

# A Cognitive-Behavioral Standpoint on the Perceived Consequences of a Major Seismic Event in Relation to Optimism and Pre-hazard Emotional Distress

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**Abstract** The study examined a circumscribed class of cognitions (i.e., dispositional optimism and perceived consequences) in connection to the emotional distress experienced in anticipation of a major seismic event (i.e., pre-hazard emotional distress). Grounded on cognitive-behavioral theory, it was argued that dispositional optimism exerts distal influence on distress, while the perceived consequences of a major seismic event are proximal to distress and, therefore, interpose the optimism-distress relationship. The hypothesis was tested via a cross-sectional study on a sample of 189 volunteers located in areas of high seismic hazard. Participants reported their level of pre-hazard emotional distress, their dispositional optimism, and their perceived consequences of a major seismic hazard. The results showed that there was a partial indirect effect from dispositional optimism to emotional distress via perceived consequences, indirect effect =  $-0.190$ , SE =  $0.114$ , 95 % CI [ $-0.487$ ;  $-0.021$ ],  $k^2 = 0.051$ . These findings could inform future prevention programs targeting emotional distress in anticipation of a natural hazard with impact on post-disaster recovery.

**Keywords** Distress · Seismic hazard · Optimism · Perceived consequences · CBT

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## Introduction

Currently, there is a tendency to focus on emotional distress only after a natural disaster has occurred (e.g., Lowe et al. 2010). However, the emotional distress experienced in anticipation of a natural hazard (i.e., pre-hazard emotional distress) can be debilitating, as well (e.g., Esperanza et al. 2008). Though under investigated, pre-hazard emotional distress is important for two reasons. First, pre-hazard emotional distress interferes with one's daily wellbeing (Esperanza et al. 2008). Second, as earlier reviews suggest, post-impact psychological consequences are partially determined by pre-impact psychological problems (e.g., Gerrity and Flynn 1997; Norris et al. 2002; Perry and Lindell 1978). For instance, Weems et al. (2007) showed that pre-impact<sup>1</sup> trait anxiety predicted post-event depressive symptoms in youths after hurricane Katrina, whereas the pre-impact negative affect predicted disaster-related posttraumatic stress and generalized anxiety disorder symptoms. As such, viewing pre-hazard emotional distress as a vulnerability factor in the diathesis-stress model (Zuckerman 1999) could help explain why in interaction with natural hazards, such as an earthquake, some people tend to develop posttraumatic responses, while others do not.

Given that natural hazards can be hard to predict and are difficult to prevent (Lindell et al. 2006), it can be argued that the simple thought of such an event ever happening can have the attributes of an uncontrollable chronic stressor, which can lead to high emotional distress and even mental health consequences. This example is all the more relevant in the case of a prospective major seismic event, which is perceived as even more uncontrollable on account of its low predictability rates.

Naturally, in order to aim to ameliorate a pre-hazard emotional distress, more fundamental studies are needed on what triggers such a response. As previously mentioned, one's subjective perceptions (thoughts) about its environment could trigger pre-hazard emotional distress. In this case, one of the most evidence-based frameworks aimed at explaining the cognitive vulnerability underlying emotional distress is the *cognitive-behavioral theory* (CBT; Ellis 1994; Beck 1995). In fact, to our knowledge, this is the first study to explain the pre-hazard emotional distress via the cognitive-behavioral theory.

At the core of CBT lays the *ABC model* (Ellis 1994; Beck 1995). According to this model, various events (**A**; e.g., “The estimated risk of a major earthquake is high”) trigger maladaptive cognitions or beliefs (**B**; e.g., low frustration tolerance—“I cannot tolerate the thought of an earthquake”) which cause emotional and behavioral consequences (**C**; e.g., emotional distress, avoidance). Therefore, according to this view, it is not the event per se (i.e., the **A**) that generates emotional distress, but the maladaptive evaluation of the event. In other words, *how* the event is cognitively perceived, whether “I can tolerate this idea or not”. Within the CBT framework, emotional distress (**C**) is managed via cognitions/beliefs (**B**) about the stressor (Beck 1995; Ellis 1994), which can be, for instance, a prospective natural hazard, meaning **A** in the *ABC sequence*.

<sup>1</sup> Pre-hazard was a term chosen to suggest the potential for an extreme environmental event, while pre-impact was chosen to refer to the actual impact of an extreme environmental event.

The ABC model can also be contrasted to the *Social Amplification of Risk Framework* (SARF; Kasperson et al. 1988). The main thesis of this framework is that “hazards interact with psychological, social, institutional, and cultural processes in ways that amplify or attenuate public responses to the risk or risk event” (Kasperson et al. 1988, pp. 177). In turn, these amplified risk models lead to responses, which result in secondary output (e.g., immigration). In other words, the way hazards (**A**) are seen is largely dependent on perceptions (**B**). Moreover, the **B**s result in micro-level (an individual’s emotional distress) and macro-level (e.g., immigration) consequences (**C**).

## Overview of the Present Study

Given the importance of pre-hazard emotional distress (**C**) for the wellbeing of an individual, the aim of the current paper is to shed some light on the cognitive factors (**B<sub>G</sub>**—dispositional optimism and **B<sub>S</sub>**—and perceived consequences) that influence this emotional response experienced in anticipation of a major seismic event (**A**). As such, the paper focuses on **B<sub>G</sub>**—general and **B<sub>S</sub>**—specific beliefs with respect to a prospective major seismic event. Of note, the current paper opens a novel line of research. Namely, it bridges the gap between environmental psychology and cognitive/clinical psychology by testing the relevance of CBT’s ABC model in the context of an environmental issue.

Drawing from CBT insights, the present study specifically focused on a circumscribed class of cognitions (i.e., dispositional optimism and perceived consequences) in connection to the emotional distress experienced in anticipation of a major seismic event (7–8 on the Richter scale). The *perceived consequences* of a major seismic event were chosen not only because they are a specific class of risk perceptions or expectancies (Brewer et al. 2007), but because an event (**A**) becomes more menacing to one’s wellbeing when thinking of its expected consequences. In the current paper, perceived consequences are operationalized via the likelihood of being significantly affected by a seismic hazard (e.g., “*A prospective seismic hazard would ruin me financially*”).

From a CBT perspective, both dispositional optimism and perceived consequences are expectancies, therefore, beliefs (**B**s). While dispositional optimism entails general positive expectancies about the future (Carver and Scheier 2014); perceived consequences are specific expectancies regarding the likelihood of being significantly affected by a seismic hazard. Namely, dispositional optimism (**B<sub>G</sub>**) reflects a general or trait-like style of thinking that can bias more context-specific thoughts or perceptions of an event (**B<sub>S</sub>**). In fact, this general-specific belief sequence is common within the ABC model, where general or trait beliefs are reflected in specific beliefs (e.g., the case of maladaptive beliefs; Ellis 1994; Vîslă et al. 2015).

In relation to distress, both types of expectancies are good predictors of distress in stressful situations (e.g., Podina and Vîslă 2014). In relation to each other, it is expected that the more optimistic a person is, the lower is his/hers perceived

likelihood of being significantly affected by a seismic hazard (*optimism bias*; Weinstein 1980).

Grounded on the CBT framework, where general cognitions manifest through specific cognitions (Ellis 1994), it can be hypothesized that dispositional optimism is a distal/trait-like influencing factor on distress, while perceived or expected consequences are more proximal to distress. As such, in the current study, we investigated whether perceived consequences interpose the relationship between dispositional optimism and emotional distress in response to a prospective major seismic event. The suggested hypothesis was tested via a cross-sectional study on a sample of volunteers from cities located in areas of seismic hazard.

## Method

### Participants

One hundred eighty-nine participants from the general population (mean age = 35.89, SD = 14.17) took part in the study. All the participants were adults (over 18 years old) selected from earthquake epicenter hotspots (i.e., mainly located in the south-central and south-eastern parts of Romania). The epicenter hotspots were selected based on published probabilistic hazard maps for Romania (e.g., Ardeleanu et al. 2005). Access to these areas was ensured by instructed research assistants, who also aided with the implementation of the study on inhabitants of these earthquake epicenter hotspots.

The gender distribution was 40.7 % males ( $n = 77$ ) and 59.3 % females ( $n = 112$ ). Of note, 27 % of the participants experienced a 7.2 degree earthquake approximately 40 years ago (in their childhood); therefore, we ran the analysis with and without this sample. The results presented here did not differ significantly when these participants were excluded. Consequently, we report the results for the entire sample size. Participants signed an informed consent prior to their enrollment in the study. The study was approved by the University's Review Board.

### Instruments

#### *Dispositional Optimism*

The Life Orientation Test–Revised Form (LOT-R; Scheier et al. 1994) was used to measure dispositional optimism (i.e., generalized positive outcome expectancies). It includes items, which tap into the belief that good things will occur (optimism), and the belief that bad things will not occur (low pessimism). Its scores range from 0 to 24 with higher scores indicating higher optimism. Previous research has documented good psychometric properties for LOT-R (e.g., Skolarus et al. 2012; Podina and Vișlă 2014). In the current study, Cronbach's alpha ( $\alpha$ ) showed adequate internal consistency ( $\alpha = 0.879$ ).

### *Emotional Distress*

Profile of Emotional Distress (PED; Opris and Macavei 2007) is an instrument designed to assess the subjective dimension of negative feelings (affect). It consists of 26 adjectives describing negative emotions. For the purposes of this study, a modified version of this instrument was used. While the standard PED version entailed a distress assessment over the two last weeks, the modified version required the participants to rate the emotional distress experienced when thinking of the proximate likelihood (e.g., next 3-year interval) of a major seismic event. The global score was used in the current study as an index of emotional distress, where higher scores meant higher distress. The scale has demonstrated high reliability both previously (Opris and Macavei 2007) and in the current study ( $\alpha = 0.940$ ).

### *Perceived Consequences of a Seismic Hazard*

In order to assess perceived consequences of a seismic hazard, a subscale pertaining to a 39-item questionnaire was used (Armaş and Avram 2008; Armaş 2006). This questionnaire is usually divided into three parts: (1) demography; (2) risk perceptions, and (3) the level of adaptation to seismic risk. For the purposes of the current study we selected the 14-item risk perception subscale. This subscale focuses on the perceived consequences of a major seismic event, a dimension of risk perceptions (Brewer et al. 2007). Perceived consequences are operationalized via the likelihood of being significantly affected by a seismic hazard (e.g., “A prospective seismic hazard would ruin me financially” or “A prospective seismic hazard would kill me”). The anchors for the risk perception items varied on a 5-point Likert scale, ranging from “Not at all likely” (0) to “Almost a certainty” (4). As such, higher scores on the subscale reflected a higher perceived likelihood being significantly affected (e.g., dying) by a seismic hazard, in the event of its occurrence. The subscale, along with the whole questionnaire, has been successfully used in relation to seismic hazard topics, showing good psychometric properties (Armaş and Avram 2008; Armaş 2006). Similarly to other publications, in our sample, Cronbach’s alpha ( $\alpha$ ) showed a good internal consistency ( $\alpha = 0.812$ ).

### **Procedure and Data Analysis**

The design of the study was cross-sectional. As such, after filling in an informed consent, participants reported their level of emotional distress when thinking of the proximate likelihood (e.g., next 3-year interval) of a major seismic event (7–8 on the Richter scale) in their place of residence. The participants also filled-in assessments of their general dispositional optimism and the likelihood of being significantly affected by a seismic hazard. The order of the instruments was counterbalanced per participant.

In order to examine the resulting data, correlational and mediational/indirect effect analyses were used. For the mediational analysis, bootstrapping tests with 5000 re-samples were used, and the reported confidence intervals were bias-corrected (Preacher and Hayes 2008). A mediational or indirect effect was considered significant when its confidence interval did not include 0. The kappa-

square (i.e.,  $\kappa^2$ ; Preacher and Kelley 2011) was employed as an effect size index. The values suggested for this index should be interpreted in the same fashion as for the Cohen's  $r^2$ , which are small (0.01), medium (0.09), and large effect sizes (0.25 or higher) (Cohen 1988). All mediation-related analyses were achieved via the PROCESS mediation script (Hayes 2012, 2013).

## Results

### Preliminary Analyses

The correlations between the investigated variables are displayed in Table 1 along with the descriptive data.

### Main Results

The results (see Fig. 1) showed that there was an indirect effect from dispositional optimism to emotional distress via perceived consequences (indirect effect =  $-0.190$ ,  $SE = 0.114$ , 95 %  $CI = [-0.487; -0.021]$ ,  $\kappa^2 = 0.051$ ). The indirect effect model explained 12 % ( $R^2$ ) of the variance in pre-hazard emotional distress,  $F(2, 186) = 11.769$ ,  $p < 0.001$ . However, dispositional optimism was still a significant predictor of emotional distress when controlling for perceived consequences ( $B = -0.906$ ,  $SE = 0.272$ ,  $p < 0.001$ ). In other words, dispositional optimism had an effect on pre-hazard emotional distress through perceived consequences, but it also had a direct effect on this outcome. Judging by the indirect effect/total effect ratio (MacKinnon et al. 2007), approximately 17 % of the total effect of dispositional optimism on emotional distress was explained by the perceived consequences of an earthquake, while 83 % of the effect of dispositional optimism on pre-hazard emotional distress was direct.

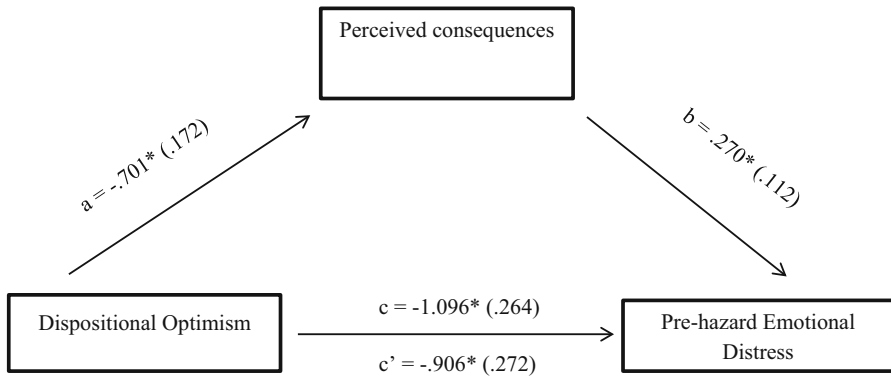
## Discussion

The current study aimed to investigate in a cross-sectional design the relation between dispositional optimism and perceived consequences of a seismic hazard in predicting emotional distress. Two main findings derived from the meditational analysis, as enlisted below.

**Table 1** Descriptive data and correlations between variables

	Mean (SD)	1	2	3
1. Dispositional optimism	22.894 (4.958)	1	$-0.296^*$	$-0.286^*$
2. Perceived consequences	30.672 (12.018)		1	$0.247^*$
3. Emotional distress	47.984 (18.519)			1

\*  $p < 0.005$  Bonferonni corrected for multiple comparisons



**Fig. 1** Simple mediation diagram:  $a$ ,  $b$ ,  $c$  and  $c'$  are path coefficients representing unstandardized regression weights and standard errors (*in parentheses*). The  $c$  path coefficient represents the total effect of dispositional optimism on pre-hazard emotional distress. The  $c'$  path coefficient refers to the direct effect of dispositional optimism on emotional distress. All significant paths ( $p < 0.05$ ) are marked with asterisk

*First*, in line with our assumptions, perceived consequences partially interposed the relation between dispositional optimism and pre-hazard emotional distress. In other words, our main finding suggests that individuals who report low optimism scores have higher levels of emotional distress in part because they have higher perceptions or expectancies regarding the likelihood of being significantly affected by major seismic hazard. This finding can be interpreted in light of the CBT framework (Beck 1995; Ellis 1994) where specific beliefs (i.e., perceived or expected consequences) mediate the relation between more general beliefs (i.e., dispositional optimism) and psychological consequences (i.e., emotional distress) (e.g., Mogoşe et al. 2013).

*Second*, dispositional optimism remained a significant predictor of pre-hazard emotional distress, even when controlling for perceived consequences. Actually, only 17 % of the effect of dispositional optimism on emotional distress was explained by the perceived consequences of a seismic hazard, meaning that 83 % of the effect of dispositional optimism on pre-hazard emotional distress was direct. Overall, these findings support the idea that dispositional optimism has an effect on distress through specific cognitions, but it also has a direct effect, bypassing other cognitive routes.

To sum up, the partial indirect effect result fits within the larger theoretical framework of dispositional optimism and CBT theory. This framework argues that individuals who are low in dispositional optimism are more likely to expect a specific negative outcome, such as being more negatively affected by a seismic hazard and therefore, be more likely to experience emotional distress.

### Clinical Relevance of the Results

Overall, these findings have significant clinical implications. As previously noted, there are no studies or programs to focus on relieving the pre-hazard emotional

distress experienced by individuals located in epicenter hotspots. As suggested by the current study, the main target of such a program could be to foster optimistic thoughts, known as resilience factors against post-trauma psychopathology (Iacoviello and Charney 2014). By cognitive behavioral techniques (e.g., cognitive restructuring), such interventions could foster optimistic thoughts regarding oneself and future in order to reduce emotional distress to adaptive levels. According to CBT, this does not mean to view a prospective major seismic event in a positive light, but to learn to focus on the positive aspects of one's life and future. This type of technique is especially recommended when a person cannot change its stressor (A), for instance, by moving away.

Furthermore, focusing on pre-hazard emotional distress might be the next-best thing to a prevention program against post-traumatic stress disorder (PTSD). Currently, we know that post-hazard interventions aimed at preventing PTSD symptoms encounter in some cases counterintuitive results. Namely, there are studies suggesting that post-hazard interventions (e.g., Critical Incident Stress Debriefing) trigger PTSD rather than prevent it (Lilienfeld 2007). The best explanation for these counterintuitive results is that the processing of the traumatic event "helps" the individual to realize how major the event was, therefore, removing any coping mechanisms such as optimism and triggering the PTSD symptoms. Based on this assumption and previous studies, optimism is a buffer against PTSD (Rauch et al. 2013) and fostering it in due time might be essential.

Acting on perceived or expected consequences of a major seismic event might be recommended as well (Turner et al. 1986; Whitney et al. 2004), especially if that intervention will act on the social and media source of the bias. Therefore, interventions on optimism could help the individual to have a more balanced perspective on life and be able to enjoy the good things in his life. Additionally, information programs regarding the probability of a natural disaster and the likelihood of being significantly affected by a major seismic event (e.g., one's death) are necessary to counteract the fear induced by the social factor (e.g., media news, opinions of friends and family) (SARF; Kasperson et al. 1988). As such, one intervention deals with the innate biases of an individual (a dysfunctional negative way of thinking), and the other counteracts the external sources of bias.

## Limitations and Future Directions

The limitations of the present study are inherent to its cross-sectional design. *First*, the current cross-sectional design makes it impossible to rule out models in which emotional distress causes estimates of perceived consequences and dispositional optimism. Therefore, under a good theoretical framework, other models could be tested as well. *Second*, because optimism is defined as having positive expectancies about the future, it will be necessary to conduct a longitudinal study and test mediation models with baseline optimism as predictor and post-event emotional distress as a criterion. It would be worthwhile to measure coping responses given the relation between optimism, coping, and distress. For example, in one study with breast cancer patients, coping mediated the relation between optimism at baseline and distress over the months following diagnosis (Carver et al. 1993). Moreover, it



would be interesting to focus on individuals vulnerable to psychopathology (e.g., high levels of depression or anxiety), as these might be more prone to having difficulties in adapting and recovering after a seismic hazard.

*Third*, the current study focused on a restricted class of predictors of pre-hazard emotional distress. As evidenced by the current results, the current meditational model predicts only 12 % in the variance of pre-hazard emotional distress. Therefore, future studies should try to expand current knowledge of the relation between optimism, perceived consequences, and pre-hazard emotional distress via more extended meditational models to identify a more comprehensive model of pre-hazard emotional distress. Particularly of interest would be the relation between the perceived negative consequences of a seismic event and the perceived likelihood of that event (i.e., risk perceptions), assuming that perceived consequences influence risk perceptions (Tobin 1997), which in turn influence the degree of emotional distress.

Of note, this study is built on the CBT framework and its ABC cognitive model. However, it should be noted that this paradigm is not refractory to an inverse chain of reaction, namely that the emotion-cognition arrow can go both ways, and emotions can trigger cognitions on their own. For instance, when one feels sad about the results of an exam, he or she can use a cognitive coping mechanism (e.g. Thinking that tomorrow he/she will do better) in order to feel better. Therefore, in the above example distress triggers a cognition which in the end modulates how that person is feeling on the long-term. This extended explanation of the ABC model is partially in line with other main-stream frameworks, such as the *affect heuristic hypothesis* (Slovic et al. 2007), the latter arguing that emotions play a lead role in cognitive processes, such as decisions. Nevertheless, future studies could focus on this inverted relationship and test how emotions influence decisions in the face of prospective dangers, such as natural hazards.

Despite its inherent limitations, the current study is the first research to consider the competitive roles of optimistic beliefs and perceived consequences of a major seismic hazard in shaping pre-hazard emotional distress. In line with the current results, we argue that knowing more about the variables that influence emotional distress and how they interact can provide pathways to prevention and perhaps ways to recover faster after such an event has occurred.

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