Risk factors of post-traumatic stress among survivors of the 2017 Iran earthquake: The importance of peritraumatic dissociation

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ABSTRACT

The aim of this study was to explore the roles of pre-earthquake characteristics (age, gender, years of education, history of childhood and recent trauma and trait dissociation), during-the-earthquake state (peritraumatic dissociation) and post-earthquake difficulties (severity of exposure to earthquake) in post-traumatic stress among survivors of the 2017 Iran earthquake. A total number of 127 individuals in Kermanshah and 103 individuals in Sarpol-e Zahab completed and returned a 105-item questionnaire. Among these, 32 (25.2%) participants in the Kermanshah sample and 80 (77.7%) participants in the Sarpol-e Zahab sample scored equal to, or more than, the cut-off score of 33 on the Impact of Event Scale – Revised and, thus, were considered as having high likelihood of having PTSD. A three-model hierarchical linear regression analysis showed that pre-earthquake characteristics, during-the-earthquake state and post-earthquake difficulties each explained a unique variance of 11.3%, 34.4% and 14.7%, respectively, and together explained a total variance of 60.4% in post-traumatic stress. Earthquake victims who report higher degrees of peritraumatic dissociation during and immediately after the earthquake are more vulnerable to develop PTSD and should be prioritized in terms of receiving psychological interventions.

1. Introduction

On the night of 12 November 2017 at 21:48 an earthquake with a moment magnitude of 7.3 occurred near the Iran–Iraq border in the northwestern region of Iran (United States Geological Survey, 2017). The earthquake resulted in 630 deaths, 9388 injured and 70,000 homeless. The Iranian province of Kermanshah was the most affected area with 559 people losing their lives only in Sarpol-e Zahab County, which is a subdivision of Kermanshah province (Iranian Legal Medicine Organization, 2017; Tasnim News Agency, 2017) (Fig. 1).

Apart from causing physical and material damage, an earthquake has a wide range of psychological consequences in affected areas. The psychological distress can be caused even by moderate exposure to earthquake and may last for years (Goenjian et al., 2018; Livanou et al., 2005). The most common psychological responses to earthquakes are Post-Traumatic Stress Disorder (PTSD; American Psychiatric Association, 2013; Dai et al., 2016; Dell'Osso et al., 2011; Naeem et al., 2011; Tang et al., 2017; Wang et al., 2009; Xu and Song, 2011; Zhou et al., 2013) with comorbid depression and anxiety (Basoglu et al., 2004; Duncan et al., 2013; Ozdemir et al., 2015; Rosendal et al., 2011; Salcioglu et al., 2007; Yuan et al., 2012). PTSD is a mental disorder

which may emerge in the aftermath of exposure to a traumatic event and its symptoms include e.g., disturbing thoughts, feelings and dreams related to the traumatic event, getting distressed by trauma-related cues, avoidance from trauma-related cues, and increased fight or flight responses. In a meta-analysis of 46 studies, PTSD was found among 28.8% of the survivors nine months after the earthquake (Dai et al., 2016).

Whereas personal characteristics, to some extent, can explain the variance of PTSD, psychological distress after the earthquake (e.g., dissociation, hyper-arousal, and helplessness) have been shown to contribute much more in the development of this disorder (Priebe et al., 2009). Findings from a range of studies (Basoglu et al., 2004; Priebe et al., 2009; Salcioglu et al., 2007; Yuan et al., 2012; Xu and Song, 2011) indicate that psychological distress during and immediately after the earthquake and feelings of fear and helplessness during the earthquake are important contributing factors in the development of PTSD. In addition, studies have found that developing PTSD heavily depends on such factors as perceived or actual threat to life, severity of exposure to earthquake, provided care and received support after the earthquake, prior trauma and vulnerability to, or pre-existing, psychopathology (Basoglu et al., 2004; Dai et al., 2016; Garfin et al., 2014; Goenjian

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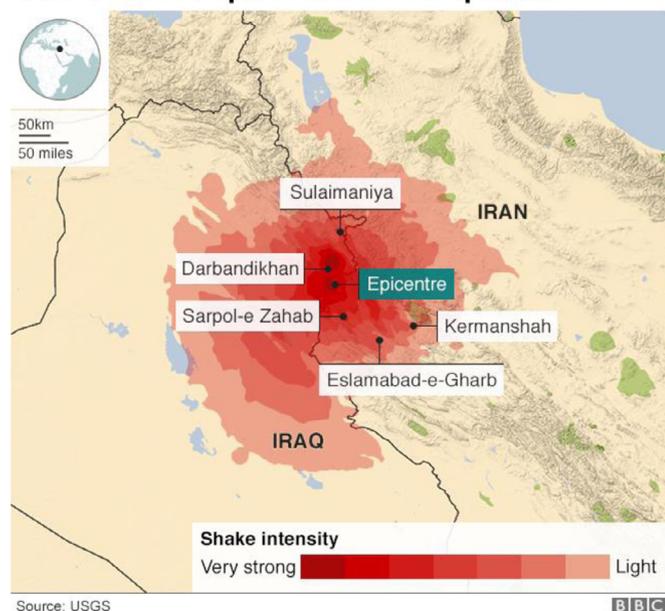 E-mail address: habib_nobakht@yahoo.com (H.N. Nobakht).

Fig. 1. Location of Sarpol-e Zahab and Kermanshah and their distance from epicenter of the earthquake.

et al., 2018; Naeem et al., 2011; Neria et al., 2008; Ozer et al., 2003; Tang et al., 2017; Tural et al., 2004; Wang et al., 2009; Xu and Song, 2011).

Trait dissociation refers to the personal tendency to having experiences of detachment from immediate surroundings, physical body and emotional states. In severe forms it may result in disruptions in the usually integrated functions of consciousness, memory, identity, emotion, perception and body representation. Dissociative phenomena include both an elevated capacity for absorption and imaginative involvement and the compartmentalization of memory and personality through amnestic barriers (American Psychiatric Association, 2013). The type of dissociative reactions emerging, specifically, during and immediately after traumatic event is labeled peritraumatic dissociation. Potentially, this involves reduced awareness of the surroundings, impaired memory, altered perceptions, emotional numbness, depersonalization, and amnesia (Cardena and Spiegel, 1993).

Peritraumatic dissociation is not only known to predict PTSD (Duncan et al., 2013; Marmar et al., 1998), but has also been shown to be the strongest predictor of PTSD (Ozer et al., 2003; Rosendal et al., 2011). A common explanation for this is that dissociation occurring around the time of a traumatic event may interfere in the encoding, processing and integration of traumatic memories, which, subsequently, may result in the type of memory fragmentation which plays an important role in the development of PTSD and dissociative disorders (Huntjens et al., 2013; Koopman et al., 1995; Van der Kolk and Van der Kart, 1989).

As Iran is the world's second most disaster-prone country and has the world's highest number of major earthquakes (magnitude higher than 5.5; United Nations Population Fund, 2006), it is of great importance to explore the psychological impacts of earthquakes in Iran. Hence, this study was aimed to investigate risk factors of post-traumatic stress among survivors of the 2017 Iran earthquake in relation to pre-earthquake characteristics, during-the-earthquake states and post-earthquake difficulties.

2. Method

2.1. Participants and procedure

Data were collected during February and March of 2018, 3–4 months after the earthquake, by the second author who was among a group of accredited psychologists sent to the affected areas to conduct psychological interventions. Sampling in Kermanshah took place in public places such as universities, parks and sport clubs. Sampling in Sarpol-e Zahab took place in university campus, neighborhoods, parks and camps that were assigned as temporary resettlement in aftermath of the earthquake. The later location was also used for implementing government-sponsored psychological interventions in the affected areas of Sarpol-e Zahab County. Young adults from these places in Kermanshah and Sarpol-e Zahab were approached by the second author and were asked if they were interested in participating in a psychological study about the recent earthquake. Aproximately 300 individuals were asked to participate and 255 of these agreed to participate in the study. They were given the questionnaire in print and were requested to fill the questionnaire privately (e.g., in empty rooms or classes, on benches) and return it after completion. The questionnaire contained a brief introduction including general information of the study and the privacy principles the researchers were committed to uphold.

The study was approved by the Director of Mental Health Division of the Health and Treatment Network of Sarpol-e Zahab County who was organizing and supervising government-sponsored psychological interventions in the affected areas. In the general information section, participants were ensured total anonymity and informed that their participation in the study was voluntary. Therefore, by returning the completed questionnaire they *de facto* agreed to participate in the study.

2.2. Materials and measures

The questionnaire contained the following 6 sections:

2.2.1. Demographics and psychological intervention history

There were eight questions in this section. There were questions asking for age, gender and total years of education (educational level was measured by summing 12 years of education in school and total years of education in college/university). Also, the name of the city/village that participants were in at the time of the earthquake was asked for. In addition to these four demographic questions, there were four questions asking about the details of psychological interventions participants might have received in the first months after the earthquake.

2.2.2. Peritraumatic dissociation

Peritraumatic dissociation was measured by the *Peritraumatic Dissociative Experiences Questionnaire (PDEQ)* which assesses dissociative experiences and reactions during and immediately after a traumatic event (Marmar et al., 1997). PDEQ is a self-report measure and contains 10 items which are rated on a 5-point Likert scale from 1 (*not at all true*) to 5 (*extremely true*). A total score of PDEQ is computed by summing scores of participants on all items. The validated Persian version of this scale with good validity, internal consistency and test-retest reliability was used (Nobakht et al., under review).

2.2.3. Severity of exposure to earthquake

Severity of exposure to earthquake was measured by the validated Persian version of the *Traumatic Exposure Severity Scale (TESS)*. The original version of the TESS contains 24 items with five sub-scales (Elal and Slade, 2005). However, the validated Persian version of the TESS (Nobakht et al., under review) includes 21 items with four sub-scales; *Being in Need / Damage to Home and Goods, Personal Harm, Harm to Significant Others,* and *Exposure to the Grotesque*. In the Persian version, participants were asked to specify how distressing each item was

for them, using 5-point Likert scale from 1 (*not at all*) to 5 (*extremely*). The TESS Distress Scale was calculated by summing the ratings from 1 to 5. The TESS has been shown to have good validity and internal consistency both in the original version (Elal and Slade, 2005) and the Persian version (Nobakht et al., under review).

2.2.4. Post-traumatic stress

Post-traumatic stress was assessed by the *Impact of Event Scale – Revised (IES-R)*; a 22-item self-report measure in which each item is rated on 5-point scale ranging from 0 (*not at all*) to 4 (*extremely*) and asks participants to specify how distressing each item has been for them during the past 7 days (Weiss and Marmar, 1997). The scale has been shown to have high validity, test-retest reliability and internal consistency (Creamer et al., 2003; Weiss and Marmar, 1997). The IES-R consists of three sub-scales; *Intrusion, Avoidance* and *Hyperarousal*. Total IES-R score which is calculated by summing scores of all items was used in this study. The cut-off point of 33 out of 88 on total IES-R score is considered to be indicative of high likelihood of presence of PTSD (Creamer et al., 2003). The validated Persian version of IES-R with good internal consistency, test-retest reliability and convergent validity was used (Panaghi et al., 2006). Since some items in this version have been judged to lack eloquence (Panaghi; personal communication), the authors were given permission to somwhat revise them in order to make them clearer.

2.2.5. History of trauma

History of Trauma was measured by the *Childhood Trauma Questionnaire (CTQ)* (Pennebaker and Susman, 2013) which includes two sections: (a) *The Childhood Traumatic Event Scale (CTES)*, containing 6 items and (b) *The Recent Traumatic Event Scale (RTES)*, containing 7 items, The validated Persian version of this scale, with good validity, internal consistency and test-retest reliability, was used (Nobakht et al., under review).

2.2.6. Trait dissociation

Trait dissociation was measured by the *Dissociative Experiences Scale-II (DES-II)*, a 28-item self-report questionnaire reported to be reliable, internally consistent, and temporally stable (Bernstein and Putnam, 1986; Dubester and Braun, 1995). Participants are asked to choose the percentage of time (given in increments of 10% ranging from 0 to 100) that they have the type of experience described within each item. The mean of the responses to all 28 items is considered as general dissociativity or simply dissociation. The validated Persian version of the DES-II (Kianpoor et al., 2016), with good internal consistency ($\alpha = 0.89$) was used.

At the end of the questionnaire, participants were thanked and given brief comments about the importance of their participation in such studies. They were informed about another study due in spring of 2018 and were asked whether they were interested to participate in this future studies or not. If interested, there was an optional section asking for their telephone number and/or address.

2.3. Design and data analysis

Descriptive and psychometric statistics for all groups were calculated (mean scores and standard deviations). The Shapiro–Wilk test showed that most variables were not normally distributed (except TESS, PDEQ, and IES-R in the Sarpol-e Zahab sample). Hence, we chose to use the Mann–Whitney test, a non-parametric analysis of variance, in combination with a Bonferroni adjustment of significance level to control for Type I error. Group comparison between Kermanshah and Sarpol-e Zahab samples with regard to all variables was performed (see Table 1).

In order to extract the most important predictors of post-traumatic stress, a hierarchical linear regression analysis was performed. Hierarchical regression is used to determine whether a variable of focus

Table 1
Comparison of Kermanshah and Sarpol-e Zahab samples with regard to all variables.

Variables	Kermanshah sample (N = 127) Mean (SD)	Sarpol-e Zahab sample (N = 103) Mean (SD)	Mann–Whitney test	
			U	P
TESS	24.57 (4.76)	47.17 (11.79)	326	< 0.0001
IES-R	23.57 (17.25)	46.56 (17.78)	2306	< 0.0001
PDEQ	22.32 (9.02)	29.72 (9.72)	3695	< 0.0001
DES-II	20.38 (15.32)	20.70 (15.72)	6540	1
Childhood trauma	0.82 (0.95)	0.84 (0.91)	6341	0.6891
Recent trauma	0.86 (1.03)	0.84 (1.03)	6445	0.8493

and interest explains a statistically significant amount of variance in the dependent variable after accounting for all other variables in previous steps (Kim, 2016). In this analysis the IES-R score was considered as dependent variable, and age, gender, total years of education, history of childhood and recent trauma, and trait dissociation (block 1), peri-traumatic dissociation (block 2), and sub-scales of TESS (block 3) were considered as independent variables (see Table 2).

3. Results

3.1. Description of sample

Of the 255 individuals who returned the questionnaire, 25 were excluded due to incomplete and/or seemingly inattentive responses (e.g., giving no responses to a full section of the questionnaire, choosing only extreme values). Of the remaining 230 participants, 127 were in Kermanshah (64 women with *M* age = 24.8 and *M* education level = 14.9; and 63 men with *M* age = 25.0 and *M* education level = 15.2) at the time of earthquake and 103 were in Sarpol-e Zahab and neighboring areas (53 women with *M* age = 26.5 and *M* education level = 13.9; and 50 men with *M* age = 25.2 and *M* education level = 14.9).

3.2. Description of data-collection strategy

Whereas the earthquake resulted in significant casualty and damage in Sarpol-e Zahab, it did not cause considerable casualty or damage in city of Kermanshah. The earthquake only resulted in horror and panic among people there. Using samples from cities with different levels of exposure to earthquake opened for observations of a wider range of effects.

An approximately even number of men and women, and their relatively close mean age and educational level, were obtained by continuously tracking the development of the sample in terms of age and gender. Hence, by having demographic information of participants at the end of each data-collection day, questionnaires were strategically distributed within specific gender/age-based populations on the next data-collection day until the current sample with relatively equal demographic characteristics was reached.

3.3. Description of results

The results from the Mann–Whitney test of variance (see Table 1) showed no significant differences between the Kermanshah and the Sarpol-e Zahab samples with regard to history of childhood and recent trauma and trait dissociation. Participants in the Sarpol-e Zahab sample scored significantly higher than participants in the Kermanshah sample with regard to scores on the TESS, the IES-R and the PDEQ. With regard to the clinical cut-off score of 33 on the IES-R - which is indicative of a high likelihood of PTSD - 32 (25.2%) of the participants in the Kermanshah sample and 80 (77.7%) participants in the Sarpol-e Zahab had

Table 2
Hierarchical linear regression analysis of predictors of post-traumatic stress.

Predictors	Model 1		Model 2		Model 3	
	B (S.E.)	Beta (p)	B (S.E.)	Beta (p)	B (S.E.)	Beta (p)
Constant	22.71 (9.40)	– (0.0165)	−10.01 (7.87)	– (0.2050)	−16.30 (7.09)	– (0.0224)
Age	0.00 (0.23)	0.00 (0.9882)	−0.08 (0.18)	−0.02 (0.6547)	−0.18 (0.16)	−0.05 (0.2589)
Gender (1: m, 0: f)	−5.53 (2.69)	−0.13 (0.0409)	−3.08 (2.12)	−0.07 (0.1475)	−5.29 (1.93)	−0.13 (0.0067)
Years of education	0.32 (0.54)	0.04 (0.5555)	0.73 (0.43)	0.09 (0.0864)	0.95 (0.37)	0.12 (0.0112)
Childhood trauma	−1.49 (1.65)	−0.07 (0.3674)	−1.23 (1.30)	−0.05 (0.3443)	−1.48 (1.12)	−0.07 (0.1885)
Recent trauma	3.25 (1.48)	0.16 (0.0297)	2.44 (1.17)	0.12 (0.0378)	2.50 (1.01)	0.12 (0.0145)
Dissociation	0.38 (0.09)	0.28 (<0.0001)	0.08 (0.08)	0.06 (0.3343)	0.14 (0.07)	0.10 (0.0478)
Peritraumatic dissociation			1.33 (0.11)	0.64 (<0.0001)	0.92 (0.11)	0.44 (<0.0001)
Being in need / Damage to home and goods					0.90 (0.13)	0.40 (<0.0001)
Personal harm					−0.22 (0.48)	−0.02 (0.6492)
Harm to significant others					0.06 (0.30)	0.01 (0.8436)
Exposure to the grotesque					0.42 (0.34)	0.06 (0.2290)
R Square	0.113		0.456		0.604	
F	4.73		26.62		30.17	
R Square Change	0.113		0.344		0.147	
F Change	4.73		140.30		20.22	
F Change Significance	0.0001		<0.0001		<0.0001	

Notes: *B* = Unstandardized coefficient, *S.E.* = Standard error, *Beta* = Standardized coefficient.
Model 1, predictors (pre-earthquake characteristics): age, gender, years of education, childhood trauma, recent trauma, dissociation.
Model 2, predictors (during-the-earthauake state added): age, gender, years of education, childhood trauma, recent trauma, dissociation, peritraumatic dissociation.
Model 3, predictors (post-earthquake difficulties added): age, gender, years of education, childhood trauma, recent trauma, dissociation, peritraumatic dissociation, being in need / damage to home and goods, personal harm, harm to significant others, exposure to the gotesque.

scores equal to, or above this.

The hierarchical linear regression analysis was performed with three models: (1) Model 1, consisting of pre-earthquake demographics and personality characteristics, (2) Model 2, consisting of previous variables plus peritraumatic dissociation during earthquake, and (3) Model 3, consisting of previous variables plus post-earthquake difficulties. As shown in Table 2, 60.4% of the variance among individuals with regard to post-traumatic stress is explained by the Model 3 after adding all predicting variables in three steps. *Pre-earthquake characteristics* (age, gender, years of education, history of childhood and recent trauma and trait dissociation) explained a significant variance of 11.3% ($p = 0.0001$) in post-traumatic stress. Adding *peritraumatic dissociation* to the model resulted in an additional 34.4% ($p < 0.0001$) of explained variance in post-traumatic stress. Finally, adding *severity of exposure to earthquake* as measured by sub-scales of the TESS resulted in an additional 14.7% ($p < 0.0001$) of explained variance in post-traumatic stress.

The standardized *B* and their corresponding *p* value in the Model 3 show that *being female* ($p = 0.0067$), *having more education* ($p = 0.0112$), *history of recent trauma* ($p = 0.0145$), *trait dissociation* ($p = 0.0478$) *peritraumatic dissociation* ($p < 0.0001$) and *being in need / damage to home and goods* ($p < 0.0001$) are significant predictors of post-traumatic stress (see Table 2).

4. Discussion

Significantly higher scores of post-traumatic stress and peritraumatic dissociation were recorded in the Sarpol-e Zahab sample in comparison with the Kermanshah sample (see Table 1). This may be attributed to the proximity of Sarpol-e Zahab to the epicenter of the earthquake, which suffered considerably higher levels of destruction and casualty. Subsequently, more destruction and severer exposure to an earthquake predicts more severe psychological responses (Goenjian et al., 2018; Neria et al., 2008; Zubizarreta et al., 2013).

There was no significant difference between the two samples with regard to their scores on trait dissociation. The first and third author have previously conducted research on university students in Iran and have found an average DES-II score of 20.6 in Babol ($N = 300$) and 19.7 in Ardabil ($N = 400$) (Nobakht and Dale, 2017; 2018a; 2018b; Nobakht and Dale, under review). The DES-II scores of the Kermanshah and the Sarpol-e Zahab samples (20.4 and 20.7, respectively) are very close to DES-II scores of university student populations, indicating that neither the severity of exposure to earthquake nor exposure to earthquake, in itself, result in apparent increases in the level of trait dissociation.

As shown in the Table 2, being female, having more education, history of recent trauma, trait dissociation, peritraumatic dissociation and being in need / damage to home and goods after the earthquake are the significant predictors of post-traumatic stress. The finding that being female is a risk factor in developing PTSD is in line with findings from recent studies (Cofini et al., 2015; Dell'Osso et al., 2011; Henderson and Elsass, 2015; Naeem et al., 2011; Ozdemir et al., 2015; Priebe et al., 2009; Salcioglu et al., 2007; Su et al., 2010; Wang et al., 2009; Xu and Song, 2011) and meta-analyses (Dai et al., 2016; Tang et al., 2017) but contradicts findings of one study on tsunami victims (Rosendal et al., 2011). The finding that more education is a risk factor in developing PTSD contradicts findings from earlier studies (Naeem et al., 2011; Priebe et al., 2009; Yuan et al., 2012; Wang et al., 2009; Xu

and Song, 2011) and meta-analyses (Dai et al., 2016; Tang et al., 2017) but is in line with a study on Sri Lankan and Danish adults exposed to tsunami (Henderson and Elsass, 2015; Rosendal et al., 2011). History of recent trauma was shown to be a significant predictor of post-earthquake PTSD and this is in line with a finding from a Turkish study (Basoglu et al., 2004) and a meta-analysis by Tang et al. (2017).

Being in need / damage to home and goods was shown to be a significant exposure-to-earthquake predictor of post-traumatic stress. This is in line with findings of some studies (Basoglu et al., 2004; Cofini et al., 2015; Henderson and Elsass, 2015; Naeem et al., 2011; Su et al., 2010; Tural et al., 2004) and meta-analyses (Dai et al., 2016; Tang et al., 2017), but contrasts findings of some other studies (Altindag et al., 2005; Priebe et al., 2009; Zhou et al., 2013) which showed that house damage and property loss did not predict PTSD. Moreover, and in contrast with previous studies (Basoglu et al., 2004; Garfin et al., 2014; Henderson and Elsass, 2015; Su et al., 2010; Tural et al., 2004; Wang et al., 2009; Zhou et al., 2013) and meta-analyses (Dai et al., 2016; Tang et al., 2017), neither personal harm nor harm to significant others predicted PTSD in this study. The finding that the standardized *B* value for personal harm and harm to significant others (see Table 2) was close to zero, was surprising, but this is, however, similar to findings of an earlier study by Rosendal et al. (2011).

To varying degrees, a series of pre-earthquake factors, as depicted above, can predict post-traumatic stress. Moreover, the role of trait dissociation is significant in this respect, which is in line with findings from a study conducted by Abdollahi et al. (2011) among survivors of the 2005 Zarand earthquake in Iran, in which higher levels of dissociation one month after the earthquake predicted more severe PTSD symptoms two years after. However, the most notable finding of this study with regard to risk factors of PTSD is the predictive role of peritraumatic dissociation, which is in line with previous studies (Duncan et al., 2013; Marmar et al., 1998; Ozer et al., 2003; Rosendal et al., 2011). In the most recent study in New Zealand (Duncan et al., 2013) a standardized *B* of 0.37 was found compared to a standardized *B* of 0.44 found in this study (see Table 2). The predictive role of peritraumatic dissociation, independent from other confounding variables, in relation to PTSD has been debated (Duncan et al., 2013). Van der Velden and Wittmann (2008) challenged the independent role of peritraumatic dissociation in PTSD in their systematic review. Some research (Basoglu et al., 2004) and meta-analysis (Tang et al., 2017) have also shown that history of previous trauma is a factor associated with later PTSD after exposure to an earthquake. This is challenged by the finding of this study in which peritraumatic dissociation was still the most important predictor of PTSD, even after controlling for the variables added in previous steps (e.g., demographic characteristics and history of previous trauma). However, one may argue that although the literature suggests that dissociative responses during trauma increases the risk of development of PTSD, the relationship is rather complex and might be effected by several other unmeasured variables (Duncan et al., 2013).

In terms of the development of PTSD, it is not unlikely that peritraumatic dissociation, as observed in this study, has been instrumental in the same manner as fear has been observed to be under similar circumstances (see e.g., Basoglu et al., 2004; Priebe et al., 2009; Salcioglu et al., 2007; Tang et al., 2017; Xu and Song, 2011; Yuan et al., 2012). This has also been demonstrated in a study by Rosendal et al. (2011) in which peritraumatic fear and peritraumatic dissociation were the strongest predictors of PTSD. This supports the notion that dissociation, and possibly also fear, when occurring around the time of a traumatic event, interfere in the encoding, processing and integration of traumatic memories, thereby increasing the eventual likelihood of PTSD (Koopman et al., 1995; Van der Kolk and Van der Kart, 1989).

The design of this study has some limitations that should be taken into consideration: (1) Although the sample covers both rural and urban populations, with a wide demographic spectrum, the participants represent only a small proportion of all the earthquake survivors.

Furthermore, they were not randomly recruited, but more as a result of what was attainable and convenient under the circumstances. This may, somewhat, reduce the generalizability of the results. (2) Using a retrospective self-report instrument to measure traumatic experiences may have affected the authenticity of the reports of history of childhood and recent trauma, possibly in the direction of artificially lower response rates (Fergusson et al., 2000; Hardt and Rutter, 2004). These two limitations may be reduced in future studies by using larger samples from an even wider spectrum of the population and by applying supplemental data collecting methods, such as qualitative interviews.

Our findings might have implications for clinical practice in the aftermath of earthquakes and similar catastrophes. Since individuals who report higher levels of peritraumatic dissociation and the most affected individuals in terms of being in need / damage to home and goods are shown to be more vulnerable to develop PTSD, they should be prioritized for receiving psychological and medical interventions and settlement aid. Hence, assessment of peritraumatic dissociation and severity of exposure to earthquake in the early days and weeks after earthquakes should be conducted to identify at-risk populations for further development of PTSD. Precise assessment of peritraumatic dissociation, may provide a basis for referral of survivors of large-scale catastrophic events to specialized support resources, where relevant psychological interventions can be conducted (Douglas Hospital and McGill University, n.d.).

More studies are called for in larger samples, and with more comprehensive measurements, in order to identify the most important risk factors of PTSD in the aftermath of earthquakes. By gaining more knowledge of the dynamics of peritraumatic fear and peritraumatic dissociation one might reach a clearer understanding of their predictive role in the development of PTSD. Also, and as suggested by Dai et al. (2016), investigating the potential role of genetic background in developing PTSD might be an important step towards gaining a more comprehensive understanding of post-earthquake PTSD.

Declarations of interest

None.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.psychres.2018.12.057.

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