Accident Analysis and Prevention 174 (2022) 106760

Contents lists available at ScienceDirect

Accident Analysis and Prevention

journal homepage: www.elsevier.com/locate/aap

The relationship between self-reported ability emotional intelligence and risky driving behaviour: Consequences for accident and traffic ticket rate

Alberto Megías-Robles *, María T. Sánchez-López, Pablo Fernández-Berrocal

Department of Basic Psychology, Faculty of Psychology, University of Málaga, Spain

ARTICLE INFO

Keywords:
Emotional intelligence
Emotional regulation
Risky driving behaviour
Traffic road accidents

ABSTRACT

Road safety represents one of the main public health issues worldwide, and risky driving behaviour is one of the most predominant factors in traffic road accidents. The primary objective of this research was to clarify the relationship between emotional intelligence (EI) abilities and the probability of engaging in risky behaviour during driving. Previous literature linking these constructs is limited, and research has yielded mixed findings. In the present study, 555 drivers from a Spanish community sample (M_{age} = 39.34, ranging from 18 to 79 years old; 49.19% women) were assessed on risky driving behaviour using the Dula Dangerous Driving Index while self-reported ability EI was measured using the Wong and Law Emotional Intelligence Scale. Gender, age, and driving experience were controlled. The results of this study revealed that a higher self-reported ability EI, particularly the ability to regulate emotions, was related to a lower tendency to engage in risky driving behaviours. In turn, self-reported ability EI was negatively and indirectly related to the number of road accidents and traffic tickets through the mediating effect of risky driving. The regulation of emotions (via direct and indirect effect) and the appraisal of the emotions of others (via direct effect) were the EI abilities that better predicted the number of accidents and traffic tickets. We discuss the practical implications of these findings, along with suggested future lines of research.

1. Introduction

Deliberate risky behaviours such as speeding, drink-driving, tailgating, or the failure to use safety measures constitute one of the main contributary factors to road accidents (DGT, 2021; Iversen, 2004; NHTSA, 2004; Turner et al., 2004; WHO, 2018). Given the known severe — and at times fatal — consequences that arise from risky driving behaviours, some of these actions appear somewhat difficult to explain from a rational point of view. In this respect, risk decision-making models have emphasised the role that emotion plays in how people behave in risk situations (Loewenstein et al., 2001; Rivers et al., 2008; Slovic, 2010). Emotions are a fundamental part of human behaviour; they guide our attention, memory, motivation, learning, and decisions (Dolan, 2002; Lerner et al., 2015; Pessoa, 2008). In risk contexts, emotions become particularly relevant given the time pressure and strong emotional consequences with which these situations are often associated (Maldonado et al., 2020; Megías et al., 2011a). The integration of emotional factors in risk behaviour processing has also been demonstrated at a neural level (Mohr et al., 2010; Pessoa, 2008; Vorhold, 2008), including the context of driving (Megías et al., 2015; Megías et al., 2018a).

Driving is a task in which emotions arise frequently. Being stuck in a traffic jam or facing a complex roundabout can make us feel frustrated or anxious, witnessing a near-crash can produce fear, whilst the aberrant driving of another driver can make us angry (Shinar, 1998; Yagil, 2001; Zhang et al., 2015). On many occasions, these emotions underpin our behaviour, including risk behaviours (Jallais et al., 2014; Megías et al., 2011b; Mesken et al., 2007; Serrano et al., 2014; Stephens and Groeger, 2011). For example, Mesken et al. (2007), using a test drive procedure with an instrumented car, observed that those participants who reported anger during the test drove faster and more frequently exceeded the speed limit. In line with these findings, Stephens and Groeger (2011), using a driving simulator, showed that angry drivers approached hazards with less caution and attempted more dangerous manoeuvres. Positive emotions evoking excitement and high levels of arousal have also been related to greater willingness to engage in reckless driving (Eherenfreund-Hager et al., 2017; Taubman-Ben-Ari, 2012).

Based on this body of research, it seems clear that the emotional state

* Corresponding author at: 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).

https://doi.org/10.1016/j.aap.2022.106760
Received 11 June 2021; Received in revised form 1 June 2022; Accepted 22 June 2022
Available online 2 July 2022

of the driver is a key factor in explaining the tendency towards risk-taking. Nevertheless, it is also well documented that emotions can be regulated (Gross, 2013). We proposed that an adequate ability to perceive, understand, and manage our emotions would allow for a better control of our emotional states during driving, which would in turn help to reduce involvement in risky behaviours and consequently the number of road accidents. Emotional intelligence (EI) is a construct that covers all these emotional abilities (Mayer et al., 2016; Mayer and Salovey, 1997). In this regard, our purpose in the present study was to verify the existence of a relationship between EI, risky driving behaviours and the negative consequences associated with these behaviours.

1.1. Emotional intelligence

EI has been defined by Mayer and Salovey as "the ability to perceive accurately, appraise, and express emotion; the ability to access and/or generate feelings when they facilitate thought; the ability to understand emotion and emotional knowledge; and the ability to regulate emotions to promote emotional and intellectual growth" (Mayer and Salovey, 1997).

It is important here to note the coexistence of different approaches to EI in the literature. Depending on the theoretical conceptualization of the EI construct (ability vs. mixed EI) and the measurement method used (self-report vs. performance-based), Joseph and Newman (2010) proposed the following categorization: self-report ability model, performance-based ability model, and self-report mixed model. The self-report ability model understands EI as a mental ability and focuses on the emotional abilities included in Mayer and Salovey's (1997) conceptualization of EI. It employs self-report measures to assess these abilities. The performance-based ability model also considers EI as a set of emotion-related abilities but assessed these via performance-based tests. Finally, the self-report mixed model conceives EI as a broad construct combining both emotion-related abilities and personality factors which are assessed through self-report instruments. It is important to consider these differences in the interpretation of EI since previous research indicates weak convergent validity between the models (Brackett et al., 2006; Joseph and Newman, 2010; Webb et al., 2013) and there are discrepant results in the literature concerning the prediction of behaviour (Gómez-Leal et al., 2018; Gong and Jiao, 2019; Gutiérrez-Cobo et al., 2017; O'Boyle et al., 2011).

1.2. Emotional intelligence and risky driving behaviour

Research relating EI to risky driving behaviour is scarce and has yielded mixed findings. To our knowledge, only six studies can be found in the literature to date (Arnau-Sabatés et al., 2012; Falahi and Goudarzi, 2015; Fernández-Abascal and Martín-Díaz, 2015; Hayley et al., 2017; Malinauskas et al., 2018; Smorti et al., 2018). Although some of these studies provide support for a negative relationship between EI and risky driving behaviour (Arnau-Sabatés et al. 2012; Falahi and Goudarzi, 2015), others reveal a lack of relationship or one that depends on specific dimensions of EI or the EI model employed (Fernández-Abascal and Martín-Díaz, 2015; Hayley et al. 2017; Smorti et al. 2018). Some studies have even reported a positive relationship between these variables (Malinauskas et al. 2018).

The lack of consensus between studies could be attributable to several factors, such as the different conceptualizations of EI used (mixed model vs. ability models) or the study samples, which have been unbalanced in terms of gender and predominantly composed of young university students. Previous studies have demonstrated that gender and age have a significant impact both on levels of EI (Cabello et al., 2016, 2021; Sánchez-López et al., 2022; Sánchez-Núñez et al, 2008) and the tendency to engage in risky driving behaviours (Navas et al., 2019; Oltedal and Rundmo, 2006; Ulleberg, 2001; Ventsislavova et al., 2021). In addition, driving experience is a key factor in explaining differences in driving behaviour (Di Stasi et al., 2011; Konstantopoulos et al., 2010; Megías et al., 2018). Annual mileage and years of holding a driving license have been shown to be related to levels of perceived risk and risk-taking in driving (Cestac et al., 2011; Dingus, 2014; Forsyth et al., 1995). However, these variables have not been controlled in the previous literature examining the relationship between EI and risky driving behaviour.

1.3. The present study

The main objective of this study was to clarify the relationship between EI abilities and risky driving behaviour. We specifically expected to find that a better recognition, use, and manage of our emotions, i.e., better EI, is related to a lower tendency to engage in risky behaviours during driving. Furthermore, we were also interested in a second objective associated with the potential negative outcomes of risky driving behaviour. Because risky driving leads to a higher rate of road accidents and traffic tickets (Turner et al., 2004; WHO, 2018), we decided to explore the possible indirect effect of EI on the number of road accidents and traffic tickets through the mediating effect of risky driving behaviour.

To achieve these objectives, we assessed the tendency towards engaging in risky driving behaviour in a community sample of drivers using the Dula Dangerous Driving Index (DDDI; Dula and Ballard, 2003). For the assessment of EI, we used the Wong and Law Emotional Intelligence Scale (WLEIS; Extremera et al., 2019; Wong and Law, 2002), which is a self-report instrument based on Mayer and Salovey's conceptualization of EI as a mental ability (Mayer and Salovey, 1997; Mayer et al., 2016). We prefer to work with the ability EI model because of its greater theoretical consistency and the fact that it is focused on a specific set of abilities for the recognition, use, and control of emotions (Joseph and Newman, 2010; Mayer et al., 2016; Palmer, 2001). In addition, we controlled for the potential influence of the sociodemographic variables of gender, age, annual car mileage, and time with a driving license given the previously demonstrated influence of these variables on risky driving behaviour and EI.

In accordance with the objectives and measuring instruments described above, we proposed the following hypotheses:

H1. Total EI scores and EI abilities will be negatively related to risky driving behaviour.
H2. Risky driving behaviour will be positively related to the number of road accidents and traffic tickets.
H3. There will be a negative indirect relationship between total EI scores (and EI abilities) and the number of road accidents and traffic tickets through the mediating effect of risky driving behaviour.

2. Method

2.1. Participants

This study comprised a community sample of 555 participants. Inclusion criteria were being older than 18 years of age and to hold a valid car driving license. The participants were recruited using a snowball sampling method with the help of undergraduate students from the University of Málaga. The study was also promoted via advertisements at the Campus of the University of Málaga and social networks related to this university. Participation was always voluntary but was compensated by means of course credits and entry into a raffle to win for a 100 € Amazon voucher.

Of the total sample, 273 participants were women (49.19%) and 282 were men (50.81%). The average age was 39.34 years (SD = 13.03), ranging from 18 to 79 years. With respect to their characteristics as drivers, the average time in possession of a car driving license was 215.95 months (SD = 152.54). The mileage driven per year by car was estimated according to 12 categories (see Procedure and Instruments section), with 5.62 (SD = 2.71) being the average category selected for

the participants, which corresponded to an annual car mileage of around 9000–12000 kms.

Before starting the study, the participants were informed about their rights and the anonymity of their responses, and completed an online consent form in accordance with the Helsinki declaration (World Medical Association, 2008). The Research Ethics Committee of the University of Málaga approved the study (approval number: 10–2019-H).

2.2. Procedure and instruments

The research was conducted through the LimeSurvey online platform (https://limesurvey.org), which participants accessed through a link provided via email from the authors. Blank responses were not allowed in order to avoid missing data. The assessment instruments are described below.

At the beginning of the study, the participants were asked questions about gender, age, annual car mileage, time in possession of a car driving license in months (from now on, time with driving license), and the number of accidents and traffic tickets as a driver throughout their life. We estimated annual car mileage by following a similar procedure to that of Megías et al. (2018b) and Zhao and Wu (2012). This variable was assessed according to 12 categories: 1. "Not at all', 2. "Less than 1000kms", 3. "1000-3000kms", 4. "3000-6000kms", 5. "6000-9000kms", 6. "9000-12000kms", 7. "12000-15000kms", 8. "15000-18000kms", 9. "18000-21000kms", 10. "21000-30000kms", 11. "30000- 40000kms", and 12. "more than 40000kms".

The Wong and Law Emotional Intelligence Scale (WLEIS; Extremera et al., 2019; Wong and Law, 2002) is a self-report scale that measure ability EI. The scale is composed of 16 items divided into four subscales (4 items each): appraisal of one's own emotions (SEA), appraisal of others' emotions (OEA), use of emotion (UOE) and regulation of emotion (ROE). Responses to each item are given on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). In our sample, the scale's internal consistency was good and similar to that reported in validation studies (Cronbach's α for the WLEIS total was 0.87, and for the subscales this ranged between 0.81 and 0.90).

The Dula Dangerous Driving Index (DDDI; Dula and Ballard, 2003; Willemsen et al., 2008) is a self-report scale developed to assess individual propensities for dangerous driving behaviour. The instrument consists of 28 items divided into three subscales: risky driving, aggressive driving, and negative emotional driving. We were interested in the risky driving subscale, which contains 12 items showing different driving behaviours that can put the safety of the driver and others at risk. Participants are required to respond to each item on the following 5-point Likert scale: "1. Never", "2. Rarely", "3. Sometimes", "4. Often", and "5. Always". In our sample, the internal consistency of the risky driving subscale was acceptable and similar to previous studies (Cronbach's $\alpha = 0.80$).

2.3. Data analysis plan

First, descriptive analyses and Pearson's correlations were computed for the study variables. Second, we conducted a series of multiple linear regressions to study the relationship between WLEIS scores and risky driving (H1) and the relationship between risky driving and the number of accidents and traffic tickets (H2) after controlling for the influence of the sociodemographic variables of gender, age, annual car mileage, and time with driving license (these variables were included as predictors in each model). For the analysis of the WLEIS dimensions, we entered the four dimensions together as predictors in a single multiple linear regression model in order to identify the EI abilities that were the strongest contributors. Third, simple mediation analyses were carried out to examine the possible mediating role of risky driving in the relationship between the WLEIS scores and the number of driving accidents and traffic tickets (H3). Fourth, we were interested in identifying the direct and indirect effects of the WLEIS dimensions that best predicted the number of accidents and traffic tickets. To this end, we used mediation models in which the four WLEIS dimensions were entered as predictors and only the significant direct and indirect effects observed in the previous simple mediation analyses were included. Moreover, these analyses help to reduce the possible problems associated with multiple statistical inferences in the previous mediation analyses. The sociodemographic variables of gender, age, annual car mileage, and time with driving license were controlled in all the mediation analyses.

The descriptive analyses, Pearson's correlations, and multiple regressions were conducted using SPSS version 24.0 (IBM Corporation, Armonk NY, USA). The level of significance was set at 0.05. IBM AMOS 21.0 software was used for the mediation analyses. Indirect effects were estimated via bias-corrected bootstrapping method (1,000 samples, 95% CI).

3. Results

Descriptive statistics and Pearson's correlations of the study variables are shown in Table 1. Analysis of the correlations of interest associated with H1 revealed a significant negative relationship between WLEIS total and risky driving ($r = -0.09$, $p = .03$). With respect to the WLEIS dimensions, WLEIS SEA and WLEIS ROE also showed a significant negative relationship with risky driving (WLEIS SEA: $r = -0.12$, $p < .01$; WLEIS ROE: $r = -0.12$, $p < .01$). Regarding H2, risky driving was positively related to the number of accidents ($r = 0.17$, $p < .001$) and traffic tickets ($r = 0.20$, $p < .001$). Note that, while significant, the magnitude of these correlations was low.

Next, although this was not the aim of this study, we thought it might be of interest to describe correlations for the sociodemographic variables, along with gender differences (see Table 1 and Table S1 included as supplementary material). Age was negatively correlated with WLEIS OEA and risky driving, and positively correlated with WLEIS SEA, number of accidents, and number of traffic tickets (all $p < .05$). Annual car mileage was negatively correlated with WLEIS OEA and positively correlated with risky driving, number of accidents and number of traffic tickets (all $p < .05$). Time with driving license was negatively correlated with WLEIS OEA and risky driving and positively correlated with WLEIS SEA, WLEIS ROE, number of accidents, and number of traffic tickets (all $p < .05$). Finally, gender differences computed by t-tests revealed that women, compared with men, showed significantly higher scores for WLEIS OEA ($p < .05$) and lower scores for WLEIS ROE, risky driving, number of accidents, and number of traffic tickets (all $p < .05$). These differences support our decision to introduce these sociodemographic variables as factors to control in subsequent analyses.

In order to study, in more detail, the relationship between EI and risky driving (H1), we decided to examine, through multiple linear regression analyses, the predictive value of the WLEIS total and the WLEIS dimensions for risky driving after controlling for the sociodemographic variables. The results revealed that WLEIS total remained a significant predictor of risky driving ($\beta = -0.11$, $p < .01$). For the WLEIS dimensions (the four WLEIS dimensions were entered as predictors in a single model), WLEIS ROE was the only EI dimension that remained a significant predictor of risky driving ($\beta = -0.12$, $p = .01$). We present the complete set of statistical results for the regression models as supplementary material (Table S2).

Next, we applied a similar analytical strategy (multiple regression models controlling for sociodemographic variables) for studying the relationship between risky driving and the number of accidents and traffic tickets (H2). These analyses revealed that risky driving remained a significant predictor of the number of accidents ($\beta = 0.17$, $p < .001$) and traffic tickets ($\beta = 0.21$, $p < .001$). The complete results for the regression models are presented as supplementary material (Table S3).

Focusing on H3, we examined whether EI had an indirect effect on the number of accidents and traffic tickets through its relationship with the tendency to engage in risky driving behaviours. A simple mediation model was tested for each combination of WLEIS scores (WLEIS total or

Table 1
Descriptive statistics and Pearson's correlations for the study variables.

	$\bar{x}$ (SD)	1	2	3	4	5	6	7	8	9	10
(1) WLEIS total	5.01 (0.72)	—									
(2) WLEIS SEA	5.17 (0.89)	0.73**	—								
(3) WLEIS OEA	5.23 (0.89)	0.55**	0.28**	—							
(4) WLEIS UOE	5.03 (1.09)	0.77**	0.45**	0.20**	—						
(5) WLEIS ROE	4.59 (1.17)	0.77**	0.40**	0.18**	0.48**	—					
(6) Risky driving	1.53 (0.39)	-0.09*	-0.12**	0.03	-0.04	-0.12**	—				
(7) Number of accidents	0.83 (1.08)	-0.08	-0.01	-0.13**	-0.03	-0.06	0.17**	—			
(8) Number of traffic tickets	1.57 (2.08)	-0.06	0.02	-0.19**	0.03	-0.05	0.20**	0.35**	—		
(9) Age	39.34 (13.03)	0.02	0.11*	-0.21**	0.04	0.08	-0.22**	0.21**	0.32**	—	
(10) Annual car mileage	5.62 (2.71)	0.04	0.02	-0.09*	0.07	0.07	0.17**	0.21**	0.36**	0.11*	—
(11) Time with driving license	216.95 (152.54)	0.05	0.13**	-0.17**	0.08	0.09*	-0.13**	0.25**	0.35**	0.88**	0.17**

*p <.05, **p <.01.

one of its dimensions) as predictor, risky driving as mediator, and number of accidents or traffic tickets as criterion. The results revealed significant indirect and direct effects of WLEIS total on both the number of accidents (indirect effect: b = -0.02, 95% CI [-0.056, −0.004]; direct effect: b = -0.12, 95% CI [-0.248, −0.009]; explained variance of the model = 12%) and the number of traffic tickets (indirect effect: b = -0.06, 95% CI [-0.137, −0.009]; direct effect: b = -0.19, 95% CI [-0.378, −0.007]; explained variance of the model = 21%). With respect to the WLEIS dimensions, the mediation analyses revealed that WLEIS SEA had an indirect effect on the number of accidents (b = -0.02, 95% CI [-0.044, −0.005]) and traffic tickets (b = -0.05, 95% CI [-0.110, −0.010]). For WLEIS OEA no indirect effects were found, but a direct effect was observed on the number of traffic tickets (b = -0.25, 95% CI [-0.396, −0.081]). WLEIS UOE did not show any indirect or direct effect. Finally, WLEIS ROE showed indirect and direct effects on the number of accidents (indirect effect: b = -0.02, 95% CI [-0.042, −0.006]; direct effect: b = -0.07, 95% CI [-0.154, −0.002]) and traffic tickets (indirect effect: b = -0.05, 95% CI [-0.094, −0.015]; direct effect: b = -0.14, 95% CI [-0.282, −0.029]). None of the remaining direct and indirect effects were significant.

Finally, we were interested in identifying those WLEIS dimensions that most strongly contribute to the mediating effects of risky driving on both the number of accidents and traffic tickets. The four WLEIS dimensions were simultaneously introduced as predictors (see Fig. 1). Only the significant direct and indirect effects observed in the previous simple mediation analyses were included in each model. The results showed that the number of accidents was predicted by the indirect (via risky driving) and direct effect of WLEIS ROE (indirect effect: b = -0.02, 95% CI [-0.039, −0.003]; direct effect: b = -0.07, 95% CI [-0.154, −0.002]). This model explained 12% of the variance. In the case of the

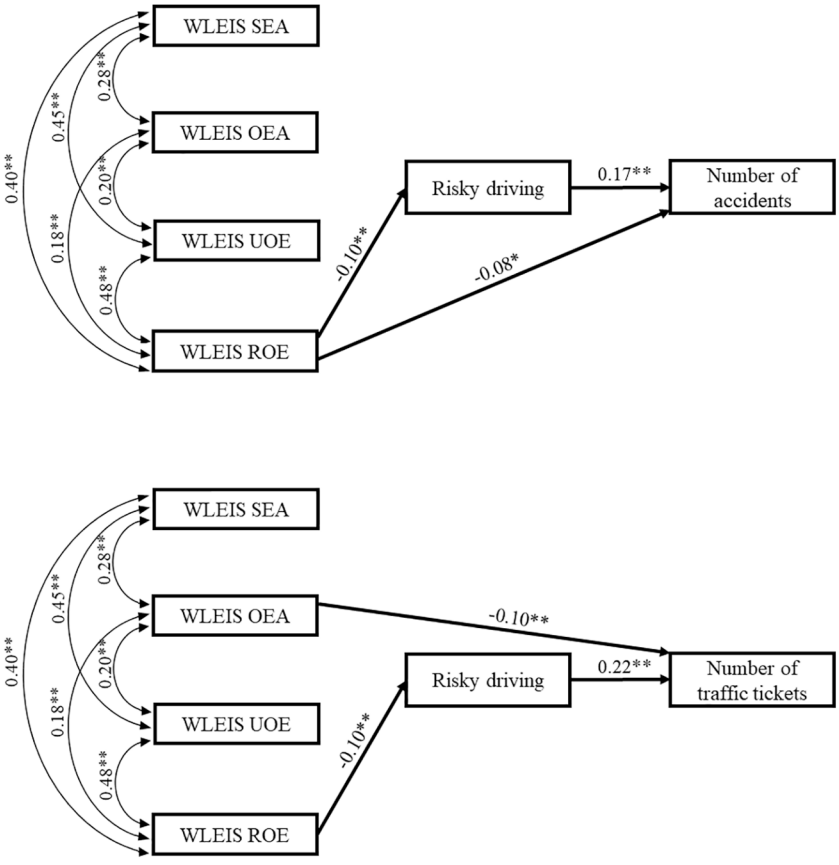

Fig. 1. Representation of the two mediation models with WLEIS dimensions as predictors and risky driving as a mediator variable. The top diagram shows the model that included the number of accidents as criterion and the bottom diagram the model that included the number of traffic tickets. For ease of interpretation, only significant paths are represented in the diagrams. Standardized path coefficients (β) are incorporated. Asterisks indicate significance level: *p <.05, **p <.01.

number of traffic tickets, this was predicted by the indirect effect of WLEIS ROE (b = -0.04, 95% CI [-0.085, −0.007]) and the direct effect of WLEIS OEA (b = -0.21, 95% CI [-0.361, −0.039]). This model explained 21% of the variance. See Fig. 1 for a graphical representation of these two models.

4. Discussion

It is clear that emotion plays an important role in explaining risk behaviour, while the latter is a critical determinant of road accidents (Turner et al., 2004; Rivers et al. 2008; Slovic, 2010; WHO, 2018). Therefore, a better understanding of the role that EI abilities play in risk-taking while driving could provide considerable benefits for road safety and society in general. The findings of this research shed new light on this question.

Focusing on each of the proposed hypotheses, first, our results provide support for H1, showing that higher levels of self-reported ability EI were associated with a lower likelihood of engaging in risky driving behaviour. The ability to regulate emotions (WLEIS ROE) was the EI ability that explained the most variance. Second, and confirming H2, a greater propensity towards risky driving behaviour was related to a higher number of accidents and traffic tickets reported throughout their life. Third, a better self-reported ability EI was also related to fewer number of road accidents and traffic tickets through the mediating effect of risky driving behaviours. In particular, the EI ability that better predicted the number of accidents was the regulation of emotions (WLEIS ROE) through both direct and indirect effects. The EI abilities that better predicted the number of traffic tickets were the appraisal of others' emotions (WLEIS OEA) via a direct effect and the regulation of emotions (WLEIS ROE) via an indirect effect.

It is important to highlight that, although significant, in general the magnitude of the relationships analysed between EI and the outcome variables was small. In fact, some of the sociodemographic variables included as control variables in the study were shown to have a similar or even stronger predictive value when compared with EI. For example, we observed a higher risk-taking propensity in men (compared with women) and a decrease in risk-taking with age, which agrees with the previous literature (Navas et al., 2019; Oltedal and Rundmo, 2006; Ulleberg, 2001; Ventsislavova et al., 2021). Moreover, annual car milage and time with driving license (when controlling for age, see Table S2) were both positively correlated with risky driving behaviour (Cestac et al., 2011). These differences suggest the need to account for these factors when studying risky driving behaviour. Importantly, our hypotheses were supported when controlling for all these variables.

Taken together, our findings seem to support the existence of a negative relationship between the levels of self-reported ability EI (mainly the ability of regulating of emotions) and the likelihood of engaging in risky driving behaviours and their associated negative consequences. As described in the Introduction section, the previous literature examining this topic had reported mixed results. We think that the present research can help to clarify these discrepancies. Specifically, our results support those reported by Arnau-Sabatés et al. (2012) and Falahi and Goudarzi (2015), although, unlike our approach, they focused on the self-report mixed model of EI. Studies such as those of Hayley et al. (2017) and Fernández-Abascal and Martín-Díaz (2015) also seem to suggest the existence of a negative relationship between EI and risky driving, but this was limited to certain EI dimensions and was dependent on the type of EI instrument used. For example, Hayley et al. (2017), using a self-report ability instrument, only found a relationship with the EI dimension of emotional recognition and expression, and Fernández-Abascal and Martín-Díaz (2015) observed that risky driving was related to EI measured by a self-report mixed instrument, but not when using a self-report ability instrument (as we used). Finally, our data are not compatible with those of Smorti et al. (2018) and Malinauskas et al. (2018), who reported no relationship or even a positive relationship between EI and risky driving. The reasons for the observed discrepancies between these findings should be examined in more depth. For example, the type of measuring instruments used or characteristics of the sample (e.g., driving experience, gender, age, or university students vs. community samples) could underlie these differences.

At a theoretical level, our findings could be explained based on the importance that decision-making models assign to emotional factors in risk-taking (Loewenstein et al., 2001; Mohr et al., 2010; Pessoa, 2008; Slovic, 2010). Emotions are experienced frequently during driving; for example, being stuck in a traffic jam, arriving late for work, or suffering the aberrant driving of another driver makes us feel frustrated, anxious, or angry. Such aroused emotional states can cause drivers to approach hazards with less caution and engage more often in reckless driving (Eherenfreund-Hager et al., 2017; Mesken et al. 2007; Stephens and Groeger, 2011). In these situations, and according with our results, an adequate perception and management of emotions would allow for controlling these emotional states during driving, which would in turn help to reduce involvement in risky behaviours.

4.1. Practical implications, limitations, and future lines of research

Our findings could have practical implications for road safety and public health. In particular, our data suggest that drivers with good EI abilities would show a lower tendency towards risk-taking, which would help to prevent road traffic accidents, and, consequently, reduce the number of deaths and serious injuries on our roads. As proposed by Ulleberg and Rundmo (2003), intervention strategies aimed at learning how to deal with emotional responses during driving could be more effective mitigating high-risk behaviours, such as speeding, drink-driving, or dangerous overtaking, than those that only inform drivers of the risk of accidents or merely ask them to change their attitudes and behaviour toward risk. RULER and INTEMO are two training programs design to improve our emotional competencies that could be adapted to the driving context (Cabello et al., 2016; Castillo et al., 2013; Nathanson et al., 2016). These programs could be included within current policies and practices in road safety that are promoted by governments and institutions. Moreover, it would be worth implementing these from an early age in schools or, at least, direct these programs towards learner drivers during their period of instruction in driving schools.

Finally, we would like to suggest some future lines of research that could help to overcome several limitations of the present study. First, our data are correlational in nature, and therefore causal inferences cannot be drawn. Experimental studies are needed to confirm the protective role of EI in risky driving. This issue will need to be addressed before applying our findings to health policies such as those discussed in the preceding paragraph. Second, the study variables were measured by self-reports. Responses in these types of instruments are based on subjective perceptions, which can be biased by social desirability or by an incorrect perception of their abilities and behaviours. The employment of performance-based EI tests (e.g., the MSCEIT questionnaire) and more realistic measures of driving behaviour using simulators or instrumented cars would help to avoid these biases and provide more objective results. Third, the magnitude of some of the significant relationships observed in this study were not particularly strong. Further studies are therefore needed to replicate our findings. Fourth, in our study sample, the drivers have been involved in a relatively small number of accidents and tickets, which, although common in a community sample, could affect our analyses. In this regard, the study of EI in particular populations of drivers such as recidivist offenders could be of special relevance. Finally, although a strength of our study was the control of the sample through the variables of gender, age and driving experience, it would be interesting to consider additional variables that have shown to be closely related to risk-taking, such as impulsivity and sensitivity to reward (Baltruschat et al., 2020; Reniers et al., 2016; Scott-Parker and Weston, 2017).

5. Conclusion

Road traffic accidents represent one of the most serious public health concerns worldwide. Unfortunately, in spite of the very commendable efforts undertaken by road safety agencies, risky driving behaviours continue to be among the most predominant factors explaining accident rates (Turner et al., 2004; WHO, 2018). Thus, there is an urgent need to apply new measures designed to reduce these behaviours. The findings of the present research suggest that drivers who self-report good abilities in EI would be less likely to behave in a risky manner while driving. This safer behaviour would then reduce the probability of potential road traffic accidents and traffic tickets. If future experimental studies are able to confirm the causal and protective role of EI in risky driving behaviour, then this would support the notion that training programs designed to improve emotional competencies could represent a useful strategy for promoting road safety.

CRediT authorship contribution statement

Alberto Megías-Robles: Conceptualization, Methodology, Formal analysis, Writing – original draft, Writing – review & editing. **María T. Sánchez-López:** Conceptualization, Formal analysis, Writing – original draft. **Pablo Fernández-Berrocal:** Conceptualization, Formal analysis, Writing – review & editing.

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.

Acknowledgment

This work was funded by the Regional Ministry of Economy and Knowledge, Junta de Andalucía (EMERGIA20_00056 and UMA18-FEDERJA-137 to Alberto Megías Robles), the Spanish Ministry of Economy, Industry and Competitiveness (PSI2017-84170-R to Pablo Fernández Berrocal), and the Spanish Ministry of Education and Vocational Training (FPU18/00610 to María T. Sánchez López).

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.aap.2022.106760.

References

Arnau-Sabatés, L., Sala-Roca, J., Jariot-Garcia, M., 2012. Emotional abilities as predictors of risky driving behavior among a cohort of middle aged drivers. Accid. Anal. Prev. 45, 818–825. https://doi.org/10.1016/j.aap.2011.07.021.

Baltruschat, S., Cándido, A., Megías, A., Maldonado, A., Catena, A., 2020. Risk proneness modulates the impact of impulsivity on brain functional connectivity. Hum. Brain Mapp. 41 (4), 943–951. https://doi.org/10.1002/hbm.24851.

Brackett, M.A., Rivers, S.E., Shiffman, S., Lerner, N., Salovey, P., 2006. Relating emotional abilities to social functioning: A comparison of self-report and performance measures of emotional intelligence. J. Pers. Soc. Psychol. 91 (4), 780–795. https://doi.org/10.1037/0022-3514.91.4.78.

Cabello, R., Castillo, R., Rueda, P., Fernández-Berrocal, P., 2016a. Programa INTEMO+. Mejorar la inteligencia emocional de los adolescentes, Pirámide.

Cabello, R., Gómez-Leal, R., Gutiérrez-Cobo, M.J., Megías-Robles, A., Salovey, P., Fernández-Berrocal, P., 2021. Ability emotional intelligence in parents and their offspring. Curr. Psychol. 1–7 https://doi.org/10.1007/s12144-021-01617-7.

Cabello, R., Sorrel, M.A., Fernández-Pinto, I., Extremera, N., Fernández-Berrocal, P., 2016b. Age and gender differences in ability emotional intelligence in adults: A cross-sectional study. Dev. Psychol. 52 (9), 1486–1492. https://doi.org/10.1037/dev0000191.

Castillo, R., Fernández-Berrocal, P., Brackett, M.A., 2013. Enhancing Teacher Effectiveness in Spain: A Pilot Study of the Ruler Approach to Social and Emotional Learning. J. Educ. Training Stud. 1 (2), 263–272. https://doi.org/10.11114/jets.v1i2.203.

Cestac, J., Paran, F., Delhomme, P., 2011. Young drivers' sensation seeking, subjective norms, and perceived behavioral control and their roles in predicting speeding intention: How risk-taking motivations evolve with gender and driving experience. Safety Sci. 49 (3), 424–432. https://doi.org/10.1016/j.ssci.2010.10.007.

DGT (Dirección General de Tráfico). (2021). *Las principales cifras de la siniestralidad vial España 2019 [The main figures of the road accident rate Spain 2019]*. DGT.

Di Stasi, L.L., Contreras, D., Cándido, A., Cañas, J.J., Catena, A., 2011. Behavioral and eye-movement measures to track improvements in driving skills of vulnerable road users: First-time motorcycle riders. Transp. Res. Part F: Traffic Psychol. Behav. 14 (1), 26–35. https://doi.org/10.1016/j.trf.2010.09.003.

Dingus, T.A., 2014. Distracted driving and risk of road crashes among novice and experienced drivers. N. Engl. J. Med. 370 (1), 54–59. https://doi.org/10.1056/NEJMsa1204142.

Dolan, R.J., 2002. Emotion, cognition, and behavior. Science 298 (5596), 1191–1194. https://doi.org/10.1126/science.1076358.

Dula, C.S., Ballard, M.E., 2003. Development and evaluation of a measure of dangerous, aggressive, negative emotional, and risky driving 1. J. Appl. Soc. Psychol. 33 (2), 263–282. https://doi.org/10.1111/j.1559-1816.2003.tb01896.x.

Eherenfreund-Hager, A., Taubman–Ben-Ari, O., Toledo, T., Farah, H., 2017. The effect of positive and negative emotions on young drivers: A simulator study. Transp. Res. Part F: Traffic Psychol. Behav. 49, 236–243. https://doi.org/10.1016/j.trf.2017.07.002.

Extremera, N., Sánchez-Álvarez, L., Rey, L., 2019. Validation of the Spanish version of Wong Law Emotional Intelligence Scale (WLEIS-S). Psicothema 31 (1), 94–100. https://doi.org/10.7334/psicothema2018.147.

Falahi, S., Goudarzi, M., 2015. Comparing the emotional intelligence and driving behaviors between the safe and risky drivers of Marivan Township. Science Arena Publ. Specialty J. Psychol. Manage. 1 (4), 60–69.

Fernández-Abascal, E.G., Martín-Díaz, M.D., 2015. Dimensions of emotional intelligence related to physical and mental health and to health behaviors. Front. Psychol. 6, 317. https://doi.org/10.3389/fpsyg.2015.00317.

Forsyth, E., Maycock, G., Sexton, B., 1995. Cohort study of learner and novice drivers: Part 3, Accidents, offences and driving experience in the first three years of driving. TRL Project Report 111. Transport Research Laboratory.

Gómez-Leal, R., Gutiérrez-Cobo, M.J., Cabello, R., Megías, A., Fernandez-Berrocal, P., 2018. The relationship between the three models of emotional intelligence and psychopathy: A systematic review. Front. Psychiatry 9, 307. https://doi.org/10.3389/fpsyt.2018.00307.

Gong, Z., Jiao, X., 2019. Are effect sizes in emotional intelligence field declining? A meta-meta analysis. Front. Psychol. 10, 1655.3514.91.4.78.

Gross, J.J., 2013. Handbook of emotion regulation, second edition. Guilford Publications.

Gutiérrez-Cobo, M.J., Cabello, R., Fernández-Berrocal, P., 2017. The three models of emotional intelligence and performance in a hot and cool go/no-go task in undergraduate students. Front. Behav. Neurosci. 11, 33. https://doi.org/10.3389/fnbeh.2017.00033.

Hayley, A.C., de Ridder, B., Stough, C., Ford, T.C., Downey, L.A., 2017. Emotional intelligence and risky driving behaviour in adults. Transp. Res. Part F: Traffic Psychol. Behav. 49, 124–131. https://doi.org/10.1016/j.trf.2017.06.009.

Iversen, H., 2004. Risk-taking attitudes and risky driving behavior Risk-taking attitudes and risky driving behaviour. Article Transp. Res. Part F Traffic Psychol. Behav. 7 (3), 135–150. https://doi.org/10.1016/j.trf.2003.11.003.

Jallais, C., Gabaude, C., Paire-Ficout, L., 2014. When emotions disturb the localization of road elements: Effects of anger and sadness. Transp. Res. Part F: Traffic Psychol. Behav. 23, 125–132. https://doi.org/10.1016/j.trf.2013.12.023.

Joseph, D.L., Newman, D.A., 2010. Emotional intelligence: An integrative meta-analysis and cascading model. J. Appl. Psychol. 95 (1), 54–78. https://doi.org/10.1037/a0017286.

Konstantopoulos, P., Chapman, P., Crundall, D., 2010. Driver's visual attention as a function of driving experience and visibility. Using a driving simulator to explore drivers' eye movements in day, night and rain driving. Accid. Anal. Prev. 42 (3), 827–834. https://doi.org/10.1016/j.aap.2009.09.022.

Lerner, J.S., Li, Y., Valdesolo, P., Kassam, K.S., 2015. Emotion and decision making. Annu. Rev. Psychol. 66 https://doi.org/10.1146/annurev-psych-010213-115043.

Loewenstein, G.F., Weber, E.U., Hsee, C.K., Welch, N., 2001. Risk as feelings. Psychol. Bull. 127 (2), 267. https://doi.org/10.1037/0033-2909.127.2.267.

Maldonado, A., Torres, M.A., Catena, A., Cándido, A., Megías-Robles, A., 2020. From riskier to safer driving decisions: The role of feedback and the experiential automatic processing system. Transp. Res. Part F: Traffic Psychol. Behav. 73, 307–317. https://doi.org/10.1016/j.trf.2020.06.020.

Malinauskas, R., Dumciene, A., Sipaviciene, S., Malinauskiene, V., 2018. Relationship between emotional intelligence and health behaviours among university students: The predictive and moderating role of gender. Biomed. Res. Int. 2018 https://doi.org/10.1155/2018/7058105.

Mayer, J.D., Salovey, P., 1997. What is emotional intelligence. In: Emotional development and emotional intelligence: Educational implications. Basic Books, p. 31.

Mayer, J.D., Caruso, D.R., Salovey, P., 2016. The Ability Model of Emotional Intelligence: Principles and Updates. Emotion Rev. 8 (4), 290–300. https://doi.org/10.1177/1754073916639667.

Megías, A., Cándido, A., Maldonado, A., Catena, A., 2018a. Neural correlates of risk perception as a function of risk level: An approach to the study of risk through a daily life task. Neuropsychologia 119, 464–473. https://doi.org/10.1016/j.neuropsychologia.2018.09.012.

Megías, A., Maldonado, A., Cándido, A., Catena, A., 2011a. Emotional modulation of urgent and evaluative behaviors in risky driving scenarios. Accid. Anal. Prev. 43 (3), 813–817. https://doi.org/10.1016/j.aap.2010.10.029.

Megías, A., Maldonado, A., Catena, A., Di Stasi, L.L., Serrano, J., Cándido, A., 2011b. Modulation of attention and urgent decisions by affect-laden roadside advertisement in risky driving scenarios. Saf. Sci. 49 (10), 1388–1393. https://doi.org/10.1016/j.ssci.2011.06.001.

Megías, A., Navas, J.F., Petrova, D., Cándido, A., Maldonado, A., Garcia-Retamero, R., Catena, A., 2015. Neural mechanisms underlying urgent and evaluative behaviors: An fMRI study on the interaction of automatic and controlled processes. Hum. Brain Mapp. 36 (8), 2853–2864. https://doi.org/10.1002/hbm.22812.

Megías, A., Petrova, D., Navas, J.F., Cándido, A., Maldonado, A., Catena, A., 2018b. Neuroanatomical variations as a function of experience in a complex daily task: A VBM and DTI study on driving experience. Brain Imaging Behav. 36 (8), 2853–2864. https://doi.org/10.1007/s11682-017-9725-8.

Mesken, J., Hagenzieker, M.P., Rothengatter, T., De Waard, D., 2007. Frequency, determinants, and consequences of different drivers' emotions: An on-the-road study using self-reports, (observed) behaviour, and physiology. Transp. Res. Part F: Traffic Psychol. Behav. 10 (6), 458–475. https://doi.org/10.1016/j.trf.2007.05.001.

Mohr, P.N., Biele, G., Heekeren, H.R., 2010. Neural processing of risk. J. Neurosci. 30 (19), 6613–6619. https://doi.org/10.1523/JNEUROSCI.0003-10.2010.

Nathanson, L., Rivers, S., Flynn, L., Brackett, M.A., 2016. Creating emotionally intelligent schools with ruler. Emot. Rev. 8, 305–310. https://doi.org/10.1177/1754073916650495.

Navas, J.F., Martín-Pérez, C., Petrova, D., Verdejo-García, A., Cano, M., Sagripanti-Mazuquín, O., Perandrés-Gómez, A., López-Martín, Á., Cordovilla-Guardia, S., Megías, A., Perales, J.C., Vilar-López, R., 2019. Sex differences in the association between impulsivity and driving under the influence of alcohol in young adults: The specific role of sensation seeking. Accid. Anal. Prev. 124, 174–179. https://doi.org/10.1016/j.aap.2018.12.024.

NHTSA, 2004. Traffic Safety Facts 2018: A Compilation of Motor Vehicle Crash Data. National Highway Traffic Safety Administration.

O'Boyle, E.H., Humphrey, R.H., Pollack, J.M., Hawver, T.H., Story, P.A., 2011. The relation between emotional intelligence and job performance: A meta-analysis. J. Org. Behav. 32 (5), 788–818. https://doi.org/10.1002/job.714.

Oltedal, S., Rundmo, T., 2006. The effects of personality and gender on risky driving behaviour and accident involvement. Saf. Sci. 44 (7), 621–628. https://doi.org/10.1016/j.ssci.2005.12.003.

Palmer, F.R., 2001. Mood and modality. Cambridge University Press.

Pessoa, L., 2008. On the relationship between emotion and cognition. Nat. Rev. Neurosci. 9 (2), 148–158. https://doi.org/10.1038/nrn2317.

Reniers, R.L., Murphy, L., Lin, A., Bartolomé, S.P., Wood, S.J., 2016. Risk perception and risk-taking behaviour during adolescence: the influence of personality and gender. PLoS One 11 (4), e0153842.

Rivers, S.E., Reyna, V.F., Mills, B., 2008. Risk taking under the influence: A fuzzy-trace theory of emotion in adolescence. Dev. Rev. 28 (1), 107–144. https://doi.org/10.1016/j.dr.2007.11.002.

Sánchez-López, M.T., Fernández-Berrocal, P., Gómez-Leal, R., Megías-Robles, A., 2022. Emotional Intelligence and Risk Behaviour: A Risk Domain-Dependent Relationship. Psichotema 34 (3), 402–409.

Sánchez-Núñez, M.T., Fernández-Berrocal, P., Montañés, J., Latorre, J.M., 2008. Does emotional intelligence depend on gender? The socialization of emotional competencies in men and women and its implications. Electr. J. Res. Educ. Psychol. 6 (2), 455–474.

Scott-Parker, B., Weston, L., 2017. Sensitivity to reward and risky driving, risky decision making, and risky health behaviour: A literature review. Transp. Res. Part F: Traffic Psychol. Behav. 49, 93–109. https://doi.org/10.1016/j.trf.2017.05.008.

Serrano, J., Di Stasi, L.L., Megías, A., Catena, A., 2014. Affective-sound effects on driving behaviour. Transport 29 (1), 100–106. https://doi.org/10.3846/16484142.2013.815133.

Shinar, D., 1998. Aggressive driving: the contribution of the drivers and the situation. Transp. Res. Part F: Traffic Psychol. Behav. 1 (2), 137–160. https://doi.org/10.1016/S1369-8478(99)00002-9.

Slovic, P., 2010. The feeling of risk: New perspectives on risk perception. Earthscan.

Smorti, M., Andrei, F., Trombini, E., 2018. Trait emotional intelligence, personality traits and social desirability in dangerous driving. Transp. Res. Part F: Traffic Psychol. Behav. 58, 115–122. https://doi.org/10.1016/j.trf.2018.06.012.

Stephens, A.N., Groeger, J.A., 2011. Anger-congruent behaviour transfers across driving situations. Cogn. Emot. 25 (8), 1423–1438. https://doi.org/10.1080/02699931.2010.551184.

Taubman-Ben-Ari, O., 2012. The effects of positive emotion priming on self-reported reckless driving. Accid. Anal. Prev. 45, 718–725. https://doi.org/10.1016/j.aap.2011.09.039.

Turner, C., McClure, R., Pirozzo, S., 2004. Injury and risk-taking behavior—a systematic review. Accid. Anal. Prev. 36 (1), 93–101. https://doi.org/10.1016/S0001-4575(02)00131-8.

Ulleberg, P., 2001. Personality subtypes of young drivers. Relationship to risk-taking preferences, accident involvement, and response to a traffic safety campaign. Transp. Res. Part F: Traffic Psychol. Behav. 4 (4), 279–297. https://doi.org/10.1016/S1369-8478(01)00029-8.

Ulleberg, P., Rundmo, T., 2003. Personality, attitudes and risk perception as predictors of risky driving behaviour among young drivers. Saf. Sci. 41 (5), 427–443. https://doi.org/10.1016/S0925-7535(01)00077-7.

Ventsislavova, P., Crundall, D., Garcia-Fernandez, P., Castro, C., 2021. Assessing willingness to engage in risky driving behaviour using naturalistic driving footage: the role of age and gender. Int. J. Environ. Res. Public Health 18 (19), 10227. https://doi.org/10.3390/ijerph181910227.

Vorhold, V., 2008. The neuronal substrate of risky choice: an insight into the contributions of neuroimaging to the understanding of theories on decision making under risk. Ann. N. Y. Acad. Sci. 1128 (1), 41–52. https://doi.org/10.1196/annals.1399.006.

Webb, C.A., Schwab, Z.J., Weber, M., DelDonno, S., Kipman, M., Weiner, M.R., Killgore, W.D., 2013. Convergent and divergent validity of integrative versus mixed model measures of emotional intelligence. Intelligence 41 (3), 149–156. https://doi.org/10.1016/j.intell.2013.01.004.

WHO, 2018. Global status report on road safety. World Health Organization.

Willemsen, J., Dula, C.S., Declercq, F., Verhaeghe, P., 2008. The Dula Dangerous Driving Index: An investigation of reliability and validity across cultures. Acc. Anal. Prevent. 40 (2), 798–806. https://doi.org/10.1016/j.aap.2007.09.019.

Wong, C.S., Law, K.S., 2002. The effects of leader and follower emotional intelligence on performance and attitude: An exploratory study. Leadership Quarterly 13 (3), 243–274. https://doi.org/10.1016/S1048-9843(02)00099-1.

World Medical Association, 2008. World Medical Association Declaration of Helsinki: ethical principles for medical research involving human subjects.

Yagil, D., 2001. Interpersonal antecedents of drivers' aggression. Transp. Res. Part F: Traffic Psychol. Behav. 4 (2), 119–131. https://doi.org/10.1016/S1369-8478(01)00018-3.

Zhang, T., Chan, A.H., Zhang, W., 2015. Dimensions of driving anger and their relationships with aberrant driving. Accid. Anal. Prev. 81, 124–133. https://doi.org/10.1016/j.aap.2015.05.005.

Zhao, G., Wu, C., 2012. The effects of driver identity on driving safety in a retrospective feedback system. Accid. Anal. Prev. 45, 354–365. https://doi.org/10.1016/j.aap.2011.08.002.