

Post-Traumatic Stress Disorder Symptoms and Their Predictors in Earthquake or Fire Survivors



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SUMMARY

Objective: In this study, we aimed to investigate the relationship between post-traumatic stress disorder and previous knowledge of emergency management, sense of control over the stressor, perceived threat, and somatic symptoms in earthquake and fire survivors..

Method: The data were obtained from the 2009-database of the İzmir Province Fire Department to include the people who had experienced domestic fire (n=92), from the people who had applied to the Health Group Directory after the 2005 earthquake in Seferihisar (n=38) and from the staff of a third step hospital who experienced a fire in public building in 2010 (n=34). The Impact of Events Scale-revised version (IES-R) was used to determine the traumatic stress levels of the participants; and the Behavior, Security, and Culture – Survivor (BeSeCu- S) questionnaire was used to acquire information on factors before and after the traumatic events.

Results: Compared to the fire survivors, the earthquake survivors perceived higher levels of threat and lower levels of control during the event gender, perceived threat, somatic symptoms experienced during the event and perceived control over the event were found to predict the post-traumatic stress disorder.

Conclusion: Results of the research suggested that control-focused treatment methods could be effective in treatment of people who had experienced earthquake and fire. It is observed that informing the public about emergency management would be protective for mental health by increasing the sense of control of the individuals at the time of the incident. On the other hand, the positive relationship between PTSD and previous knowledge on emergency suggests that the ringing alarms and practice errors during the fire and earthquake drills could traumatize people. Future research is recommended on the relationship between information processing, somatic symptoms and emotional processes in individuals during earthquake, fire and their drills.

Keywords: Posttraumatic Stress Disorder (PTSD), earthquake, fire, perceived threat, sense of control

INTRODUCTION

Natural disasters are sudden traumatic events with serious consequences. Tsunamis, floods, landslides, forest fires, and earthquakes threaten many people within the same moments and have direct effects on mental health. Post-traumatic stress disorder (PTSD) is one of the most frequently observed and investigated mental health disorders seen with natural disasters (Galea et al. 2005, Norris et al. 2002a). Although many people are affected at the same time, the prevalence of PTSD symptoms after a natural disaster was reported to

be 0.0 - 3.8% by the World Mental Health Survey (Bromet et al. 2017). Both individual and event related factors are effective in the development of PTSD after traumatic events involving masses. It was found that high educational level, death or severe injury of a close person in the event, forced displacement, trauma experience previous to the traumatic event and mental disorder history were among the factors that increased the risk of PTSD (Bromet et al. 2017).

According to the *learned helplessness theory*, the controllability of the encountered stressor has a significant impact on the

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emergence of traumatic stress (Maier and Seligman 1976, Abramson et al. 1978). Brain imaging studies indicate that the brain's ventromedial prefrontal cortex, amygdala and hippocampus activity increase when the stimulus is unexpected and uncontrollable. In other words, a more intense emotional response is given to traumatic stress when the stimulus is perceived as uncontrollable (Wood et al. 2015, Amat et al. 2008). Hence it is understood that, when facing natural disasters of sudden onset, the feeling that there is no behavioral, cognitive, and emotional control over the stressful event causes intense emotional distress. The high level of emotional distress experienced during the trauma causes traumatic stress symptoms (Başoğlu and Şalcıoğlu 2011). Although the causes of PTSD emergence after terror, war and violence have been extensively investigated, lack of PTSD research in Turkey on experiencing fire and its comparison with experiences of other traumatic events is noteworthy. Also, peri-traumatic distress, confirmed by many studies to be related to PTSD (Thomas et al. 2012), is mostly measured by rating feelings such as fear, stress, sadness, and disgust, without adequately focusing on the relationship between somatic symptoms during the event and PTSD. In this study, it is aimed to compare the traumatic stress symptom levels of individuals who have experienced earthquake and fire; and to investigate the effects age, education, gender, somatic symptoms experienced during the traumatic event, perceived threat to life, knowledge of emergency before the event, and perceived control over the event.

This study was carried out as a sub-study of a multinational project under the European Union 7th Framework Program on Behavior, Security, and Culture. Ethical approval for the research was obtained from the University of Greifswald by the project coordinators.

METHOD

Participants

Since the research was carried out in Izmir province of Turkey, people living in this province were reached for assessment of their earthquake and fire experiences. In order to gain access to the people who had experienced earthquake, the working staff of the Health Group Directory in Seferihisar district and people consulting the directory for various reasons such as vaccination, license or health counselling were contacted. Those individuals who had experienced the earthquake in Seferihisar on 21 October, 2005 with a magnitude of 5.9 on the Richter Scale and gave written informed consent to participate were asked to complete the data acquisition questionnaires.

People with the experience of domestic fires were identified in the 2009 fire database of the Izmir Province Fire Department. Individuals above the age of 18, who had experienced domestic fire, in the neighbouring home or had witnessed and reported domestic fire were reached by phone to give information on the study and the volunteers were visited at home on designated dates and times to complete the questionnaires.

The working staff of a third step hospital damaged by fire and partially evacuated in 2010 were reached for having experienced fire in a public building. The hospital staff were informed about the study and the attendants who accepted to participate were invited to the conference hall of the hospital at the time and date announced. They were given the questionnaires for completion. Completing the questionnaires took approximately 45 minutes.

The data were collected between September 2010 and February 2011 from a total of 164 participants consisting of 92 individuals with domestic fire experience, 34 individuals with fire experience in a public building and 38 individuals with earthquake experience.

Measurement Tools

In this study, Behaviour, Security, and Culture- Survivor self-report scale (BeSeCu- S) was used. This form was developed to comprehend the reactions of disaster survivors before, during, and after the disaster (Knuth et al. 2014). The gender, age, marital status, and educational status of the participants were obtained by means of the sociodemographic questionnaire used.

Trauma Experience: The participants were asked to give information about any other traumatic earthquake, residential fire and public building fire they had experienced before having experienced the residential fire, earthquake, and public building fire that the researchers had reached them for the purposes of this study. The participants with domestic fire and public building fire experiences were merged under the "fire" category. To be able to estimate the severity of the incident, the participants were asked whether the evacuation of the premises during the event took 30 seconds, 2 minutes, 5 minutes, 10 minutes, 30 minutes, 1 hour, 5 hours, 12 hours, 24 hours or longer than 24 hours, and whether they personally or someone they knew had been injured.

Previous Emergency Management Knowledge: The participants were asked to rate their knowledge on emergency management in 5 levels (1 = not at all; 2 = a little bit; 3 = moderately; 4 = quite a bit; 5 = extremely) in response to 7 different statements consisting of: "I had professional knowledge, gained from working for the emergency services"; "I had first aid knowledge, gained from a first aid course"; "I

had fire safety knowledge, gained from being a warden/fire safety officer”; “I had taken part in fire drills at school”; “I had taken part in fire drills at work”; “I had read safety notices/evacuation plans in public places, such as in hotel rooms, train carriages, etc” and “ I had thought about what would happen if an emergency occurred in such a location and had prepared my evacuation plan”. Total scores were used.

Experiences of Peri-trauma Somatic Symptoms:

Participants were asked whether they experienced the eight symptoms including fast heartbeat, sweating, trembling/shaking, shortness of breath and choking, chest pain or discomfort, nausea or abdominal distress, and feeling confused/ instability/dizzy or faint. Each symptom was scored as 1 point, and the total score was used.

Perceived Threat Level: To enable understanding the perceived threat at the moment of awareness of an emergency situation, the participants were asked the following questions: “When did you realize experiencing an emergency; did you think your life and health were in danger?”; “Did you think that the life and health of your family and friends were in danger?”; “Did you think that your property and belongings were in danger?”. All statements were rated on a 5-point Likert scale with 1= not at all; 2= a little bit; 3-moderately; 4-quite a bit; and 5= extremely. The total score of the answers to the three questions was used as the perceived level of threat.

Perceived Control Over the Stressor: The participants were asked to answer the question “When you realized you were experiencing an emergency, did you think that you would be able to overcome this situation?” over 5 choices comprising 1 = not at all; 2 = a little bit; 3 = moderately; 4= quite a bit; and 5 = extremely.

The Impact of Events Scale-Revised (IES-R): The IES-R is a 22-item self-report scale which evaluates PTSD symptoms in three subscales on avoidance, hyperarousal, and re-experiencing. The participants were asked to rate each symptom in the last seven days on a 5-point Likert scale of 0 (not at all) up to 4 (extremely). Scoring on the scale varies from 0 to 88 with high scores indicating high level of traumatic stress. The IES-R was reported to be successful in measuring traumatic stress with high internal consistency on all three sub-scales (Weiss and Marmar 1996). Adaptation of IES-R to the Turkish language, achieved by Çorapcioglu et al. (2006) on 104 individuals with and 65 individuals without PTSD diagnosis, had an internal consistency coefficient of 0.94. Also, the range for scale specificity was 70.7-81.0% and the sensitivity varied as 74.0%- 92.2% with respect to cut off points of 24 – 33. In this study, the Turkish language version of the IES-R was used.

Statistical Analysis

In this study, characteristics of the participants were analyzed by descriptive statistics. In order to compare the traumatic stress and perceived threat levels, the participants were grouped according to the experienced traumatic events including earthquake, domestic fire, public building fire; and the intergroup differences were assessed by the one-way ANOVA method. The relationships between the post- traumatic stress level and the variables of previous emergency management knowledge, the peri-trauma somatic symptoms, the perceived life-threat and the perceived control over the stressor were analysed using the Spearman correlation method.

The variables predicting the PTSD were investigated with multiple linear regression analysis. Data on age, gender, education level, past trauma experience, emergency management knowledge, perceived threat, perceived control, and peri-trauma somatic symptoms were included in the model as independent variables.

RESULTS

The participant group with residential and public building fire experiences included 89 males and 33 females with a mean age of 38.89 (± 11.47); and the group with earthquake experiences included 19 females and 19 males with a mean age of 31.13 (± 8.45). Previous experience of earthquake was reported by 39 participants of the group with fire experience; and previous experience of fire was reported by 5 participants of the group with earthquake experience. Educational variation in the group with fire experience included ‘literacy’ (n=3), primary school (n=16), middle school (n= 11), lyceé (n=47) and university (n=48); while the educational variation in the group with earthquake experience included middle school (n=5), lyceé (n=15) and university (n=18).

Evacuation time from the disaster site was reported to vary as within the first 10 minutes (n=72, 45%), 30 minutes (n=7); one hour (n=2) and 5 hours after the start of the incident (n=3), with the missing relevant data being (n=) 86. In the group with home or public fire experience, 8 participants were personally injured, and 16 reported injured family members and friends, while in the group with earthquake experience 1 participant was injured and 25 reported injured family members and friends. Psychotherapy or professional help had been received after the event by 23 (14%) participants, with the missing relevant data being (n=15).

The PTSD mean scores of the participants (n=164) were compared according to the experienced traumatic event; and the mean score of the group with earthquake experience (43.2 ± 19.8) was higher than that of the group with fire experience

Table 1. Perceived Control Level During Earthquake or Fire Experience

	Not at all		Medium		Extremely	
	n	%	n	%	N	%
Fire	17	14.2	54	45.0	49	40.8
Earthquake	7	18.9	22	59.5	8	21.6

Note 1: "A little bit" and "moderately" responses were merged as "medium" and "quite a bit" and "extremely" were merged as "extremely"

(35.3 ±19.9). Comparison of the combined data on the mean PTSD scores of all participants with and without previous traumatic experience did not show significant intergroup difference ($t=0.39$, $p=0.695$).

The mean score on perceived life threat of the group with earthquake experience (10.4 ±2.6) was significantly higher than that of the group with fire experience (7.3±3.0); ($t=-5.81$, $p<0.000$). The perceived control by the participants over the incident can be said to be higher in the group with fire experience (Table 1). The mean scores of the peri-event somatic symptoms of the group with fire experience (1.79±1.80) did not differ significantly from that of the group with earthquake experience (2.14±2.10), ($t=-0.99$, $p=0.322$).

While there were moderate positive correlations between PTSD and the perceived life threat and the experienced somatic symptoms, the correlation between perceived threat and the perceived control of the event was moderately negative (Table 2). It could be said that individuals perceive the event as more threatening and experience increased somatic symptoms as the perception of control decreases. Also, it is seen that, as the level of previous knowledge of emergency increases, the perceived control over the event increases; and that as the level of this knowledge decreases, the somatic symptoms increase.

Hierarchical multiple regression analyses were used in order to demonstrate the factors that determine the stress level in the participants with fire and earthquake experience. Variables of

Table 3. Factors Predicting PTSD in Relation to Fire and Earthquake Experiences

	R2	β	t	p
	.29			
Age		0.28	1.84	.068
Gender		7.47	2.25	.026
Education		0.76	0.47	.640
Past Trauma Experience		0.03	0.01	.994
Emergency Knowledge		0.57	2.83	.005
Perceived Control		-3.93	-2.95	.004
Perceived Life Threat		1.23	2.41	.017
Peri-trauma Somatic Symptoms		2.84	3.44	.001

gender, previous knowledge of emergency, perceived threat during the event, perceived control over the event and the peri-event somatic symptoms were found to predict PTSD [$F(8.138)=7.185$, $p<0.001$] (Table 3). In conclusion, as the perceived control on the event decreases, the probability of PTSD development increases by 3.9 fold (95% $CI=-6.56$, -1.30) and an increase in the perceived life threat during the event increases the probability of PTSD by 1.2 fold (95% $CI=0.22$, 2.23).

The female gender increases the risk of developing PTSD after a fire or an earthquake by 7.5 fold (95% $CI=0.92$, 14.03) and the experienced somatic symptoms during the event increase the emergence of PTSD after the event by 2.8 fold (95% $CI=1.21$, 4.48). Unexpectedly, previous knowledge of emergency management was also observed to increase the probability of PTSD development by 0.6 fold (95% $CI=0.17$, 0.97). Previous trauma experience, education, and age were not predictive variables for PTSD. Hence, the model, formed

Table 2. Correlation Coefficients Between Traumatic Stress Level, Emergency Knowledge, Perceived Control, Perceived Life Threat and Peri-trauma Somatic Symptoms

	PTSD	Emergency Knowledge	Perceived Control	Perceived Life Threat	Peri-trauma Somatic Symptoms
PTSD	-				
Emergency Knowledge	.05	-			
Perceived Control	-.27***	.47***	-		
Perceived Life Threat	.34***	-.13	-.34***	-	
Peri-trauma Somatic Symp.	.38***	-.16***	-.35***	.36***	-

*** $p<.001$

on the basis of the results obtained with all the variables, explained 27% of the variance of the PTSD presenting after experiencing an emergency situation.

DISCUSSION

In this study investigating the effects of certain factors before and during the event on the development of traumatic stress symptoms, experiencing earthquake was seen to create more traumatic stress than experiencing fire. In comparison to urban fires, earthquakes are acts of nature which individuals cannot bring an end to or ensure escaping easily; and, therefore, expectedly they perceive less control over the event. The results of this study support those of many others in the literature proving that the perceived control over the events at the start, continuation, and termination of the traumatic event mediates in the appearance of PTSD symptoms (Bargai et al. 2007, Başoğlu and Mineka 1992, Bayram-Kuzgun 2018, Cankardaş – Nalbantçılar 2018, Foa et al. 1992, Şalcıoğlu et al. 2017).

Among the variables investigated, gender was seen to be significantly predict the PTSD among both earthquake and fire survivors; and especially the female gender increased the risk of developing PTSD. This result was in agreement with reports in the trauma literature that the probability of PTSD development is higher in females (Kessler 2000, Hapke et al. 2006, American Psychiatric Association 2013). However, in contrast to the results of various studies, age and education level were not found to predict the PTSD. Whereas being at younger ages was reported in the literature to be a risk factor for PTSD (Brewin et al. 2000, Norris et al. 2002b), including mostly participants in middle ages within a narrow range may underlie the negative results of this study. Similarly, lack of an effect of education may be due to working with participants mostly with education at and above the lycée level.

In this study, traumatic stress appearing after experiencing earthquake or fire was predicted by the perceived threat, perceived control over the event, and the level of somatic symptoms experienced during the event. In the studies on people with experiences of different traumatic events, loss of control over stressors was observed to determine the level of distress during trauma (Bayram-Kuzgun 2018, Brewin et al. 2000, Alloy et al. 1990). Thinking that there is nothing one can do against the stressor causes experiencing more emotional distress at the time of the event, which in turn prepares the ground for traumatic stress symptoms (Başoğlu and Şalcıoğlu 2011). This study differed from others by considering the physiological dimension of emotions.

Studies indicate that the psychophysiological reactivity associated with trauma explains a higher level of variance

in PTSD than the self-reported emotional distress (Pineles et al. 2013). Investigating the relationship between anxiety sensitivity and PTSD, Olatunji and Fan (2015) reported that the physiological arousal of the participants while watching a traumatising film moderated the intrusive thoughts and anxiety sensitivity occurring in the following days. Results of this study supported the literature by indicating that the somatic symptoms experienced during an earthquake or fire predicted the symptoms of PTSD. Threat detection by the amygdala stimulates the alarm system of the body resulting in physical reactions. In frightening situations, the conscious emotions reported by people arise as a result of amygdala and long term memory activation (LeDoux 2000). Accordingly, amygdala affects the cortical sensory processing during fire and earthquake and causes physical symptoms the level of which indicates the threat perception by the amygdala. At the time of the event, perceiving the stressor as uncontrollable and a high level of life threat cause the amygdala to overstimulate the arousal system, which maintains the physiological and psychological pain experienced by the brain on the face of the stressor and causes the situation called allostatic loading. Hence, the adaptation mechanism of the brain, including hormones, immune system elements and others, is disrupted by allostatic loading that results in traumatic stress symptoms such as overexcitation and retrieval (McEwen 2016).

In this study, it has been seen that having previous knowledge of emergency management about self-protection during the incident and what to do during the evacuation contribute to decreased threat perception and to increased sense of control over the event. In this context, it is considered that performing drills in schools and work places, and giving emergency management education may be useful in preventing traumatic stress symptoms that may develop after natural disasters. However, determining in this study a positive correlation between knowledge about emergency and the level of PTSD symptoms was surprising. False alarms in fire and earthquake drills can cause insensitivity and unresponsiveness to the alarms in a real emergency. In such situations, people, initially assuming that there is not any emergency, start acting upon detecting the environmental stimuli like smoke, smell and the voices of other people. (Zhao and Zhang 2008). Although the level of emergency management knowledge increases the sense of control and decreases the physical symptoms, it can be said that the time taken to discriminate the true emergency alarm from the alarms for fire or earthquake drills results in delayed evacuation with adverse effects on the individuals.

This study, despite contributing to psychological trauma literature by explaining how symptoms of PTSD occur in survivors of fire and/or earthquake, has its limitations. One of the limitations is not having any data on the mental

health history of the participants and their mental health status during the research period. In this study, the perceived control over the traumatic event was evaluated on the basis of a single question. Perceived control points to a highly complex cognitive process, and if a measurement tool had been used for better evaluation of this structure, it is believed that a stronger effect of the perceived control on PTSD could have been detected. Another limitation of the study was acquiring the information on the physical symptoms experienced during the event by way of self-reporting. In the study, the participants were asked to recall and report their traumatic experiences during and after the incidents approximately six years after the earthquake, and a year after the fires. This approach can cause loss or distortion of the data. Not having the means to measure the knowledge of the participants on emergency management before the event or the way this knowledge was used during the event is also a limitation. The relationships between practice experience, knowledge on emergency management and the traumatic stress symptoms would be better understood by designing longitudinal studies.

In this study, it was observed in individuals with earthquake and/or fire experience and the belief of having a control over the stressor, that as the perception of overcoming the stressor and reducing the pain experienced was decreased, the risk of developing PTSD increased. It can be deduced from these observations that preparing the individuals for action during emergencies as a preventive measure should reduce the risk of developing PTSD. Based on this, it can be said that preparing people for emergencies could be an effective preventive intervention to reduce the risk of PTSD development. It is also thought that using behavioral interventions to increase the sense of control in individuals with earthquake and fire experience would be useful. This study found that gender, perceived threat during the traumatic event, the experienced somatic symptoms and the perceived control had effects on the development of PTSD symptoms after experiencing fire and/or earthquake. This study differs from the previous works in being the first to use the somatic symptoms experienced during the event as the indicator of peri-traumatic distress. It is recommended that future studies should be conducted to clarify the relationship between cognitive information processing, somatic symptoms and emotional distress during the trauma.

Author's Note

A part of this study was presented as a poster presentation in Turkey Traumatic Stress Congress, which was held in Istanbul/Turkey, 7-9th December 2018.

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