

Silent, unsafe... and underestimated? Exploring the relationships between life stress and safety issues among Spanish drivers

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Key Findings

- Life stress remains an understudied topic compared with other stress-related factors which affect driving performance.
- However, it can be considered relatively common among the Spanish driving population.
- Although stress-related awareness is relatively high, it seems not enough to affect the decision to drive.

Abstract

Almost all the recent studies addressing road safety from the approach of human factors agree that stress is one of the most considerable (but underestimated) threats for safe driving. However, evidence on the relationship between stressful life events and driver performance remains scarce. Therefore, this study aimed to assess life stress-related perceptions of Spanish drivers, as well as exploring their relationships with self-reported driving performance, decision-making and other road safety-related issues. Methods: This cross-sectional research analysed the information gathered from a nationwide sample of $n=840$ Spanish drivers responding to an electronic survey on psychosocial issues, stress-related factors and driving issues. The results show that a high percentage (75%) consider that stress may impair their driving performance, while 76.9% of drivers report having experienced at least one major stressful life event during the last year. Despite this relatively high awareness of the negative role of stress and its associated factors for driving safety, this study found that drivers tend to 'ignore the alarm signals', as they often reported keeping driving, even when noticing their driving fitness and performance might be impaired by stress-related factors. This study highlights the need to create and apply interventions aimed at informing and training drivers to identify, manage and cope with stress from different spheres, including stressful life events, as a means of potentially improving their driving safety habits and outcomes.

Keywords

Spanish drivers, stress-related factors, life stress, driving performance, road safety

Introduction

During the last 20 years, new evidence on psychosocial risk factors (especially stress-related ones) suggests not only that they might have a key role to explain negative driving safety outcomes but also that they have been traditionally underestimated by drivers as factors affecting their driving performance (Lane et al. 2020; Legree et al. 2003).

This has been hypothesised to be a negative consequence of many factors, such as overconfidence, repeated practice, lack of information and insufficient risk perception among drivers, a set of facts that could be worsening their road safety outcomes (Alonso et al. 2020a; Spencer et al. 2020). In this context, environmental, social and life-related stressors could be considered as relatively frequent, even though underreporting of their rates remains very high among many sectors of the population (Gustavson et al.

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2018, Weiten et al. 2014). Stress is a feeling of physical or emotional tension that can come from any situation or thought making one feel frustrated, furious or nervous (Koolhaas et al. 2011). Every person has experienced stress symptoms at some point in their life, since, originally, it is a feeling that alerts the subject in case of danger or challenge, being therefore necessary for survival (Soto, Orozco-Fontalvo & Useche, 2021; Koscinczuk 2014). However, the current social context makes stress increasingly linked to life situations. The body reacts excessively and maladaptively to any demand, having a negative impact on different social spheres of the person's life (Escobar et al. 2010). Life-related stressors are very variable, including health, family, economic and/or financial issues, among others.

The typical symptomatology related to stress includes emotional issues in the form of anger, irritability and/or anxiety, but also physical phenomena such as muscular tension, stomach issues and a temporary overexcitement that leads to an increase in blood pressure and heart rates, sweating, palpitations, breathing troubles and/or chest pain (Stults-Kolehmainen & Sinha 2014). This situation forces the subject to use an important part of their resources to face or mitigate these effects, thus reducing the attention paid to the surrounding environment (García et al., 2019; Myhr et al. 2019).

More specifically, there is considerable empirical evidence of the negative effects of stress on health through direct and indirect mechanisms (Nguyen et al. 2020; Stogner et al. 2020; Useche et al. 2021b). According to recent studies, stress affects and deteriorates cognitive, emotional, and behavioural functions (Pfefferbaum & Doughty 2001). The research showing the effects of stress on cognitive functioning is based on two basic approaches (Stawski et al. 2006). First, according to the theory of appraisal, when individuals deem life stressful, cognitive resources must be allocated to cope with environmental demands, thus reducing the resources available to perform cognitive functions (Bakker & Demerouti 2017, Calvo & Gutierrez-Garcia 2016). In this sense, several studies of aging have provided similar findings, indicating that individuals who report higher levels of subjective distress exhibit poor episodic memory, fluid intelligence and processing speed performance, as well as an increased risk of cognitive decline (Perrotin et al. 2017; Wilson, et al. 2005). The second method to assess the effects of stress consists of evaluating cognitive interference, intrusive off-task thoughts and images, and the intentional suppression of such intrusions that limit attentional resources used for working memory (Luna et al. 2020; Oberauer et al. 2016; Oberauer 2019; Sepp et al. 2019). Among other adverse effects of stress, the deviation of attention resources from the main task should be emphasised. In other words, the interference with recording, attention, and processing of the information affects aspects that compromise the execution of such tasks (Grover et al. 2017). Specifically,

cognitive and emotional processes associated with stress may lead to difficulties experienced in one domain transferring information to another (Rowden et al. 2011; Rowden et al. 2006).

Reducing the cognitive resources destined for certain daily activities is not especially problematic; however, there are some tasks that can be adversely affected. In this sense, some recent evidence has systematically shown how stress (approached from different theoretical models and conceptions) and driving performance are closely related, as safe driving requires balancing external and personal demands and resources, but demands often overcome the latter (Epel et al. 2018, Rowden et al. 2011, Spencer et al. 2020, Useche et al. 2021a). Also, there exists a growing body of scientific evidence endorsing the hypothesis of a relationship between stress and traffic crash rates among drivers (Legree et al. 2003).

Life-related stressors affect driving in many ways. To the previously mentioned cognitive deterioration, must be added an emotional and physical symptomatology that impairs the ability to adequately perform activities. On the one hand, a higher irritability and impatience can lead to aggressive driving. In addition, risk perception could be diminished, which may imply dangerous or inadequate behaviours (Taylor & Dorn 2006). The driving performance can be altered by muscular tension, fatigue and physical pain derived from stress. Also, other, secondary risks produced by stress (approached from the transactional perspective) must be mentioned as well, such as behavioural strategies to face the stress-related emotional and cognitive responses caused by, for instance the development of unhealthy lifestyles and the consumption of psychoactive drugs, especially alcohol (Alonso et al., 2017, Chilcoast & Menard 2003, Emo et al 2016, Marti-Belda et al. 2019, Rowden et al. 2011).

Therefore, the literature overall supports the proposition that assessing driving stress must also imply considering life events, as well as the stress generated by the traffic context itself. In this sense, interaction between the driving environment and the characteristics of the driver may take place, with particularly negative results in terms of driving safety (Rowden et al. 2011; Taylor & Dorn 2006). Said differently, a prolonged and not intervened imbalance between drivers' own cognitive, emotional and behavioural resources and the demands imposed by both life and traffic contexts can constitute a 'hazardous formula' for drivers, as well as for other road users (Useche et al. 2018). This makes it extremely more likely to observe riskier behaviours such as cognitive lapses, errors, aggressive patterns and conventional traffic violations (Wickens et al. 2008) that, in turn, remain considered by the empirical literature as related to pre-crash situations and crash rates (Lagarde et al. 2004; Legree et al. 2003).

The underexplored (or undervalued?) role of life stress on driving performance

Contrary to what has been explained so far, an essential sphere of stress remains markedly underexplored in this context, i.e. the role of stressful life events on driving performance. The scarce scientific literature available in this regard has shown that the probability of being involved in a traffic crash notably increases during the subsequent days and even months after a highly stressful event. More specifically, major events or the cumulative effect of daily hassles have been linked with detrimental road safety outcomes (Rowden et al. 2011) such as family issues (Lagarde et al. 2004), financial difficulties (Norris et al. 2000), occupational stress (Cendales et al. 2017), resulting in adverse situations at the wheel (Scott-Parker et al. 2018). Furthermore, increased exposure to acute life stressors may predict stress-related outcomes of drivers when exposed to certain traffic conditions, such as traffic jams and challenging road conditions, thus increasing their likelihood of involvement in traffic crashes (Hennessy et al. 2000). The few studies in this field confirm the need for research addressing the real influence of stressful events in the driving task, and, consequently, in road safety.

Study objective and hypothesis

The core aim of this study was to assess life stress-related perceptions of Spanish drivers, as well as exploring their relationships with self-reported driving performance, decision-making and other safety-related issues. On the basis of the aforementioned theoretical and empirical findings, it was hypothesised that (i) as per the general population, life stressful events would be relatively common among drivers, and (ii) as in other stress-related spheres, there might be a low awareness of the potentially impairing effects on driving performance.

Methods

Sample

This study analysed the data retrieved from a nationwide sample of $n=840$ Spanish drivers with a mean age of $M=37.6$ ($SD=14.9$) years, all of them of legal driving age. 466 (56%) were males, and 374 (44%) were females. Most drivers had reached high school (53.7%), or university (28.9%), and 73% of them were working, while 5.5% were dedicated to housework.

In relation to driving issues, 27.4% had driven for between 11 and 20 years, while 24.1% had driven for between 3 and 10 years. More than half of the drivers acknowledged that they had been involved in at least one crash (24% had been involved in one crash, and 34% in two or more) in the previous 12 months.

The starting (minimum) sample size was initially established as about $n=720$ individuals with an anticipated

effect size of .20, and a statistical power level of .80 assumed (Salgado 2018).

The response rate was $\approx 91\%$, as approximately 925 persons were invited to participate. There were 65 (9%) people who did not wish to participate in the survey or did not complete the questionnaire once it was started.

The sample was obtained through a convenience (non-probabilistic) sampling process, based on accessibility to the population of interest i.e. licensed Spanish drivers. For this purpose, an inter-institutional mailing list of the general population previously utilised in other studies, shared by various Spanish universities and research centers was used. Participants were invited to take part in the study through a personal invitation (e-mail) providing the link to a structured electronic survey.

As data were being received, quotas were used to cover age segments and regions with low representation in the sample. These quotas (without being too rigorous, as they did not pursue the statistical representativeness of a probabilistic design) were guided by the data provided by the national records of the Directorate-General of Traffic (DGT) and information from the Spanish National Institute of Statistics (INS) in terms of age, gender and regional distribution of the Spanish population.

This structured questionnaire was administrated during the second semester of 2019, through electronic surveys, whose duration to complete ranged between 6-22 minutes, depending on the age and literacy profiles of the respondents.

Study setting and measures

The only selection criteria for participating in this research were (i) owning any type of driving licence for four-wheeled vehicles (i.e. motorcycles were excluded), which ensured all participants were aged over 18; (ii) driving at least once a month, but not being a professional driver, and (iii) currently residing in Spain.

The questionnaire, presented in Spanish, was composed of three sections:

The first section aimed to gather basic data on participants, useful as profiling variables. These variables, mainly focused on socio-demographic features, were: *demographic variables*: gender, age, and occupation; *driving-related variables*: driving experience (years since first licensed), type of vehicle most frequently driven, usual time of driving (day/night/both), average driving hours a week, and the main reason for driving (e.g.) commute, work, leisure and/or personal motives; and *self-reported road safety records*: traffic sanctions (*finas*) received and crashes in the last 12 months. Also, drivers were asked to what extent did they consider that stress: (i) may affect overall driver performance, and (ii) may increase the

likelihood of crash involvement, using a Likert-based [0-3] scale, where 0 = not at all, and 3 = definitely.

Secondly, and in order to assess stressful life events, the questionnaire included a selection of eight items from the Social Readjustment Rating Scale (SRSS; Holmes & Rahe 1967), that present a series of life situations likely to represent significant sources of stress among individuals (Fig. 1). Cronbach's Alpha of the SRSS is 0.89 (Scully et al. 2000). It is important to note that under this approach, not all stressful events necessarily are prototypically *negative* situations, even though the most relevant ones tend to have such characteristics (e.g. sickness, loss of loved ones, financial issues). Instead, theoretically *positive* events might easily turn into sources of stress, anxiety and psychological issues, as this is the case of (e.g.) weddings, pregnancy/childbirth, or challenging situations such as exam sessions (in the academic context) and job-seeking (Hassanzadeh et al. 2017; Salm Ward 2017).

The third section of the questionnaire was only applied to those drivers who reported they had experienced at least one of the significant stressful life events included in the SRSS during the last year. They were asked about whether: (i) they kept driving during the month after the stressful event(s); and (ii) they perceived that their driving performance had been impaired as a consequence of such event(s). These two questions were structured on the basis of a dichotomic (Yes/No) scale. In order for participants to adequately answer the questionnaire, they were provided with an explanation of what 'stressful life events' are.

Ethics

This study was conducted in conformity with the Code of Ethics of the World Medical Association (Declaration of Helsinki). The Research Ethics Committee of the University Research Institute on Traffic and Road Safety (INTRAS) of the University of València (Institutional Board) was consulted, certifying that the research subject met the general ethical principles and the study was approved to be carried out in Spain (IRB number: HE000231119).

Each participant signed an informed consent statement and participated voluntarily. All the questionnaires and tests were designed and applied to ensure the anonymity of the participants and the non-existence of wrong or right answers. Data were confidential and participation was anonymous implying no potential risks for the integrity of participants.

Data Processing

For this study, descriptive analyses (frequencies and central tendency measures) were used to describe and characterise the prevalence of stress and crash-related factors among Spanish drivers.

To explore the association between driver risk levels and life stress events, drivers were firstly classified in accordance with their risk level, as follows: (i) drivers who had been fined at least once over the last year (except for parking tickets) and/or suffered more than one traffic crash were labeled as 'high risk drivers' ($n=135$; 16.1%); (ii) drivers not having suffered crashes or received fines, but having a greater risk exposure (i.e. higher average weekly driving time, that can be understood as 'driving exposure'), were considered as 'medium risk drivers' ($n=462$; 55%); and (iii) drivers not having suffered crashes nor receiving fines, added to a low-risk exposure, were classified as 'low-risk drivers' ($n=243$; 28.9%).

In regard to the statistical tests used in the study: Chi-square (χ^2) analyses were conducted to establish potential statistical associations between categorical variables. After performing normality tests and testing basic parameters, One-way Analyses of Variance (ANOVA) were used for testing potentially statistically significant outcomes in terms of stress and crash rates, according to dichotomic demographic variables (i.e. gender), and Tukey's Post hoc was used to compare variables with more than two groups, such as driver experience (divided into six levels). Once the data was obtained, the relevant statistical analyses were carried out using IBM SPSS (Statistical Package for Social Sciences), version 26.0.

Results

Stress-related perceptions and driving

The first key outcome was related to the life stress-related perceptions of Spanish drivers. Three out of four (75.4%) reported believing that stressful life events have a major impact on driving patterns. On the other hand, 21.5% considered that their effect is limited – although it exists, while 3.2% perceived that these events have no effect on driving performance. Comparative age and gender-based analyses concerning the appraisal of the negative effects of stress on driving show that neither driver age nor gender had a significant impact on continuing or avoiding driving ($p>.05$).

Regarding participants' assessments on how much stress may increase the likelihood of crash involvement, measured on a scale ranging between 0 (not at all) and 3 (definitely), found a mean of $M=2.73$ ($SD=.87$). Mean comparison tests indicated there were differences between groups of drivers, namely:

1. Reasons for driving, where participants using the vehicle for both commuting or working reasons ($M=1.51$ $SD=.89$) considered that stress increases crash likelihood to a greater extent than participants who use the vehicle for personal reasons or leisure ($M=1.40$; $SD=.79$), with $F_{(1,825)}=3.41$; $p<.050$; (One-way ANOVA between groups).

2. Drivers’ years of experience, where participants with more than 30 years ($M= 1.59$; $SD= .90$) of driving experience considered that stress has a higher impact on driving, compared with drivers with 21-30 years of experience ($M= 1.36$; $SD= .78$), with $F_{(5,789)}=2.68$; $p< .050$ (Tukey’s Post-hoc significant difference= $.22$).
3. Usual driving time (*i.e.*, day, night or both), where average scores were significantly greater among *daylight drivers* ($M= 1.51$; $SD= .75$), compared to those driving equally during both the day and night ($M= 1.33$; $SD= .74$), with $F_{(2,796)}= 5.15$; $p< .050$ (Tukey’s Post-hoc significant difference: $M_{diff}= .18$).

Other variables such as gender, age, risk exposure, type of vehicle, hours of non-stop driving, type of road most frequently used, crash involvement, penalties received over the last three years (excluding parking tickets), working status, occupation or work schedule did not report One way ANOVA-based significant differences among participants.

Life stress and safety outcomes

Among the 840 participants, over three-quarters (76.9%) admitted to having experienced at least one of the relevant life stressors listed in the research protocol, which were theoretically likely to trigger stress during the past year.

In brief, more than 40% experienced a wedding, a birth or a similar positive family-related event. On the other hand, almost 30% had faced the death or illness of a loved one; around 20% reported having a significant occupational or academic change; approximately 15% had reported negative changes on their own health or family/relationship problems; and more than 10% experienced financial or

other problems. The full set of positive and negative cases is presented in Fig. 1.

Categorical (Chi-square) analyses found that statistically significant differences existed for both gender ($\chi^2=5.03$; $p \leq 0.05$) and age ($\chi^2= 21.73$; $p \leq 0.01$). As for gender, female drivers were more prone to report having experienced at least one stressful life event (79.9%), compared with 75% of male drivers. In terms of age, drivers aged between 18-25 (88.5%) and between 26-35 (83.2%), were most likely to report experiencing a stressful event. Table 1 shows the frequency and percentage of stressful life events classified by gender and age.

Could riskier driver safety be related to life stress?

In order to answer this question, driver risk profiles (risk levels) in terms of crashes and fines were analysed against life stress. The results (Fig. 2) show how the relative frequency of drivers reporting having suffered stressful life events is considerably greater among ‘high-risk drivers’, compared to the other two groups ($\chi^2=2.890$; $p< .050$). Although there were no significant gender-based differences in terms of risk levels, Figure 2 depicts the results for the total sample and for male/female drivers.

In other words, there seems to be a relationship between the fact of having experienced relevant stressful life events and road safety-related issues such as traffic crashes and sanctions. Nevertheless, it is worth mentioning that this outcome is merely associative, as no causal inferences could be measured due to the nature of the present data.

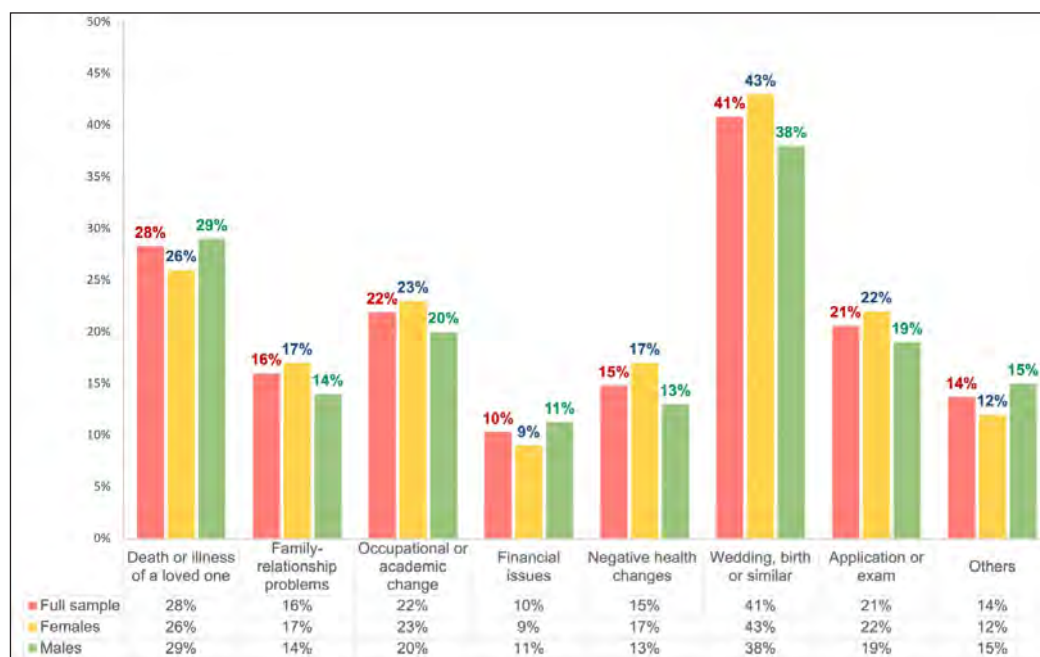


Figure 1. Self-reported stressful life events suffered among Spanish drivers (last 12 months)

Table 1. Gender and age-based distribution of self-reported stressful life events among Spanish drivers

Variable	Category	n	Experienced at least one stressful life event		Did not experience stressful life events	
			Frequency (n=646)	Percentage (76.9%)	Frequency (n=194)	Percentage (23.1%)
Gender	Female	374	299	79.9%	75	20.1%
	Male	466	347	74.4%	119	25.6%
Age group	18-25	87	77	88.5%	10	11.5%
	26-35	185	154	83.2%	31	16.8%
	36-45	243	178	73.2%	65	26.8%
	46-55	163	117	71.7%	46	28.3%
	56-65	120	89	74.1%	31	15.9%
	>65	42	31	73.8%	11	26.2%

Do life stress events affect the decision to drive?

Another question raised by this study referred to the continuing (or avoiding) driving during the following month after facing a stressful life situation. For this purpose, only those participants who indicated facing at least one significant stressful event in the last year were considered for the analysis. Therefore, a total of 646 drivers (76.9% of the full sample) responded to the following two questions: (i) *did you keep driving during the following month after experiencing such stressful situation(s)?*, and (ii) *do you consider your driving performance was substantially impaired by such event(s)?*. The results obtained are presented in Fig. 3.

Overall, 4 out of each 5 (79.6%) drivers who experienced one or more significant stressful life situations reported they kept driving during the following month after facing such event(s). A similar proportion (77.2%) considered that their driving performance had been considerably impaired because of these event(s). Finally, Chi-square tests identified a significant relationship between keeping driving after a stressful event and the belief that driving performance was lessened because of such life stress sources ($\chi^2=8.405$; $p<.001$).

Discussion

The core aim of this self-report questionnaire study was to assess life stress-related perceptions of Spanish drivers,

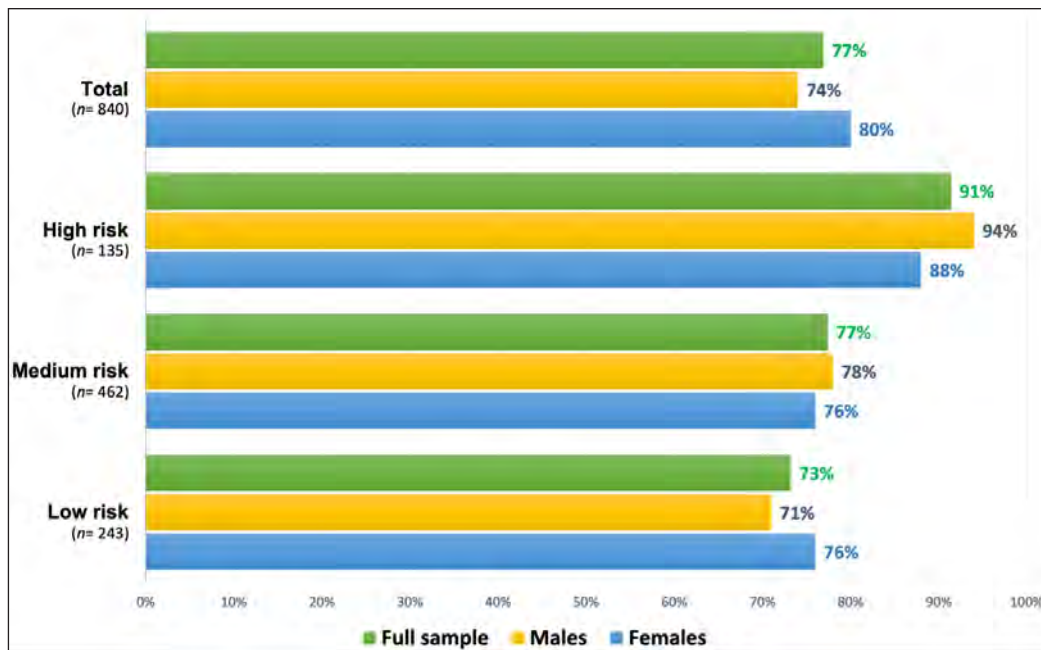


Figure 2. Percentage of drivers having suffered stressful life events according to their risk level

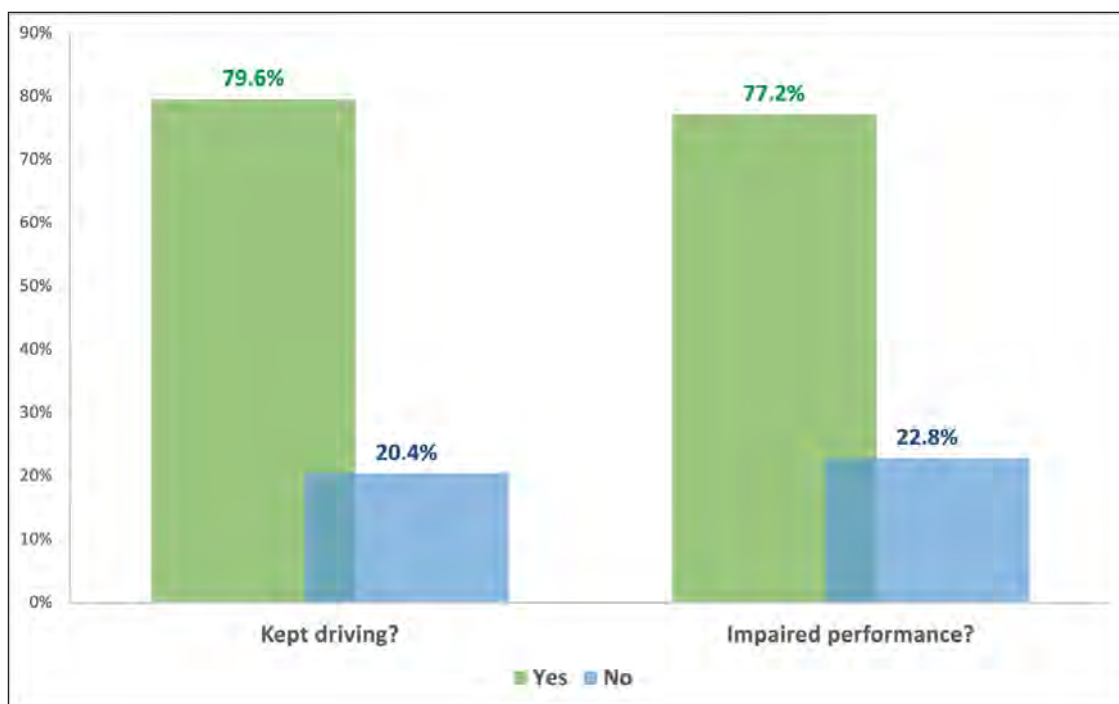


Figure 3. Decision to drive (or not) and perceived driving impairment as a result of stressful life events

as well as to explore their relationships with self-reported driving performance, decision-making and other safety-related issues. Overall, the results show how stressful life events are relatively common among the driving population, as 76.9% of the 840 study participants reported having faced such events at least once during the previous year. More specifically, this percentage was slightly greater among females (79.9%) if compared with male drivers (74.4%). This first result is consistent with other similar studies reporting the prevalence of life-related stressful events, even though mostly for the case of general population samples (Grelotti et al. 2018; Salm Ward et al. 2017).

Within these studies gender seems to be a key factor modulating the number and the impacts of these circumstances on individuals. In this case, and although there is not enough evidence to relate it to driving performance, it draws attention to how female drivers tended to report a greater prevalence of stressful life events, in comparison to males. This is consistent with previous studies, most suggesting that women tend to suffer –or at least to self-report– higher levels of stress than males (Andreou et al. 2011, Thwe et al. 2017).

Further, while 38.6% of women reported having been involved in any crashes during the previous year, in contrast with 60.8% of men who had at least a slight crash. This is, female drivers report suffering a slightly greater number of stressful situations than males, but have lower crash involvements. At a theoretical level, and far from underestimating stress as a potential source of road risk, it is possible that its value is relative, especially if the

large number of variables intervening in driving tasks, including usual road behaviours, that tend to be riskier among males are considered (Peterson et al. 2019, Useche et al. 2021a). Also, it could be considered that women are usually the main caretakers of their families, as well as being responsible for the family economy (Hodgson et al. 2013, Spence et al. 2011), implying, the so-called *caretaker load* enhances a greater number of demands usually developing in stressful situations, including having less time for oneself, the abandonment of social relationships and behavioural changes, including tasks such as driving (Pinto et al. 2017).

The study results also correlate, to a certain extent, with other studies on stress and crash rates. Different studies performed in Spain point out that young women, as well as people older than 65, have higher crash rates than men (Lardelli-Claret et al. 2003, Perez et al. 2006). The ‘impatient driver’ profile outlined in various studies, attributes this role to higher levels of stress and anxiety faced by women (Segura et al. 2009). However, it has been demonstrated that with the same levels of stress, women are usually the most capable of providing emotional support to other people, managing their stress better than their own (Bodenmann et al. 2015). This gives an interesting starting point for the elaboration of programs addressing the management of stressful driving events.

On the other hand, the scientific literature that approaches stress from a generalist perspective offers some key ideas on how certain stressful factors can negatively affect safety in driving (Rowden et al. 2011). There is empirical evidence supporting a positive association between

problems related to stress (including the different life events) and negative outcomes on the driving task (Bitkina et al. 2019; Norris et al. 2000). Moreover, some evidence (however limited) related stressful life events with (i) risky driving and (ii) involvement in crashes (Lagarde et al. 2004). Most of the evidence assessing the relationships between stress (from different approaches) and driving performance have been developing from the field of professional driving, as people who require a vehicle to perform their job-related tasks (e.g. Boada-Grau et al. 2013 and 2012; Chung & Wu 2013; Taylor & Dorn 2006, Useche et al. 2021b and 2017). However, given their considerably longer driving shifts and risk exposure, and all the driving stressors they frequently face, this study did not cover professional drivers.

The present study also found a relationship between having lived stressful life events and issues related to road safety, such as traffic accidents and fines. Therefore, there is an association between risky driving and stress, which is consistent with results from other studies. This evidence (although frequently in a very implicit way) suggests the existence of an interaction between stress and driver performance, which increases the negative emotions from stress such as aggressiveness, impatience or anger (Rowden et al. 2011). Driving under stress-related conditions has also been linked to detrimental road safety outcomes such as cognitive lapses, errors, intentional traffic violations (Wickens et al. 2008) and an increased likelihood of crash involvement (Lagarde et al. 2004). Therefore, road safety countermeasures aimed at increasing drivers awareness about stress symptomatology, coping and emotional management delivered via behaviour change education type programs could be helpful (Jawi et al. 2017; Miller 2016).

A key finding is that a high percentage of the surveyed drivers who had lived stressful life events during the previous year were still driving at the time of the data collection. This situation is problematic, as it has been proved that symptoms related to stress, such as fatigue or anger, are directly linked to road crashes (Bener et al. 2017, Duan et al. 2019; Wang et al. 2019). However, the majority of these drivers were aware that the stress produced by life events was reducing their driving performance. Thus, one must wonder why, if users are aware of this circumstance, they are still making the decision to drive, but (in absence of in-depth interviews or any other type of qualitative data) the authors remain dependent on the previous literature on the matter. In these studies, other factors potentially explaining differences in driver decision-making, such as driver income, social resources available and accessibility to other transport modes are briefly considered (Alonso et al. 2020b). Said differently, if a person, because of economic, safety, time and/or accessibility related reasons, cannot choose to travel in any other way than by car, it will be quite complicated to give it up in case of feeling unwell, being, fatigued or for any other issue (Gabrielli & Maimone, 2013).

Therefore, even though it would be ideal that people who are not in perfect condition to drive did not do so, the fact that they are aware of their state and capabilities is important. This way, understanding the symptomatology of stress and knowing to what extent it affects driving is essential to identifying when driving should be avoided (Petersen et al. 2019). However, these results contradict those of other studies where about a third of Spanish drivers underestimated the influence of other types of stress on driving performance (Alonso et al., 2021). As a consequence, it seems necessary to promote informative actions on the negative (i.e. physical, cognitive, emotional, social and behavioural) effects of stress in relation to life events and other relevant spheres also potentially affecting driver safety (Rowden et al. 2011; Taylor & Dorn 2006). Another important element in this field is the advance in fatigue-detection systems for drivers, which prevent drivers from starting the vehicle if they are not in adequate condition (Sikander & Anwar 2018).

Moreover, this study followed a dynamic transactional approach to life stressful factors, i.e. individuals' interaction with the stressful factor(s), which remain relevant as factors potentially enhancing negative outcomes (Cunningham & Regan 2016). Therefore, it is possible to state subjective stress appraisals and 'coping' as key factors potentially mediating the link between life stressors and road safety outcomes, as suggested by Calderwood et al. (2019), Rowden et al. (2011), Useche et al. (2021a).

It should be mentioned that studies in this area suggest that a holistic approach is needed to base any intervention when considering road safety as a complex process that should cover a sufficient variety of factors (Rowden et al. 2006). In the case of life stress, several fields and factors can contribute to explaining an eventual imbalance between life demands and personal resources, including driving performance, to potentially explain road safety outcomes (beyond their associations) in an analytic perspective.

Lastly, the data analysed in the present study was gathered just before the COVID-19 pandemic. Therefore, it is possible to hypothesise that the prevalence of stressful life events in many spheres might be substantially higher after the data was collected, that could impair the external validity of the results (Talaee et al. 2020). Therefore, it would be relevant to design communication campaigns directed at drivers, discussing stress symptomatology and raising awareness of its consequences for road safety. In addition, it would be interesting to include in stress-coping programs, advice for drivers to identify and prevent its negative consequences at the wheel. In this sense, future studies should aim at identifying the influence of certain stress coping techniques for vehicle management, in order to determine to what extent they could be useful in this field of study.

Limitations of the study

Although this study involved an extensive sample of Spanish drivers from all regions across the country (even though the sample is not fully representative) and the methodology followed was rather *prudent* and exploratory, there are some crucial study limitations worth acknowledging. First, this was a self-report questionnaire study. In this regard, common method biases (CMBs) could have influenced the outcomes of this research. In other words, given the heightened vulnerability of participants to socially desirable responses or inaccurate memories, the self-report data may also be a limitation (Subar et al. 2015). While efforts were made to reassure participants of the anonymity of their responses, it could not be ensured that all responses were unbiased. Secondly, social norms, prejudices and misunderstandings on the concept of ‘stress’ would have a certain influence on the study outcomes. Thirdly, at the time of asking participants about if they avoided driving, the authors did not consider nor control their actual needs or contextual circumstances (e.g., *force majeure* events, the availability of other transport means) but only their unwillingness to drive as a determinant of this behaviour. Finally, and even though a transactional definition of stress (as mentioned in this study) was provided to participants, it cannot be assumed that a total comprehension has been achieved in all cases, given the complexity of the term, which is evident even among academics and researchers.

As for further research, the authors would like to encourage other researchers to perform additional studies on this underexplored (and sometimes undervalued) research problem, involving other tools for assessing stress-related factors (e.g. psychometric measurement questionnaires), driving behaviour and road safety outcomes –and the potentially hypothesised relationships among them–, under optimal methodological assumptions.

Conclusions

The results of this study highlight that stressful life events can be considered to be relatively prevalent among Spanish drivers. Given their potential negative effects (e.g. cognitive, emotional, social and behavioural) and their relationship to impaired driving performance (as suggested by other studies), road safety countermeasures aimed at increasing the information available for drivers about stress-related awareness, coping and management might contribute to reducing potential crash risk. Furthermore, these outcomes also suggest that there could be key relationships among demographic factors (especially gender and age), life stress and driving-related decisions that remain pending to explore in depth).

Finally, and despite a relatively high awareness of the negative role of stress and its associated factors for driving safety, this study highlights that drivers tend to ‘ignore the alarm signals’, as they usually keep driving even when

noticing their driving fitness and performance might have been impaired by stress-related factors. Therefore, there is a need to provide drivers with information on how to assess stress levels, reduce stress levels, understand the possible road safety implications of stress and implement possible crash risk countermeasures associated with being stressed. As a potential scenario for it, the literature highlights the need of addressing stress-related awareness and coping in driving training processes, so they whether do not drive when stressed, or seek for reasonable sources of information and/or intervention.

Conflicts of interests

The authors declare that they have no competing interests.

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