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## ORIGINAL ARTICLE

### Post-traumatic stress symptoms in adolescents exposed to an earthquake: Association with self-efficacy, perceived magnitude, and fear



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#### KEYWORDS

Post-traumatic stress symptoms;  
earthquake;  
self-efficacy;  
fear;  
ex post fact study

**Abstract** The objective of this study was to evaluate the relationship between the magnitude of an earthquake, the fear experienced, the self-efficacy beliefs, and post-traumatic stress symptoms in adolescents. We expected self-efficacy beliefs to predict post-traumatic stress symptoms, and this relation to be mediated by fear. We used data from a longitudinal project on adolescent normative development that was under way at the time of the 2010 earthquake in Chile. Six months before the earthquake, 218 adolescents responded to a self-efficacy beliefs scale; three months after the earthquake they reported the perceived magnitude of the event, the fear they experienced, and their post-traumatic stress symptoms. Results showed that perceived magnitude was not associated with fear or post-traumatic stress symptoms, but self-efficacy beliefs and fear were associated with post-traumatic stress symptoms. The hypothesized role of fear as a mediator in the relation between self-efficacy beliefs and post-traumatic stress symptoms was supported by the data. The results of the study, suggest that preventive interventions aimed to increase awareness of how to face a disaster may not only contribute to save lives but may also increase adolescents' sense of personal efficacy, reducing subsequent emotional reactivity associated with the event.

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#### PALABRAS CLAVE

Síntomas de estrés postraumático;  
terremoto;  
autoeficacia;

**Síntomas de estrés postraumático en adolescentes expuestos a un terremoto: asociación con autoeficacia, magnitud percibida y miedo**

**Resumen** El objetivo del estudio fue evaluar la relación entre la magnitud percibida, el miedo experimentado, las creencias de autoeficacia y los síntomas de estrés post-traumático en

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miedo;  
estudio ex post facto

adolescentes. Se esperaba que las creencias de autoeficacia se asociaran con los síntomas de estrés post-traumático y que esta relación fuera mediada por el miedo. Se utilizaron datos que formaban parte de un estudio longitudinal sobre desarrollo normativo en la adolescencia que estaba en curso en el momento de ocurrir el terremoto del año 2010 en Chile. Seis meses antes del terremoto, 218 adolescentes respondieron una escala de creencias de autoeficacia y tres meses después del terremoto reportaron la magnitud percibida del terremoto, el miedo experimentado y los síntomas de estrés post-traumático. La magnitud percibida no se asoció al miedo ni a los síntomas de estrés post-traumático, pero las creencias de autoeficacia y el miedo se asociaron con los síntomas de estrés post-traumático. Se encontró apoyo para el rol mediador del miedo percibido en la relación entre creencias de autoeficacia y síntomas de estrés post-traumático. Estos resultados sugieren que la prevención orientada a preparar a los adolescentes para enfrentar desastres naturales puede, además de salvar vidas, mejorar la respuesta emocional de aquellos que sobreviven.

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Post-traumatic stress symptoms (PTSS) are commonly observed in people exposed to natural disasters such as earthquakes (American Psychiatric Association, 2000; Cova & Rincón, 2010; Neria, Nandi, & Galea, 2008). However, not every person experiencing such events develops stress symptoms, and even fewer experience post-traumatic stress disorder (PTSD<sup>1</sup>). In fact, the prevalence of PTSD after an earthquake has been reported to be around 20%, both in adults (Durkin, 1993; Önder, Tural, Aker, Kiliç, & Erdoğan, 2006) and adolescents (Díaz, Quintana, & Vogel, 2012). The probability of presenting PTSD has been linked to the magnitude of the event and the intensity of the fear experienced. There is evidence that the probability of developing the disorder is greater when the magnitude of a natural disaster is bigger and when it is associated with human or material loss (Bokszczanin, 2008; Sumer, Karanci, Berument & Gunes, 2005). However, the American Psychiatric Association (APA) (2000) states that in order to diagnose the disorder, simple exposure to a traumatic event is not enough, because the exposed person must react with intense fear. Thus, the fear plays a central role in the development of PTSD (Tomb, 1994). Başoğlu, Kiliç, Salcioğlu and Livanou (2004) found support for this relation: in a study conducted after an earthquake in Turkey, where they found that the fear of the event was the strongest predictor of PTSD 14 months after the event. In addition, it has been noted that women display more PTSD symptomatology than men after a natural disaster (Başoğlu et al., 2004; Díaz et al., 2012; Guerra, Martínez, Ahumada, & Díaz, 2013; Pérez-Benítez

et al., 2009; Sumer et al., 2005), but to this day it is not clear why (Tolin & Breslau, 2007).

While the magnitude of the disaster has a role in the generation of individual symptoms, several other factors contribute to the emotional response of the individual to the event. Human adaptive systems and social interactions with family, peers, and community members play a central role in people's response to threats, such as natural disasters (Masten & Obradović, 2008). Self-capabilities, such as agency beliefs, and self-regulatory mechanisms that are activated to cope with the threat can buffer the expected negative effects of the magnitude and/or intensity of the event experienced, thus leading to different emotional or behavioral outcomes.

Findings from several studies illustrate the role of self-efficacy beliefs (SB) in post-traumatic stress symptoms. SB describe a person's certainty of his/her ability to perform the necessary behaviors to attain a goal and to cope with the demands following a stressful event (Bandura, 2006a). Benight and Bandura (2004) indicate that self-efficacy beliefs act as a buffer against stressors by enhancing people's motivation to seek more resources and effectively use them. Luszczynska, Benight and Cieslak (2009) made a systematic review of the evidence in support of the relation between SB and psychological outcomes of collective traumatic events like wars and natural disasters. The review, which included twenty-seven studies with a total of 8,011 participants, found general support for the relation between SB and health-related outcomes. The specific relation between SB and PTSS after a natural disaster has been reported in studies with adults. Benight, Ironson and Durham (1999) reported an inverse relation between SB and PTSS 1 to 5 months after two hurricanes in the USA in a sample of 228 adults. Similar findings were reported by Benight and Harper (2002) in a sample of 46 adults who survived two natural disasters (a fire and a flood) in the same year. The inverse relation between SB and PTSS was stable 3 to 8 weeks after the first event, and 1 year after the second disaster. Similar results were found by Sumer et al. (2005) from 336 adults 4 to 6 months after an earthquake in Turkey. Finally, Bosmans, Benight, van der Knaap, Winkel and van der Velden (2013) assessed the relationship between SB and PTSS in 514 adults

<sup>1</sup> The diagnostic of Post-traumatic Stress Disorder (PTSD) requires a number of conditions. The exposed person should react to the event with intense fear or helplessness, the traumatic event is persistently re-experienced (e.g., images, thoughts, dreams, flashbacks), the person makes efforts to avoid stimuli associated with the trauma and present increased arousal symptoms not present before the trauma (e.g., irritability, difficulty concentrating, hypervigilance), and these symptoms cause clinically significant distress or impairment in life (American Psychiatric Association, 2000). Given the stringent criteria to diagnose PTSD, and the self-report nature of the scales used, in this study we talk about posttraumatic stress symptoms (Crespo & Gómez, 2012).

affected by a big explosion occurring at a fireworks depot located on an urban area in the Netherlands. Self-efficacy beliefs were inversely related with symptoms 4 to 10 years postdisaster.

These studies provide relevant antecedents to implement prevention programs for PTSD (Leiva-Bianchi, Baher, & Poblete, 2012), since SB can be modified through intervention (Benight & Bandura, 2004). However, the previous studies have some notable limitations. First, the studies have used cross-sectional data or the data on the SB were collected after the traumatic event. It is necessary to evaluate the SB before the traumatic event because stressful situations change SB (Bandura, 1977; Maddux, 1995). This kind of limitation is common because natural disasters are unexpected events, which prevent data collection before their occurrence (Masten & Osofsky, 2010).

Second, most studies relating PTSS with SB have been conducted with adults. It is important to research with adolescent samples because this population present particular characteristics and are in the process of developing their identity, which includes SB (Bandura, 2006a). There is just one instance of research with an adolescent sample which related SB with psychological outcomes after a natural disaster (Yang et al., 2010). These authors reported no relation between SB and a number of psychological outcomes (somatization, obsessive-compulsive symptoms, interpersonal sensitivity, depression, anxiety, hostility, phobic-anxiety, paranoid ideation and psychoticism) in a sample of 167 adolescents who survive an earthquake in China. However, their study did not explore the relation between SB and PTSS.

The objective of the present study was to evaluate the association between SB before an earthquake, its perceived magnitude, and the fear experienced during the disaster with PTSS 3 months after the event in a sample of adolescents participating in a longitudinal study at the time of the 2010 earthquake in Chile. Two hypotheses were advanced: a) the perceived magnitude of the earthquake will predict PTSS, with fear acting as a mediator in this relation (the higher the perceived magnitude, the more fear experienced, and the more fear experienced, the stronger the PTSS), and b) SB will predict PTSS, with fear again acting as a mediator (the stronger the SB, the milder the fear, and the milder the fear, the lower the PTSS).

The traumatic event that provides the context for this study was the 8.8 Richter scale earthquake which occurred on February 27th, 2010 in Chile. The earthquake, considered the 6th strongest in history, affected 630 linear kilometers of central Chile, inhabited by 12,800,000 people (three quarters of the total Chilean population). The earthquake, followed by a tsunami, damaged the homes of 2,000,000 people and left 521 dead and 56 unaccounted for (Ministerio de Desarrollo Social de Chile, 2010; Ministerio del Interior de Chile, 2010).

## Method

### Participants

The sample comprised 218 adolescents from the city of Santiago (52.8% female; ages 14–19;  $M=15.72$ ;  $SD=1.09$ ) exposed to the February 27th, 2010 earthquake. Participants were part of a larger study on normal adolescent

development which was in its fourth year of data collection. An additional point of data collection was added to the design 3 months after the earthquake in order to test if some dimensions of normal adolescent development could impact on the reaction to the stress. Only 1.8% of participants reported having suffered physical injuries caused by the earthquake. The participants' sociocultural status was established by asking them about their parents' educational level: 23.6% of mothers and 19.3% of fathers did not finish high school; 23.1% of mothers and 25.9% of fathers finished high school; 12.5% of mothers and 10.9% of fathers had technical studies (complete or incomplete) or incomplete university studies; 28.7% of mothers and 25% of fathers completed their university education; 12% of mothers and 18.9% of fathers had graduate studies.

### Instruments

**Self-Efficacy Scale.** The study used an adapted version (Cumsille, Martínez, Rodríguez, & Darling, 2014) of the scale developed by Sherer et al. (1982) and Sherer and Adams (1983), which includes 6 items that evaluate SB (e.g., *I can focus on a task and persist in doing it*). The items are answered in a five-point Likert scale (1= *does not describe me at all* to 5= *completely describes me*). The score was computed by adding the 6 items together. Possible scores range from 6 to 30 points: the higher the score, the stronger the SB ( $\alpha=.80$ ).

**Perceived Magnitude.** This aspect was evaluated through 3 self-report questions about the perception of material consequences of the earthquake. The response format provides 4 or 5 alternatives (between 1 and 4 or 5), from no damage (e.g., *There was no damage to most of the nearby houses and buildings*) to considerable damage (e.g., *Most constructions such as houses or buildings were destroyed*). The score was computed by adding the 3 items together. Possible scores range from 3 to 14 points; the higher the score, the higher the perceived magnitude ( $\alpha=.65$ ).

**Fear experienced during the earthquake.** A 6-question scale was created, with questions that assessed the fear experienced during the earthquake (e.g., *Did you think your life was in danger?*), with dichotomous answers: 1= *yes*, 0= *no*. The total score was computed by adding the 6 items together. Possible scores range from 0 to 6 points; the higher the score, the more intense the fear during the earthquake ( $\alpha=.77$ ).

**Post-traumatic stress scale.** An adapted version of Davidson's scale (Davidson et al., 1997) was used, with 17 items which evaluate the frequency of PTSS experienced over the previous two weeks (e.g., *Do you feel anguish when there is an unexpected noise or an abrupt movement?*). The responses could range from 1 = *never* to 6 = *nearly every day*. The total score was computed by adding the 17 items together. Possible scores range from 17 to 102 points; the higher the score, the stronger the PTSS ( $\alpha=.93$ ).

The questionnaire also included questions about the demographic characteristics of the participants.

### Procedure

The procedure was approved by the ethics committees of the sponsoring university and the organism which funded the

**Table 1** Descriptive statistics and correlations (Spearman’s rho).

	<i>M</i>	<i>SD</i>	Range	1	2	3	4
1. Self-efficacy	23.96	3.98	11-30				
2. Perceived magnitude	3.82	1.20	3-12	-.17*			
3. Fear	3.67	1.91	0-6	-.18**	.07		
4. PTSS	28.45	15.17	17-89	-.23**	.11	.56***	
5. Age	15.72	1.09	14-19	-.13	.01	.11	.17*
6. Female	52.8%						

\*  $p < .05$ .  
 \*\*  $p < .01$ .  
 \*\*\*  $p < .001$ .

study. Parents were required to provide their passive consent while the participants gave their active assent. Afterwards, psychology students applied the questionnaire in the adolescents’ schools. The participants were given a snack in way of thanks. The SB were evaluated in October 2009. The perceived magnitude of the February 2010 earthquake, the fear experienced during it, and the strength of the participants’ PTSS were evaluated in May 2010.

**Data analysis**

Descriptive analyses, including bivariate correlations, were run in SPSS (IBM Corporation, 2012). The hypothesized mediational path model was tested in MPlus (Muthén & Muthén, 1998–2012), using bootstrap with 10,000 iterations to generate significance tests and confidence intervals for the estimated parameters (Hayes, 2013; MacKinnon, 2008). Age and gender were introduced as control variables.

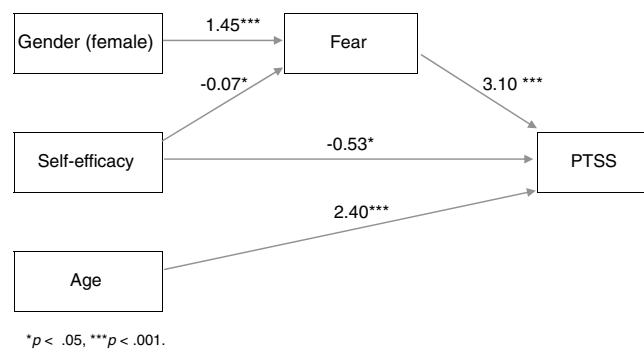
**Results**

Table 1 presents the descriptive statistics and the correlations for all variables. As compared to the range of possible scores, the average scores suggest that participants reported relatively high self-efficacy (23.96 points over a maximum of 30), perceived the earthquake to be of low magnitude (3.82 points over a maximum of 14), experienced moderate fear (3.67 points over a maximum of 6), and experienced low PTSS three months after the earthquake (28.45 points over a maximum of 102).

Contrary to our expectations, perceived magnitude was not associated with fear or PTSS. Consequently, our first hypothesis was not supported by the data. As was expected, self-efficacy beliefs were inversely associated with the fear experienced, and with PTSS, whereas fear was directly associated with PTSS.

The results for the proposed path analysis (Figure 1) are presented in Table 2. Both SB and fear predicted PTSS. Furthermore, the effect of SB over PTSS was mediated by fear ( $b = -.053, p = .047, 95\% \text{ CI } [-0.105, -0.001]$ ); the stronger the SB, the milder the fear, the milder the fear, the weaker the PTSS).

In addition, results showed that age predicted PTSS (the older the participant, the stronger the PTSS) but, contrary to findings from previous studies, gender was not predictive



**Figure 1** Path diagram of predictive relations.

of PTSS. Whereas females had greater fear ( $M_{diff} = 1.50, t = -6.22, p < .001, d = 0.85$ ), and greater PTSS ( $M_{diff} = 7.90; t = -4.06; p < .001, d = 0.53$ ) than males, we hypothesized that fear acted as a mediator in the relationship between gender and PTSS. The path analysis made it possible to evaluate this emerging hypothesis. The results of this analysis supported the mediational hypothesis ( $b = .15; p < .001$ ), suggesting that gender differences in PTSS may be related to males’ and females’ initial emotional experience of the event.

**Table 2** Regression coefficients associated with predictors of fear and PTSS.

	<i>B</i>	$\beta$	95% CI	$\Delta R^2$
<i>Fear</i>				
Female gender	1.45***	0.38***	[0.99, 1.92]	
Age	0.13	0.08	[-0.08, 3.46]	.16
Self-efficacy	-0.07*	-0.14*	[-0.13, 0.00]	.02
<i>R</i> <sup>2</sup> total	0.18			
<i>PTSS</i>				
Female gender	2.92	0.10	[-0.40, 6.13]	
Age	2.40***	0.17***	[0.46, 4.47]	.12
Self-efficacy	-0.53*	-0.14*	[-0.99, -0.07]	.04
Fear	3.10***	0.39***	[2.26, 4.07]	.12
<i>R</i> <sup>2</sup> total	0.28			

\*  $p < .05$ .  
 \*\*\*  $p < .001$ .

## Discussion

The goal of the present study was to evaluate the association between self-efficacy beliefs previous to an earthquake, the earthquake's perceived magnitude, and the fear experienced during the disaster with PTSS. Results showed a low level of post-traumatic stress in adolescents who participated in this study. Furthermore, age, SB and fear predicted PTSS, with part of the effect of SB mediated by fear. The effect of gender on PTSS was totally mediated by fear. Finally, the perceived magnitude of the event was not predictive of fear or PTSS.

The low level of stress symptomatology 3 months after the earthquake is consistent with previous research. The APA (2000) reports that about 50% of people with PTSD are usually completely recovered within 3 months of the traumatic event. In addition, all participants lived in Santiago, a city that resisted the earthquake in a good way, which was not affected by the tsunami, and which quickly returned its normal functioning after the event. This is reflected by the fact that participants reported little material damage caused by the earthquake (perceived magnitude) and only 1.8% of participants reported physical damage from the earthquake.

Despite the low level of PTSS, several interesting findings were observed. First, the lack of an association between perceived magnitude and PTSS contradicts prior observations (Bokszczanin, 2008; Sumer et al., 2005). As mentioned before, the magnitude of the earthquake was evaluated through questions posed to adolescents from the same city about the damage caused by the earthquake. Future studies should look at more objective measures of the earthquake's magnitude (for example, by including participants from different cities) in order to determine its role more reliably.

The association between SB and PTSS, as well as the mediating role of fear, are consistent with earlier suggestions (Başoğlu et al., 2004; Benight & Harper, 2002; Benight et al., 1999; Bosmans et al., 2013; Sumer et al., 2005). Individuals with a better sense of self-efficacy feel less fear during adverse situations because they trust their ability to deal with them (Williams, 1995); also, such beliefs are likely to favor an emotional response that is more circumscribed to the event at hand, which may in turn result in a lower PTSS.

Fear also operates as a mediator in the relationship between gender and PTSS. This is a relevant finding, since the literature shows that women display greater PTSS levels than men, but reasons for it remain unclear (Tolin & Breslau, 2007). In line with this observation, females displayed greater PTSS levels than males when gender and PTSS were associated in the absence of other variables, but when the relation was examined taking fear into account, the direct effect of gender on PTSS disappeared, suggesting that the relationship between gender and PTSS is mediated by fear.

Finally, age was directly related to PTSS, but the reasons for this are not evident. This finding contradicts results observed in the past (Bokszczanin, 2007), and highlights the need for further research in the future.

Some limitations of the study should be noted (Hartley, 2012). First, we used a scale that measured general self-efficacy beliefs and not beliefs that are specific to cope

with disasters. Bandura (2006b) suggests that people differ in the areas in which they cultivate their SB, so future research should specifically measure self-efficacy to cope with natural disasters, in order to have a more reliable estimate of their role in the development of PTSS. Second, because the original study was designed to assess normal adolescent development, no other antecedents of stressful response were available to incorporate in the study.

In spite of the previous limitations, the use of data collected prior to the natural disaster infuses our result with important insights which should inform studies of reactions to natural disasters and aid the development of PTSS prevention programs (Leiva-Bianchi et al., 2012). Specifically, our results highlight the role of SB in the affective experience (fear and PTSS) and the possibility of targeting them in preventive interventions. For example, interventions aimed at providing adolescents with information about what to do in the event of an emergency situation may increase adolescents' sense of personal efficacy to deal with the events, decreasing the fear experienced and the subsequent emotional consequences.

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