale, the associations between age, sex, and the specific dimensions of trait driving anger (impeded progress by others, illegal driving, and direct hostility) are low or non-existent. It was also found that illegal driving is the most anger-provoking factor in Colombian professional drivers. This finding is inconsistent with most of the available studies, which report direct hostility as the most anger-provoking factor of the DAS-14 (for a summary, see Deffenbacher et al., 2016). It is possible that the relative tolerance of Colombian professional drivers to direct hostility and to the obstructed traffic is due to the very high prevalence of the situations that constitute these factors (verbal aggressions, aggressive use of the horn, slow and interrupted traffic) in the country (Useche et al., 2018).

Moreover, safety outcomes are a priority issue in the transportation industry (Cafiso et al., 2013; Mooren et al., 2014). According to the psychological appraisal theory, driving anger can be understood as an emotional response to stimuli incongruent with personal goals (Mesken et al., 2007). Therefore, it can be expected that illegal driving evokes higher levels of anger in professional drivers, to the extent that it compromises the priority objective of maintaining high safety standards.

Regarding the association between trait driving anger and driving styles, the results of this study suggest that professional drivers with predisposition to anger at illegal driving, at advance prevented by others, and at direct hostility, externalize their driving anger differently. In particular, anger at direct hostility, and especially at progress prevented by others, are associated with maladaptive driving styles (angry, anxious, dissociative and risky driving). The predisposition to anger at illegal driving was also positively associated with the angry driving style, which involves externalization of anger through hostile actions directed at other drivers such as cursing, honking, or flashing headlights. However, the predisposition to anger at illegal driving was positively associated with careful driving, which involves planning routes, concentration, and respect for traffic regulations; and with distress reduction styles, which involves the engagement in relaxation activities during driving.

Taken together, these results suggest that professional drivers with a predisposition to feel anger towards illegal driving externalize their emotions through hostile actions directed at other drivers, but without breaking traffic rules. Meanwhile, drivers predisposed to anger at the progress impeded by others tend to use the vehicle aggressively as a mechanism of emotional response. From a cognitive perspective, specific responses to anger-triggering situations are associated with particular ways of appraisal. For instance, according to Deffenbacher (2016), the aggressive use of the vehicle to express anger or to "pay back" aggressions is associated with revengeful/retaliatory thinking styles. Meanwhile, the externalization of anger through verbal hostility, honking, and flashing headlights is associated with pejorative labeling and verbally aggressive thinking styles.

This finding is relevant from a practical point of view, because it suggests some interesting points for the design of tailored driving anger management interventions. In particular, this study suggests that professional drivers predisposed to anger at the progress impeded by others would benefit especially from cognitive and behavioral interventions focused on modifying retaliatory thinking and road environment appraisals such as catastrophizing (e.g., "This is awful!"), overgeneralizing (e.g., "There's always a billion people on the road"), and demanding (e.g., "He should get out of my way"). Meanwhile, professional drivers predisposed to anger at illegal driving would especially benefit from

interventions focused on modifying the pejorative and verbally aggressive thinking, and road environment appraisals such as inflammatory labeling (e.g., "Idiot!"), hostile attributional bias (e.g., "He did that on purpose"), and aggression-supportive beliefs (e.g., "He deserves to be run off the road") (Deffenbacher, 2016). Furthermore, the association between trait driving anger and distress reduction driving style suggests that professional drivers are relatively aware of their need to positively cope with anger triggering situations. Therefore, they could be a highly receptive audience for anger management interventions.

#### 4.1. Limitations

The cross-sectional design of this research and the sample selection criteria (convenience) respectively limit the attributions of causality and the generalization of the results. In addition, future research could obtain more evidence on the external validity of the DAS-14 by associating trait driving anger with objective indicators. This could allow for the quantification of health and safety outcomes derived from having a predisposition to anger. Unlike previous validation studies on the DAS-14 (Zhang et al., 2018; Herrero-Fernández, 2016; Zhang et al., 2015; Egea-Caparrós et al., 2012), this research superficially examines the differences between both sexes in trait driving anger. This is overall due to the very low representation of women in the occupational group of Colombian professional drivers, which can generate a general loss of statistical power in comparative analyses (e.g., *t* test or ANOVA). Therefore, future research specifically focused on women could expand the available knowledge about the associations between sex and trait driving anger in professional drivers.

The findings regarding the DAS-14 psychometric characteristics in the Colombian context suggest that a culture-specific adaptation of the scale could be needed in order to decrease the correlations among constructs and thereby increase convergent and discriminant validity. Finally, although the factor "direct hostility" has only two items, and therefore the CFA may be more prone to estimation errors (Kline, 2015), it was decided to keep it taking into account that the subscale has acceptable levels of internal consistency, is theoretically meaningful, and has been differentiated as a factor of the DAS-14 in most of the validation studies (Deffenbacher et al., 2016).

#### 5. Conclusion

Trait driving anger has been seldom studied in the context of professional drivers, and even less so in the case of Latin American countries. This study differs from previous researches and adds to the literature on driving anger by documenting the psychometric characteristics of the DAS-14 applied to a sample of Colombian drivers, and discussing the association between the different dimensions of trait driving anger and driving styles. Confirmatory factor analyses revealed that, in the examined population, the DAS-14 data fits a three-dimensional structure, which makes a distinction between the anger provoked by "impeded progress", "illegal driving", and "direct hostility". These dimensions differ from each other in the levels of anger they provoke in drivers, and in the magnitude and direction of their associations with different driving styles. Together, these results highlight the importance of taking into account the type of trait driving anger in the Colombian context, and particularly in the population of professional drivers. Interventions tailored to the drivers' trait driving anger profile can be especially effective in counteracting the specific consequences of each type of anger predisposition.

#### Declarations

##### Author contribution statement

Sergio A. Useche: Conceived and designed the experiments; Analyzed and interpreted the data; Wrote the paper.

Boris Cendales: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

Francisco Alonso, Juan C. Pastor: Contributed reagents, materials, analysis tools or data.

Luis Montoro: Performed the experiments.

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#### Competing interest statement

The authors declare no conflict of interest.

#### Additional information

No additional information is available for this paper.

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