

RESEARCH ARTICLE

WILEY

Driving cognitions, rumination, and posttraumatic stress disorder in road traffic accidents survivors

Cornelia Măirean 

Department of Psychology, Alexandru Ioan
Cuza University, Iasi, Romania

Correspondence

Cornelia Măirean, Department of Psychology,
Alexandru Ioan Cuza University of Iasi, Toma
Cozma Street, No 3. Iasi 700554, Romania.
Email: cornelia.mairean@uaic.ro

Funding information

Executive Unit for Financing Higher Educa-
tion, Research, Development and Innovation,
Grant/Award Number: PN-III-P1-1.1-
PD2016-0902

Abstract

This study evaluated the relationships between driving cognitions (i.e., panic-related cognitions, accident-related cognitions, and social-related cognitions), rumination, and posttraumatic stress disorder (PTSD) symptoms in a sample of road traffic accidents (RTAs) survivors. We also investigated the indirect effect of driving cognitions on PTSD symptoms through rumination. The sample included 633 drivers (62% were men; $M_{age} = 36.09$; standard deviation [SD] = 11.42 years). The participants completed scales measuring driving cognitions, rumination, and PTSD symptoms, as well as providing their demographic information. The results showed that all three types of driving cognitions assessed in the present study and rumination were significantly positively associated with PTSD symptoms. Furthermore, rumination mediated the relation between social-related cognitions and PTSD symptoms. The implications for PTSD treatment and future research are discussed.

KEYWORDS

driving cognitions, PTSD symptoms, rumination

1 | INTRODUCTION

All over the world, road traffic accidents represent a major source of negative psychological and physical outcomes (Veazey, Blanchard, Hickling, & Buckley, 2004). The most common psychiatric disorder following road traffic accidents (RTAs) is posttraumatic stress disorder (PTSD), characterized by intrusive distressing recollections of the traumatic event, avoidance, arousal, and negative cognitions and dispositions (APA, 2013). A significant proportion of survivors (10%–30%) display chronic PTSD symptoms, even at 12 or 18 months after the accident (Blanchard et al., 1996; Hours et al., 2013; Ozaltin, Kaptanoğlu, & Aksaray, 2004). Moreover, although the severity of some PTSD symptoms (i.e., intrusions and hyperarousal symptoms) decreased over time, the severity of other symptoms (i.e., avoidance) remained unchanged even 6 months post trauma (Wu & Cheung, 2006). Among the negative consequences of PTSD are impairments in health-related quality of life (Wang, Tsay, & Elaine Bond, 2005), as well as additional physical and psychological functional impairments (Bryant et al., 2010).

According to cognitive models of emotional disorders, dysfunctional cognitions, and maladaptive coping strategies are responsible

for the development and maintenance of PTSD symptomatology (Clark & Beck, 2010; Ehlers & Clark, 2000). Previous studies mainly focused on three types of dysfunctional cognitions—concerning the self, concerning the world, and self-blame (Barton, Boals, & Knowles, 2013; Ehling, Ehlers, & Glucksman, 2008). Specific cognitions about driving, such as concerns about having an accident, may manifest stronger associations with PTSD symptomatology, among RTAs survivors, compared with general dysfunctional cognitions. However, the relation between driving cognitions and PTSD following a RTA is less explored. Therefore, to advance the literature in the field of PTSD among RTA survivors, the aim of the present study is to assess the relation between driving-related cognitions and PTSD symptoms. Moreover, we assessed the role of rumination in the relations between driving cognitions and PTSD symptomatology. Defined as passive, repetitive, and recurrent thinking about the causes of a past life event, its meanings and consequences (Michael, Halligan, Clark, & Ehlers, 2007; Nolen-Hoeksema, 1991), rumination represent a cognitive coping strategy that was associated with PTSD symptoms both in cross-sectional (Clohessy & Ehlers, 1999) and longitudinal studies (Ehring et al., 2008; Ehring & Ehlers, 2014).

1.1 | Driving cognitions and PTSD symptomatology

Several theories of emotional disorders have identified cognitions as important in the psychopathology of PTSD. These cognitions fall broadly into the following classes: negative thoughts about oneself (e.g., a sense of the self as incompetent), self-blame regarding the trauma, and negative thoughts about the world (e.g., belief that the world is utterly dangerous; see Beck, Jacobs-Lentz, Jones, Olsen, & Clapp, 2011; Brewin & Holmes, 2003 for reviews). These types of cognitions were most often studied in relation with PTSD symptoms, using Posttraumatic Cognitions Inventory (Foa, Ehlers, Clark, Tolin, & Orsillo, 1999).

McCann and colleagues proposed the constructivist self-development theory suggesting that beliefs regarding own safety and that of others, trust, control, esteem, and intimacy determine posttraumatic reactions (McCann & Pearlman, 1990). Emotional processing theory (Foa & Riggs, 1993) is another theoretical framework sustaining the fact that cognitive distortions that the world is completely dangerous and the self is entirely incompetent increases the risk for the development of PTSD. Further, the cognitive model of PTSD developed by Ehlers and Clark (2000) suggest that negative views of trauma and its consequences contribute to the development and maintenance of PTSD symptoms by producing an ongoing sense of threat.

Among RTAs survivors, previous studies showed that negative perceptions about the self, the world, and one's responsibility for the trauma represent risk factors for PTSD development (Bennett, Beck, & Clapp, 2009; Ehling et al., 2008; O'Donnell, Elliott, Wolfgang, & Creamer, 2007). However, despite solid empirical evidence about the role of dysfunctional cognitions in PTSD development, contradictory results were also reported. For example, self-blame was not related to PTSD symptoms severity, in some samples of motor vehicle accident survivors (Beck et al., 2004; Cieslak, Benight, & Caden Lehman, 2008). A previous study showed that self-blame correlated with PTSD in samples of individuals who had interpersonal trauma but not in samples with accident-related trauma (Müller et al., 2010). On the contrary, another study showed that negative thoughts about the world and self-blame showed significant associations with PTSD in the sample of motor vehicle accident survivors but not in the sample of interpersonal violence survivors (Beck, Jones, Reich, Woodward, & Cody, 2015). Thus, the relation between cognitions and PTSD in motor vehicle accident survivors must be explored further, in order to identify cognitions that are most strongly and constantly associated with PTSD symptomatology.

Another gap in the literature consist of the fact that three types of cognitions—negative cognitions about the self, negative cognitions about the world, and self-blame—were most often studied in relation with PTSD symptoms. Few studies addressed the role of other types of cognitions (e.g., cognitions about pain, catastrophizing thoughts, and blaming others) in the development of PTSD symptoms, in samples of participants exposed to different types of trauma including RTAs (Alschuler & Otis, 2012; Beck et al., 2004; Kaczurkin et al., 2017; Scher, Suvak, & Resick, 2017). Among other cognitions less studied in relation with PTSD are driving cognitions (Ehlers et al.,

Key Practitioner Message

- Passive rumination significantly positively predicted PTSD symptoms.
- Panic-related cognitions are also significant positive predictors of PTSD symptoms.
- Rumination represents the mechanism that links social-related cognitions with PTSD symptoms.
- Helping people to change their dysfunctional cognitions related to their driving behaviour and to avoid trauma-related rumination may also be helpful for preventing the development of PTSD symptomatology.

2007). Three types of driving cognitions can be identified: those related to panic (e.g., not being able to react fast enough), accident-related ones (concerns that an accident could happen and concerns about the consequences of an accident), and social concerns (e.g., people thinking they are bad drivers). In a previous study, all three cognitions showed significant correlations with PTSD (Ehlers et al., 2007). Another study also found that concerns about future RTAs are positively associated with PTSD, at different time points after the accident (i.e., 2 weeks, 1 month, 3 months, and 6 months; Ehling et al., 2008). However, we found no other study, from the last decade, about the relations between these cognitions and PTSD symptomatology. Thus, the first aim of the present study was to examine whether the dysfunctional driving cognitions predict PTSD symptomatology. Based on previous literature, we expected a positive association between driving cognitions and PTSD symptomatology (Hypothesis 1).

1.2 | The mediating role of rumination

Cognitive strategies used to control unwanted thoughts, such as persistently thinking about the event or avoiding reminders of the event, can interfere with successful processing of a trauma. This, in turn, can lead to the development of posttraumatic symptoms (Wells, 2000). Rumination represent a general vulnerability factor for different difficulties, such as poor problem solving, more negative future thinking, negative cognitive biases, and so on (e.g., Lavender & Watkins, 2004). Moreover, rumination represent a risk factor for emotional disorders (Ehling, Ehlers, & Glucksman, 2006) being examined more often in relation with depression (Birrer & Michael, 2011). However, cognitive models of PTSD present rumination as a maladaptive cognitive processing style that maintains PTSD (Brewin & Holmes, 2003; Ehlers & Clark, 2000). Moreover, empirical studies linked trauma-related rumination with PTSD symptoms following different types of traumas, such as receiving a cancer diagnosis, stillbirth, physical or sexual assault, work-related trauma in emergency personnel, and so on (Birrer & Michael, 2011; Chan, Ho, Tedeschi, & Leung, 2011; Gul & Karanci, 2017; Horsch, Jacobs, & McKenzie-McHarg, 2015; Michael et al., 2007). Rumination is also a predictor of PTSD for RTA survivors, as was shown in previous longitudinal studies (Ehlers, Mayou, &

Bryant, 1998; Ehrling et al., 2008; Ehrling & Ehlers, 2014; Mayou, Ehlers, & Bryant, 2002) and in a review of the literature about the predictors of PTSD for RTA survivors (Heron-Delaney, Kenardy, Charlton, & Matsuoka, 2013).

Although cognitions and rumination have been shown to be individually associated with PTSD, little is known about the role of rumination in the relationship between dysfunctional cognitions and PTSD symptomatology. Previous research offers some support for the fact that dysfunctional cognitions are related to PTSD, indirectly through coping strategies (i.e., coping self-efficacy) among samples of victims of child sexual abuse and survivors of motor vehicle accident (Cieslak et al., 2008). Moreover, in a sample of medical staff indirectly exposed to trauma, negative cognitions predicted traumatic stress, indirectly through rumination (Turluc, Măirean, & Turluc, 2015). In the context of a traffic accident, individuals with dysfunctional driving cognitions might attempt to find meaning for the aversive experience (i.e., car accident) through repetitive thinking about the cause and consequences of that experience. Further, rumination is predominantly a thought process of longer duration, and it can maintain PTSD symptoms long-term after a trauma (Mayou et al., 2002; Speckens, Ehlers, Hackmann, Ruths, & Clark, 2007; Wells, 2000). In order to bring further evidence for the mechanisms that explain the relations between dysfunctional driving cognitions and PTSD symptomatology, the second aim of the present study was to investigate the role of rumination in the relations between driving cognitions and PTSD symptoms. We expected that dysfunctional driving cognitions would lead to more rumination about trauma, which further would increase the level of PTSD symptoms (Hypothesis 2). We also included a measure of travel phobia in this study, in order to assess the validity of the scale used for measuring driving cognitions, as it was developed to predict travel phobia.

2 | METHOD

2.1 | Participants and procedure

The study was conducted in a large area in the North-east of Romania. We analysed data collected as part of a larger study on the particularities of driving cognitions and behaviour. Field operators were instructed to identify drivers among personal acquaintances. They contacted the potential participants at their homes, informed them about the scope of the study, and then asked for their consent to participate in the study. The participants were informed that their responses would be kept anonymous and confidential, and they could discontinue participation in the study at any time. For the present study, participants were screened for inclusion based on the affirmative response to the question "Have you been involved in the last year in a serious motor vehicle accident (MVA) in which one or more people were seriously injured or killed?" We selected the participants that reported that the accident occurred 3–12 months ago. From the initial sample of 1,472 drivers, 633 drivers (62% were men) were selected. The participants' mean age is 36.09 (standard deviation [*SD*] = 11.42), and they had been driving for 13.49 years on average (range 0–58, *SD* = 8.90 years). During their lifetime, the participants reported that

they had been involved on average in 0.88 active accidents (produced by their fault; range 0–7, *SD* = 1.04) and in 1.64 passive accidents (range 0–18, *SD* = 1.64). Inclusion criteria were injury in a MVA, having a valid driving licence, and the accident having occurred 3–12 months before the study took place. During the accident, 67.4% of the participants were driving the cars, whereas 32.6% were passengers in the cars involved in the accident. Eight percent of our sample met the criteria for a probable diagnosis PTSD (Weathers et al., 2013).

2.2 | Instruments

2.2.1 | Driving cognitions

The *Driving Cognitions Questionnaire* (DCQ; Ehlers et al., 2007) is a 20-items scale that measures three areas of driving-related concerns: about panic (seven items; e.g., "My heart will stop beating."), accident (seven items; e.g., "I will die in an accident."), and social-related cognitions (six items; e.g., "People will think I am a bad driver."). Each item was rated according to how often each thought (i.e., item) occurs while driving, using a 5-point Likert scale from 0 (*Never*) to 4 (*Always*). Higher scores indicated higher levels of driving cognitions. In order to verify the factorial validity of the scale, we used confirmatory factor analysis. For the model fit, we applied the maximum-likelihood estimation and reported the following fit indexes: comparative fit index (CFI), and the normative fit index (NFI), root mean square error of approximation (RMSEA). The model fit the data in a satisfactory degree (Hu & Bentler, 1999): $\chi^2(77) = 87.48$, $p = 0.194$; CFI = 0.99; NFI = 0.98; RMSEA = 0.01, 90% confidence interval (CI) [0.00, 0.02]. In the present study, the Cronbach's α are 0.78 for panic-related cognition, 0.79 for accident-related cognition, and 0.78 for social-related cognition.

2.2.2 | Rumination

The *Response to Intrusion Questionnaire* (RIQ; Clohessy & Ehlers, 1999; Murray, Ehlers, & Mayou, 2002) assesses cognitive variables associated with the persistence of intrusive memories. Rumination (seven items; e.g., "I think about how life would have been different if the event had not occurred.") subscale of the RIQ was used in this study. The participants stated how frequently they experienced the items on a Likert scale ranging from 0 (*not at all*) to 3 (*always*). Higher scores indicated a high tendency to use rumination. The previous findings indicated that RIQ was a strong predictor of PTSD severity, providing support for its predictive validity (e.g., Horsch et al., 2015; Murray et al., 2002). Cronbach's α coefficient for this current sample was 0.91.

2.2.3 | Posttraumatic stress

PTSD Checklist for DSM-5 (PCL-5; Weathers et al., 2013) is a 20-item self-report scale that measures PTSD symptomatology presented in the past month. Participants were asked to think about the traffic accident in which they were involved. Then, they were asked to rate how much they were bothered by the presence of PTSD symptoms. The instrument contains four scales: intrusions (five items), avoidance (two items), alterations in mood and cognition (seven items), and arousal (six items). Items are rated on a 5-point Likert scale from 0 (*not at all*) to 4 (*extremely*). Higher scores indicated higher levels of PTSD symptoms. Confirmatory factor analysis indicated that the model fit the data adequately: $\chi^2(91) = 159.13$, $p < 0.001$; CFI = 0.99;

NFI = 0.98; RMSEA = 0.03, 90% CI [0.02, 0.04]. In the present study, the Cronbach's α are 0.86 for intrusion, 0.87 for alterations in mood and cognition, and 0.85 for arousal. For avoidance scale, we computed the Spearman–Brown reliability estimate because it has two items only (Eisinga, Te Grotenhuis, & Pelzer, 2013). The Spearman–Brown reliability coefficient is 0.72. For the total score, the Cronbach's α is 0.95.

2.2.4 | Travel phobia

The *Travel Phobia Questionnaire* (Ehring et al., 2006) is 12 items assessing the severity of travel phobia symptoms. Each item from fear subscale (e.g., *I always feel frightened when I have to drive.*) was rated using a 5-point Likert scale from 1 (*Not at all*) to 5 (*Very strongly*), whereas the items from avoidance subscale (e.g., *I avoid driving a car in bad weather conditions.*) was rated using a 5-point Likert scale from 1 (*Never*) to 5 (*Always*). A total score can be computed as the sum score of all 12 items. In the present study, we used only the total score, and the Cronbach's α was 0.83. The participants rated how much each statement was true for them in the past month.

The demographic questionnaire asked the participants to report their age, gender, their total number of kilometres covered since they obtained the driving licence, and the number of years since obtaining the driving licence.

2.3 | Data analysis

We conducted preliminary analysis to examine the descriptive statistics and the associations for all variables analysed in the present study. Then, we explored the nature of the sample depletion by comparing participants with missing data with the sample of complete data sets using the missing values analysis (Missing completely at random (MCAR), Little & Rubin, 2014). We found no systematic differences in any investigated variable, age, and sex, $\chi^2(54) = 43.16, p = 0.855$. Further, we simultaneously tested the main effects of driving cognitions and rumination on PTSD and the mediating role of rumination. A structural equation model was performed to verify whether PTSD is predicted by driving cognitions and whether these associations are mediated through rumination. Panic-related cognitions, accident-related cognitions, social-related cognitions, rumination, and PTSD were entered in the model. For the evaluation of the overall model fit, four different fit indices were used: the chi-square statistic (χ^2), the NFI, the CFI, and the RMSEA. A RMSEA < 0.05, $\chi^2/df < 3$, and NFI and CFI > 0.90 indicate a very good model fit (Hu & Bentler, 1999). In addition, we assessed the significance of the mediation effects using the Tofighi and MacKinnon's (2011) method, computing the confidence interval for the mediated effect. When zero is not in the confidence interval, the indirect effect is significantly different from zero at $p < 0.05$ (two-tailed), and thus, the effects of driving cognitions on PTSD symptoms are mediated by rumination.

3 | RESULTS

3.1 | Preliminary analysis

Descriptive statistics for the main study variables are presented in Table 1. The participants' age was negatively associated with social-related cognitions, intrusions, arousal, and the total score for PTSD

TABLE 1 Means, SDs, and minimum and maximum values of the main study variables

Variables	Mean	SD	Minimum	Maximum
1. Panic-related cognitions	2.31	2.95	0	19
2. Accident-related cognitions	3.88	3.62	0	22
3. Social-related cognitions	2.98	3.00	0	16
4. Rumination	9.83	6.17	0	26
5. Intrusions	5.22	3.03	0	15
6. Avoidance	2.26	1.54	0	7
7. Mood and cognition	6.88	3.72	0	20
8. Arousal	6.56	3.78	0	20
9. PTSD total score	20.98	11.11	0	59
10. Travel phobia	18.60	6.50	0	43

Note. $N = 633$. PTSD: posttraumatic stress disorder; SD: standard deviation.

symptoms. The number of years since obtaining the driving licence was negatively related to driving cognitions and arousal but did not significantly correlate with rumination and the total score for PTSD symptoms. Further, travel phobia was positively associated with driving cognitions, rumination, and PTSD symptoms.

We also conducted an independent samples t test comparing the male and female participants' means on the frequency of rumination and PTSD symptoms. The results showed that there are significant differences between women and men in panic-related cognitions, $t(631) = 1.98, p = 0.048$; accident-related cognitions, $t(631) = 2.06, p = 0.040$; and social-related cognitions, $t(631) = 1.96, p = 0.050$. Women reported higher scores on panic-related cognitions ($M = 2.61, SD = 2.82$), accident-related cognitions ($M = 4.26, SD = 3.53$), and social-related cognitions ($M = 3.28, SD = 3.10$) compared with men ($M = 2.13, SD = 3.03$; $M = 3.65, SD = 3.66$; $M = 2.80, SD = 2.92$). There were not significant gender differences in rumination and PTSD symptoms, $t_s < 0.15, p_s > 0.05$.

Further, we investigated the differences between drivers and passengers in driving cognitions, rumination, and PTSD symptoms. The independent sample t test revealed significant differences between drivers and passengers in panic-related cognitions, $t(632) = -2.98, p = 0.003$; social-related cognitions, $t(632) = -2.04, p = 0.042$; and PTSD symptoms, $t(632) = 4.59, p < 0.001$. Specifically, drivers reported lower scores on panic-related cognitions ($M = 2.04, SD = 2.70$) and social-related cognitions ($M = 2.80, SD = 2.83$) but higher scores on PTSD symptoms ($M = 22.52, SD = 9.67$) compared with passengers ($M = 2.85, SD = 3.36$; $M = 3.35, SD = 3.30$; $M = 17.82, SD = 13.08$).

3.2 | The associations among the main study variables

Table 2 presents the Pearson correlations of all variables from the present study. The results showed that the three types of driving-related cognitions are positively associated with rumination, intrusions, avoidance, alterations in mood and cognitions, and arousal. Moreover, rumination is positively associated with the four symptoms of PTSD. Therefore, high levels of driving cognitions and rumination are associated with a high level of PTSD symptomatology. Based on Cohen's (2013) criteria for magnitude of effect sizes, all the above

TABLE 2 Pearson correlations between all the study variables

	1	2	3	4	5	6	7	8	9	10	11
1. PC	—										
2. AC	0.64***										
3. SC	0.72***	0.65***									
4. Rumination	0.26***	0.27***	0.32***								
5. Intrusions	0.25***	0.25***	0.23***	0.29***							
6. Avoidance	0.20***	0.18***	0.22***	0.33***	0.75***						
7. Mood	0.19***	0.20***	0.22***	0.30***	0.83***	0.72***					
8. Arousal	0.23***	0.21***	0.24***	0.28***	0.82***	0.69***	0.85***				
9. PTSD	0.24***	0.23***	0.25***	0.32***	0.93***	0.81***	0.94***	0.94***			
10. DE	-0.08*	-0.10**	-0.14***	0.004	-0.07	-0.01	-0.05	-0.10**	-0.07		
11. Age	-0.03	-0.07	-0.09*	-0.01	-0.08*	-0.01	-0.07	-0.09*	-0.08*	0.95***	
12. TP	0.39***	0.31***	0.39***	0.23***	0.25***	0.25***	0.20***	0.27***	0.26***	-0.08*	-0.05

Note. $N = 633$. PC: panic-related cognitions; AC: accident-related cognitions; SC: social-related cognitions; PTSD: posttraumatic stress symptoms, total score; DE: driving experience (years of driving); TP: travel phobia.

* $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$.

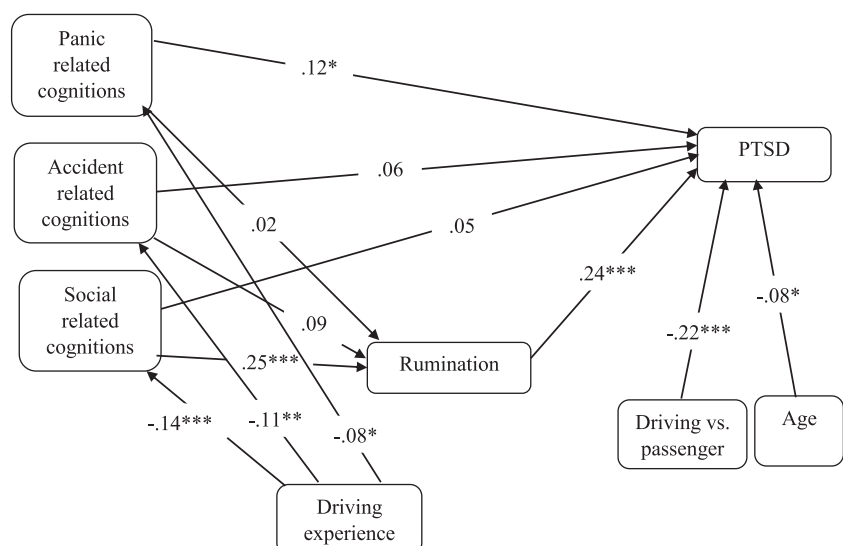
relationships are small to medium. However, the correlation between the PTSD symptoms exceed 0.80, suggesting multicollinearity (Tabachnick & Fidell, 2007). For this reason, we computed a total score for PTSD, which was used in subsequent analysis. The results showed that the total score for PTSD symptoms was significantly positively related with panic, accident, and social cognitions, as well as with rumination. In order to assess whether the correlations of DCQ with PTSD symptoms are due to its correlation with the travel phobia, we computed partial correlations of the driving cognitions and PTSD symptoms, when travel phobia was controlled. The results showed that the relations between driving cognitions and PTSD remain significant, when travel phobia was controlled (panic-related cognitions: $r(625) = 0.15$, $p < 0.001$; accident-related cognitions: $r(625) = 0.17$, $p < 0.001$; social-related cognitions: $r(625) = 0.17$, $p < 0.001$).

3.3 | Path analysis testing the study hypotheses

Then, we simultaneously tested the main effects of driving cognitions and rumination on PTSD symptoms and the mediating effect of rumination on these relations. Based on the preliminary analysis, age,

gender, the number of years since obtaining the driving licence, and the type of participant (driver vs. passenger) were included in the model as control variables because of their significant relations with driving cognitions, rumination, and PTSD symptoms. The fit for our overall model was good: $\chi^2(12) = 26.92$, $p = 0.008$; NFI = 0.98; CFI = 0.99; RMSEA = 0.04, 90% CI [0.02, 0.06]. Standardized path estimates are shown in Figure 1. The model explained 19.30% of the variance in PTSD and 11.10% of the variance in rumination. Rumination and panic-related cognitions significantly predicted PTSD symptoms ($\beta = 0.24$, $SE = 0.06$, $p < 0.001$; $\beta = 0.12$, $SE = 0.20$, $p = 0.029$, respectively). Accident-related cognitions and social-related cognitions did not predict PTSD symptoms ($\beta = 0.06$, $SE = 0.15$, $p = 0.205$; $\beta = 0.05$, $SE = 0.20$, $p = 0.336$, respectively). Further, social-related cognitions significantly predicted rumination ($\beta = 0.25$, $SE = 0.11$, $p < 0.001$), whereas accident-related cognitions and panic-related cognitions did not predict rumination ($\beta = 0.09$, $SE = 0.08$, $p = 0.073$; $\beta = 0.02$, $SE = 0.12$, $p = 0.689$, respectively). Results showed that rumination mediated the relations of social-related cognitions with PTSD, indirect effect estimate (SE) = 0.21 (0.05), 95% CI [0.113, 0.334]. However, rumination did not mediate the relation between accident-

FIGURE 1 Structural equation model and path analysis of the risk factors for and mediation of posttraumatic stress disorder (PTSD) symptoms ($N = 633$). Standardized path coefficients are reported. For readability, only significant paths for the relations between the control variables and the independent, mediator, and dependent variables were included in the figure. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.



related cognitions and PTSD symptoms, estimate (SE) = 0.06 (0.03), 95% CI [-0.003, 0.138], not between panic-related cognitions and PTSD symptoms, estimate (SE) = 0.01 (0.05), 95% CI [-0.085, 0.121].

4 | DISCUSSION

The present study investigated the relations of driving cognitions and rumination with PTSD symptomatology in a sample of RTA survivors. We also explored whether rumination acts as mediator in the relations between dysfunctional driving cognitions and PTSD.

Our results showed that panic-related cognitions, accident-related cognitions, and social-related cognitions are positively associated with intrusions, avoidance, alterations in mood and cognitions, and arousal. Therefore, if people are concerned about having an accident, about people's opinion on his or her driving behaviour, or about being panicked while driving, this may exacerbate the posttraumatic symptomatology. These results are consistent with previous studies showing that participants with dysfunctional cognitions also report the presence of PTSD symptomatology (Kaczurkin et al., 2017; Mitchell, Brennan, Curran, Hanna, & Dyer, 2017). In addition, we showed that specific cognitions related to driving situations are associated with PTSD symptoms. As far as we know, only two previous studies examined the relations between these cognitions and PTSD following a RTA (Ehlers et al., 2007; Ehling et al., 2008). Our correlations are comparable with those reported by Ehling et al. (2008), among accident-related cognitions and PTSD, but lower than those reported by Ehlers et al. (2007) between driving-related concerns and PTSD. As in our study, in Ehlers et al. (2007), the assessment of PTSD symptoms was not made soon after the accident. In their study, participants had experienced a RTA prior to participation in the study with even 2 years. Therefore, even if the occurrence of the RTA is in the past, ongoing dysfunctional cognitions relating to the risk of being involved in an accident, of losing control on the road, or about shame and fear of being criticized are related to PTSD symptomatology. However, the results of the path analysis indicated that, after controlling other relevant variables (e.g., driving experience, driving vs. passenger), accident-related cognitions and social-related cognitions did not significantly predicted PTSD symptoms. Only panic-related cognitions proved to be significant predictors of PTSD symptomatology. These results may suggest that the relation between accident- and social-related cognitions with PTSD symptoms may be moderated by other variables. The role of panic cognitions in developing and maintaining PTSD symptoms is well recognized. Panic cognitions may worsen PTSD severity through the fact that they activate trauma-related fear networks and increase arousal (Brewin & Holmes, 2003). Thus, these cognitions may be better predictors of PTSD symptoms, compared with other type of cognitions.

Moreover, in our study, driving cognitions also showed substantial correlations with travel phobia. The correlation coefficients are similar with those reported by Ehlers et al. (2007). Thus, our study showed that driving cognitions are associated with different anxiety disorders after trauma, such as travel phobia and PTSD symptoms. Moreover, the results of the current study offer further support for the convergent validity of the DCQ, revealing moderate correlations with another measure (i.e., Travel Phobia Questionnaire) that have been

developed to assess typical travel-related concerns of persons with PTSD symptomatology (Ehlers et al., 2007).

Further, our results also revealed that rumination significantly predicted PTSD symptoms. These results are in line with previous findings that also reported positive associations between rumination and PTSD (Ehring et al., 2008; Ehring & Ehlers, 2014; Michael et al., 2007). By analysing the correlations between ruminations and each PTSD symptom, we also extends previous work, by reporting similar associations with each symptom, not only with the overall assessment of the disorder. Our results also showed that rumination significantly mediates the relation between social-related cognitions and PTSD. Thus, the presence of social-related concerns is associated with a higher tendency to ruminate, which in turn is associated with a higher frequency of PTSD symptoms. As previous studies showed, passive thinking on negative issues related to the trauma heightens awareness towards threat stimuli and hinders the emotional processing of the experience, which in turn, can lead to PTSD symptomatology (Ehring, Fuchs, & Kläsener, 2009). Social concerns may predispose to ruminative thinking in a higher degree compared with other driving cognitions because they imply the feeling of being embarrassed when driving and the fact that others may observe the personal inability to adopt safe driving behaviours. Thus, not only the sense of the self as incompetent but also the shame of being criticized for this incompetence may explain the association of social-related cognitions with rumination. Because rumination may result in a temporary relief (Stallard & Smith, 2007), individuals may prefer to use it, after a traumatic experience, but they should be aware of the fact that rumination is a maladaptive cognitive coping strategy that leads to persistent symptoms (see Brewin & Holmes, 2003 for a review). Given the fact that rumination is a malleable causal risk factor for PTSD symptomatology (Querstret & Cropley, 2013), interventions should address the tendency to think passively about the past and should encourage the processing of experiences, in order to reduce the present distress.

When interpreting these results, we need to consider certain limitations. First, the cross-sectional design used in this study prohibited causal interpretations. Longitudinal designs with cross-lagged panel models and experimental designs are needed to rule out alternative causal models. Second, the method for selecting participants may represent a limitation of the study. All participants were asked to participate in this study voluntarily, without mentioning any remuneration. Two risks of the lack of randomization when selecting the sample may exist. On the one hand, the participants may be individuals who have fewer PTSD symptoms and less difficulty reporting them. On the other hand, on the contrary, the majority of the participants may be people with severe emotional problems. In both cases, a restriction of range in the severity of disorder may exist (Birrer & Michael, 2011). A further limitation consists of the fact that the participants experienced the RTA in different temporal moments, in the past year. According to the time passed since the RTA took place, the pattern of relation between driving cognitions, rumination, and PTSD symptoms may vary. However, as previous studies sustain, rumination is a process of longer duration that can maintain PTSD symptoms long-term after a traumatic event took place (Murray et al., 2002; Speckens et al., 2007). Moreover, longitudinal studies showed that PTSD might be a chronic disorder, without specific treatment, with the intensity of some symptoms remaining unchanged

since trauma was produced (Wu & Cheung, 2006). However, future studies with more controlled variables are needed to gain more insight about the risk factors for PTSD development after a RTA. Finally, some participants may have been involved in more than a single RTA, during their lifetime. Those who had been involved in multiple RTAs during their lifetime may present different responses to a similar event, compared with those who had been involved in a single RTA.

Despite these limitations, the results of the present study have theoretical and practical implications for clinical practice. From a theoretical point of view, we extended previous results by highlighting the associations of driving cognitions with PTSD symptomatology in RTAs survivors. From a practical point of view, mental health services should aim to decrease passive rumination, providing awareness of the risk of this maladaptive coping strategy for all PTSD cluster of symptoms, in the same degree. Moreover, interventions for reducing or preventing PTSD symptomatology, after an RTA, should address specific dysfunctional driving cognitions not only general dysfunctional cognitions about the self and the world. It would be useful to assess in future studies if driving cognitions have a greater predictive role in predicting PTSD symptoms, after a RTA, compared with general cognitions affected by the trauma.

In summary, the present study has provided insights into the relations between driving cognitions, rumination, and PTSD symptomatology, in a sample of RTAs survivors, revealing significant associations among these concepts. Further, the results showed that the relations between social-related cognitions and PTSD symptoms are mediated by rumination. Although more research is needed in order to better understand the mechanisms that may explain the relations between driving cognitions and PTSD symptoms, the present results may guide researchers and practitioners who are concerned about the posttraumatic reactions among RTAs survivors.

ACKNOWLEDGEMENT

This work was supported by a grant of the Executive Unit for Financing Higher Education, Research, Development and Innovation (UEFISCDI), project number PN-III-P1-1.1-PD2016-0902.

ORCID

Cornelia Măirean  <http://orcid.org/0000-0001-6895-8627>

REFERENCES

- Alschuler, K. N., & Otis, J. D. (2012). Coping strategies and beliefs about pain in veterans with comorbid chronic pain and significant levels of posttraumatic stress disorder symptoms. *European Journal of Pain*, 16, 312–319. <https://doi.org/10.1016/j.ejpain.2011.06.010>
- American Psychiatric Association (2013). *Diagnostic and statistical manual of mental disorders (DSM-5®)*. American Psychiatric Pub.
- Barton, S., Boals, A., & Knowles, L. (2013). Thinking about trauma: The unique contributions of event centrality and posttraumatic cognitions in predicting PTSD and posttraumatic growth. *Journal of Traumatic Stress*, 26, 718–726. <https://doi.org/10.1002/jts.21863>
- Beck, J. G., Coffey, S. F., Palyo, S. A., Gudmundsdottir, B., Miller, L. M., & Colder, C. R. (2004). Psychometric Properties of the Posttraumatic Cognitions Inventory (PTCI): A replication with motor vehicle accident survivors. *Psychological Assessment*, 16, 289–298. <https://doi.org/10.1037/1040-3590.16.3.289>
- Beck, J. G., Jacobs-Lentz, J., Jones, J., Olsen, S. A., & Clapp, J. D. (2011). Understanding post-trauma cognitions and beliefs. In L. Zoellner, & N. C. Feeny (Eds.), *Facilitating resilience and recovery following traumatic events* (pp. 167–190). Guilford Publications.
- Beck, J. G., Jones, J. M., Reich, C. M., Woodward, M. J., & Cody, M. W. (2015). Understanding the role of dysfunctional post-trauma cognitions in the co-occurrence of posttraumatic stress disorder and generalized anxiety disorder: two trauma samples. *Behaviour Research and Therapy*, 70, 23–31. <https://doi.org/10.1016/j.brat.2015.04.011>
- Bennett, S. A., Beck, J. G., & Clapp, J. D. (2009). Understanding the relationship between posttraumatic stress disorder and trauma cognitions: The impact of thought control strategies. *Behaviour Research and Therapy*, 47(12), 1018–1023. <https://doi.org/10.1016/j.brat.2009.07.015>
- Birrer, E., & Michael, T. (2011). Rumination in PTSD as well as in traumatized and non-traumatized depressed patients: A cross-sectional clinical study. *Behavioural and Cognitive Psychotherapy*, 39, 381–397. <https://doi.org/10.1017/S1352465811000087>
- Blanchard, E. B., Hickling, E. J., Taylor, A. E., Loos, W. R., Forneris, C. A., & Jaccard, J. (1996). Who develops PTSD from motor vehicle accidents? *Behaviour Research and Therapy*, 34, 1–10.
- Brewin, C. R., & Holmes, E. A. (2003). Psychological theories of posttraumatic stress disorder. *Clinical Psychology Review*, 23, 339–376. [https://doi.org/10.1016/S0272-7358\(03\)00033-3](https://doi.org/10.1016/S0272-7358(03)00033-3)
- Bryant, R. A., O'Donnell, M. L., Creamer, M., McFarlane, A. C., Clark, C. R., & Silove, D. (2010). The psychiatric sequelae of traumatic injury. *American Journal of Psychiatry*, 167, 312–320. <https://doi.org/10.1176/appi.ajp.2009.09050617>
- Chan, M. W., Ho, S. M., Tedeschi, R. G., & Leung, C. W. (2011). The valence of attentional bias and cancer-related rumination in posttraumatic stress and posttraumatic growth among women with breast cancer. *Psycho-Oncology*, 20, 544–552. <https://doi.org/10.1002/pon.1761>
- Cieslak, R., Benight, C. C., & Caden Lehman, V. (2008). Coping self-efficacy mediates the effects of negative cognitions on posttraumatic distress. *Behaviour Research and Therapy*, 46, 788–798. <https://doi.org/10.1016/j.brat.2008.03.007>
- Clark, D. A., & Beck, A. T. (2010). Cognitive theory and therapy of anxiety and depression: Convergence with neurobiological findings. *Trends in Cognitive Sciences*, 14, 418–424. <https://doi.org/10.1016/j.tics.2010.06.007>
- Clohessy, S., & Ehlers, A. (1999). PTSD symptoms, response to intrusive memories and coping in ambulance service workers. *British Journal of Clinical Psychology*, 38, 251–265. <https://doi.org/10.1348/014466599162836>
- Cohen, J. (2013). *Statistical power analysis for the behavioral sciences*. New York: Lawrence Erlbaum Associates.
- Ehlers, A., & Clark, D. M. (2000). A cognitive model of posttraumatic stress disorder. *Behaviour Research and Therapy*, 38, 319–345. [https://doi.org/10.1016/S0005-7967\(99\)00123-0](https://doi.org/10.1016/S0005-7967(99)00123-0)
- Ehlers, A., Mayou, R. A., & Bryant, B. (1998). Psychological predictors of chronic posttraumatic stress disorder after motor vehicle accidents. *Journal of Abnormal Psychology*, 107, 508–519. <https://doi.org/10.1037/0021-843X.107.3.508>
- Ehlers, A., Taylor, J. E., Ehring, T., Hofmann, S. G., Deane, F. P., Roth, W. T., & Podd, J. V. (2007). The driving cognitions questionnaire: Development and preliminary psychometric properties. *Journal of Anxiety Disorders*, 21, 493–509. <https://doi.org/10.1016/j.janxdis.2006.08.002>
- Ehring, T., & Ehlers, A. (2014). Does rumination mediate the relationship between emotion regulation ability and posttraumatic stress disorder? *European Journal of Psychotraumatology*, 5, 23547. <https://doi.org/10.3402/ejpt.v5.23547>
- Ehring, T., Ehlers, A., & Glucksman, E. (2006). Contribution of cognitive factors to the prediction of post-traumatic stress disorder, phobia and depression after motor vehicle accidents. *Behaviour Research and Therapy*, 44, 1699–1716. <https://doi.org/10.1016/j.brat.2005.11.013>
- Ehring, T., Ehlers, A., & Glucksman, E. (2008). Do cognitive models help in predicting the severity of posttraumatic stress disorder, phobia, and depression after motor vehicle accidents? A prospective longitudinal

- study. *Journal of Consulting and Clinical Psychology*, 76, 219–230. <https://doi.org/10.1037/0022-006X.76.2.219>
- Ehring, T., Fuchs, N., & Kläsener, I. (2009). The effects of experimentally induced rumination versus distraction on analogue posttraumatic stress symptoms. *Behavior Therapy*, 40, 403–413. <https://doi.org/10.1016/j.beth.2008.10.001>
- Eisinga, R., Te Grotenhuis, M., & Pelzer, B. (2013). The reliability of a two-item scale: Pearson, Cronbach, or Spearman-Brown? *International Journal of Public Health*, 58(4), 637–642. [https://doi.org/10.1016/S0005-7967\(99\)00123-0](https://doi.org/10.1016/S0005-7967(99)00123-0)
- Foa, E. B., Ehlers, A., Clark, D. M., Tolin, D. F., & Orsillo, S. M. (1999). The posttraumatic cognitions inventory (PTCI): Development and validation. *Psychological Assessment*, 11, 303–314. <https://doi.org/10.1037/1040-3590.11.3.303>
- Foa, E. B., & Riggs, D. S. (1993). Post-traumatic stress disorder in rape victims. In J. Oldham, M. B. Riba, & A. Tasman (Eds.), *American psychiatric press review of psychiatry* (ed., Vol. 12) (pp. 273–303). Washington, DC: American Psychiatric Press.
- Gul, E., & Karanci, A. N. (2017). What determines posttraumatic stress and growth following various traumatic events? A study in a Turkish community sample. *Journal of Traumatic Stress*, 30, 54–62. <https://doi.org/10.1002/jts.22161>
- Heron-Delaney, M., Kenardy, J., Charlton, E., & Matsuoka, Y. (2013). A systematic review of predictors of posttraumatic stress disorder (PTSD) for adult road traffic crash survivors. *Injury*, 44, 1413–1422. <https://doi.org/10.1016/j.injury.2013.07.011>
- Horsch, A., Jacobs, I., & McKenzie-McHarg, K. (2015). Cognitive predictors and risk factors of PTSD following stillbirth: A short-term longitudinal study. *Journal of Traumatic Stress*, 28, 110–117. <https://doi.org/10.1002/jts.21997>
- Hours, M., Chossegros, L., Charnay, P., Tardy, H., Nhac-Vu, H. T., Boisson, D., ... Laumon, B. (2013). Outcomes one year after a road accident: results from the ESPARR cohort. *Accident Analysis & Prevention*, 50, 92–102. <https://doi.org/10.1016/j.aap.2012.03.037>
- Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6, 1–55. <https://doi.org/10.1080/10705519909540118>
- Kaczurkin, A. N., Zang, Y., Gay, N. G., Peterson, A. L., Yarvis, J. S., Borah, E. V., ... Young-McCaughan, S. (2017). Cognitive emotion regulation strategies associated with the DSM-5 posttraumatic stress disorder criteria. *Journal of Traumatic Stress*, 30, 343–350. <https://doi.org/10.1002/jts.22202>
- Lavender, A., & Watkins, E. (2004). Rumination and future thinking in depression. *British Journal of Clinical Psychology*, 43, 129–142. <https://doi.org/10.1348/014466504323088015>
- Little, R. J., & Rubin, D. B. (2014). *Statistical analysis with missing data* (Vol. 333). New York: John Wiley & Sons.
- Mayou, R. A., Ehlers, A., & Bryant, B. (2002). Posttraumatic stress disorder after motor vehicle accidents: 3-year follow-up of a prospective longitudinal study. *Behaviour Research and Therapy*, 40, 665–675. [https://doi.org/10.1016/S0005-7967\(01\)00069-9](https://doi.org/10.1016/S0005-7967(01)00069-9)
- McCann, I. L., & Pearlman, L. A. (1990). Vicarious traumatization: A framework for understanding the psychological effects of working with victims. *Journal of Traumatic Stress*, 3, 131–149. <https://doi.org/10.1002/jts.2490030110>
- Michael, T., Halligan, S. L., Clark, D. M., & Ehlers, A. (2007). Rumination in posttraumatic stress disorder. *Depression and Anxiety*, 24, 307–317. <https://doi.org/10.1002/da.20228>
- Mitchell, R., Brennan, K., Curran, D., Hanna, D., & Dyer, K. F. (2017). A meta-analysis of the association between appraisals of trauma and posttraumatic stress in children and adolescents. *Journal of Traumatic Stress*, 30, 88–93. <https://doi.org/10.1002/jts.22157>
- Müller, J., Wessa, M., Rabe, S., Dörfel, D., Knaevelsrud, C., Flor, H., ... Karl, A. (2010). Psychometric properties of the Posttraumatic Cognitions Inventory (PTCI) in a German sample of individuals with a history of trauma. *Psychological Trauma Theory Research Practice and Policy*, 2, 116–125. <https://doi.org/10.1037/a0018603>
- Murray, J., Ehlers, A., & Mayou, R. A. (2002). Dissociation and post-traumatic stress disorder: Two prospective studies of road traffic accident survivors. *The British Journal of Psychiatry*, 180, 363–368. <https://doi.org/10.1192/bjp.180.4.363>
- Nolen-Hoeksema, S. (1991). Responses to depression and their effects on the duration of depressive episodes. *Journal of Abnormal Psychology*, 100, 569–582. <https://doi.org/10.1037/0021-843X.100.4.569>
- O'Donnell, M. L., Elliott, P., Wolfgang, B. J., & Creamer, M. (2007). Post-traumatic appraisals in the development and persistence of posttraumatic stress symptoms. *Journal of Traumatic Stress*, 20(2), 173–182. <https://doi.org/10.1002/jts.20198>
- Ozaltin, M., Kaptanoğlu, C., & Aksaray, G. (2004). Acute stress disorder and posttraumatic stress disorder after motor vehicle accidents. *Turkish Journal of Psychiatry*, 15, 16–25.
- Querstret, D., & Copley, M. (2013). Assessing treatments used to reduce rumination and/or worry: A systematic review. *Clinical Psychology Review*, 33(8), 996–1009. <https://doi.org/10.1016/j.cpr.2013.08.004>
- Scher, C. D., Suvak, M. K., & Resick, P. A. (2017). Trauma cognitions are related to symptoms up to 10 years after cognitive behavioral treatment for posttraumatic stress disorder. *Psychological Trauma: Theory, Research, Practice, and Policy*, 9(6), 750–757. <https://doi.org/10.1037/tra0000258>
- Speckens, A. E., Ehlers, A., Hackmann, A., Ruths, F. A., & Clark, D. M. (2007). Intrusive memories and rumination in patients with post-traumatic stress disorder: A phenomenological comparison. *Memory*, 15, 249–257. <https://doi.org/10.1080/09658210701256449>
- Stallard, P., & Smith, E. (2007). Appraisals and cognitive coping styles associated with chronic post-traumatic symptoms in child road traffic accident survivors. *Journal of Child Psychology and Psychiatry*, 48, 194–201. <https://doi.org/10.1111/j.1469-7610.2006.01692.x>
- Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics* (5th ed.). Boston: Allyn and Bacon.
- Tofighi, D., & MacKinnon, D. P. (2011). RMediation: An R package for mediation analysis confidence intervals. *Behavior Research Methods*, 43, 692–700. <https://doi.org/10.3758/s13428-011-0076-x>
- Turliuc, M. N., Măirean, C., & Turliuc, M. D. (2015). Rumination and suppression as mediators of the relationship between dysfunctional beliefs and traumatic stress. *International Journal of Stress Management*, 22, 306–322. <https://doi.org/10.1037/a0039272>
- Veazey, C. H., Blanchard, E. B., Hickling, E. J., & Buckley, T. C. (2004). Physiological responsiveness of motor vehicle accident survivors with chronic posttraumatic stress disorder. *Applied Psychophysiology and Biofeedback*, 29, 51–62.
- Wang, C. H., Tsay, S. L., & Elaine Bond, A. (2005). Post-traumatic stress disorder, depression, anxiety and quality of life in patients with traffic-related injuries. *Journal of Advanced Nursing*, 52, 22–30. <https://doi.org/10.1111/j.1365-2648.2005.03560.x>
- Weathers, F. W., Litz, B. T., Keane, T. M., Palmieri, P. A., Marx, B. P., & Schnurr, P. P. (2013). *The PTSD checklist for DSM-5 (PCL-5)*. Scale available from the National Center for PTSD at www.ptsd.va.gov.
- Wells, A. (2000). *Emotional disorders and metacognition: Innovative cognitive therapy*. Chichester, UK: Wiley.
- Wu, K. K., & Cheung, M. W. (2006). Posttraumatic stress after a motor vehicle accident: A six-month follow-up study utilizing latent growth modeling. *Journal of Traumatic Stress*, 19, 923–936. <https://doi.org/10.1002/jts.20178>

How to cite this article: Măirean C. Driving cognitions, rumination, and posttraumatic stress disorder in road traffic accidents survivors. *Clin Psychol Psychother*. 2019;26:47–54. <https://doi.org/10.1002/cpp.2329>