

Adolescents' posttraumatic stress reactions and behavior problems following Marmara earthquake

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Background: Although most children and adolescents exhibit some kind of postdisaster reactions, their symptoms vary depending on the age, gender, parental social support, disaster and postdisaster contextual factors.

Objective: This study examined adolescents' postdisaster experiences, posttraumatic stress disorder (PTSD) symptoms, and behavior problems 13 months after the 1999 Marmara earthquake in Turkey.

Design: Participants included 695 adolescents aged 12-17 years, who resided in three districts of Izmit at varying distances from the epicenter (e.g., high (HI), medium (MI), and low impact (LI) areas). Measures included demographics, earthquake exposure experiences, Child PTSD Reaction Index, and Behavior Problems Index.

Results: Findings revealed that 76% of the adolescents reported moderate to very severe levels of PTSD symptoms (82% HI, 70% MI, and 70% LI) after the devastating earthquake. As expected, the HI group reported more symptoms than did members of MI and LI groups. Overall, 39% of the variance in adolescents PTSD symptoms was accounted for by the degree of exposure and gender. Analyses also indicated an increase in the frequency of adolescents' behavior problems following the earthquake.

Conclusions: The findings of this study have clinical implications for designing and implementing effective, developmentally appropriate, and culturally sensitive intervention programs for the victims of major disasters.

Keywords: *disaster; earthquake; adolescents; posttraumatic stress disorder; behavior problems*

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Since the 1950s, children's and adolescents' post-disaster reactions to a wide range of natural (e.g., earthquake, hurricane) or man made disasters (e.g., explosion of nuclear plants, wildfire) have been the focus of much research. Earlier studies examined general dysfunctioning among children, whereas more recent ones have addressed different types of symptoms and psychopathology (Lonigan, Anthony & Shannon, 1998). In part, this change reflects the diagnosis of posttraumatic stress disorder (PTSD) that was applied to children and adolescents in the Diagnostic and Statistical Manual of Mental Disorders-Third Edition in 1987 (American Psychiatric Association). Coincident with this recognition was the appearance of more sophisticated models and

research designs for postdisaster studies: measurement of "dose of exposure" model (Pynoos et al., 1987), use of control groups (Bromet, Hough & Connel, 1984), the evaluation of different conceptual models (La Greca, Silverman, Vernberg & Prinstein, 1996), use of large samples including a wide range of age groups (Shannon, Lonigan, Finch & Taylor, 1994), and follow-up studies examining the nature of continuing symptoms (La Greca et al., 1996).

Findings from these more recent studies indicate that although most child and adolescent victims exhibit some kind of postdisaster reactions, their symptoms vary with age: preschool children show a higher incidence of trauma-specific fears and behavioral problems (Ponton

& Bryant, 1991); school-age children exhibit a wide range of somatic, cognitive, behavioral, emotional, and social problems as well as more PTSD symptoms and a greater understanding of traumatic experience compared to preschoolers (Coffman, 1994). Adolescents have been considered more adult-like than child-like in their responses: they show postearthquake fears, impaired identity formation, a foreshortened and pessimistic sense of future, antisocial behaviors (e.g., vandalism, truancy), depression, anxiety, belligerence, adult-like PTSD symptoms, school-related problems, and interpersonal difficulties (Arroyo & Eth, 1996; Clark & Miller, 1998; Dufka, 1988; Gleser, Green & Winget, 1981; Sugar, 1999).

Following exposure to an extreme stressor, most children and adolescents exhibit at least some clinical symptoms; however, there are marked individual differences in the nature and severity of symptoms. Specifically, individual and family factors influencing outcomes include age (Green et al., 1991), gender (Roussos et al., 2005; Silverman & La Greca, 2002), previous psychopathology (e.g., La Greca, Silverman & Wassertein, 1998), adolescents' perceptions of parental reactions to the disaster (Rustemli & Karanci, 1996), and the availability of social support (Joseph, Dalglish, Thrasher & Yule, 1995). Contributing factors include characteristics of the disaster and postdisaster contextual factors such as physical proximity to disaster event (Goenjian et al., 2001; Groome & Soureti, 2004), extensiveness of damage (La Greca et al., 1996), life-threatening experiences, and self-injury (Pynoos & Nader, 1990), loss of family members/peers (Nader, Pynoos, Fairbanks & Frederick, 1990), separation from family members (McFarlane & Raphael, 1984), and changes in living conditions and schooling. These data argue for use of a broad framework in identifying sources of individual differences (Compas & Epping, 1993). At the very least, recognition of these variables may have direct implications for designing and implementing effective and age-appropriate intervention programs.

Current study

On August 17, 1999, at 3:02 a.m. local time, an earthquake measuring 7.4 on the Richter scale hit the city of Izmit, approximately 70 miles southeast of Istanbul. The epicenter of this devastating earthquake was Golcuk, and it was felt as far away as Ankara, 280 miles away, and across parts of the Balkans. The earthquake damaged nine Northwestern provinces and resulted in approximately 18,000 deaths, 25,000 injuries, and 400,000 homeless. Extensive damage occurred to homes, schools, hospitals, highways, and industrial buildings. The devastation to infrastructure, family functioning, and children's and adolescents' socialization was unparalleled in recent times. This study reveals that many months after the disaster, lives remained unsettled, with geographic proximity

to the epicenter having an important role in outcome.

Three goals formed the core of this study of adolescents' postdisaster experiences 13 months after the earthquake. The first focused on assessing the prevalence and severity of the adolescents' PTSD symptoms and behavior problems; the second examined the impact of relative geographic exposure (e.g., physical proximity) on the number and severity of symptoms; and the third goal focused on the contribution of earthquake exposure experiences, postdisaster adversities, and individual characteristics in predicting adolescents' PTSD reactions.

Method

Participants

The sample was subdivided by geographic proximity to the epicenter. The first group (high impact (HI)) of adolescents lived in Golcuk, the epicenter, and were likely to have experienced the greatest damage and material loss. The second group (medium impact (MI)) consisted of adolescents who lived in Derince whose locale was on the earthquake's fault line. The last group (low impact (LI)) included adolescents who lived in downtown Izmit and who were more likely to have experienced minimal personal damage or material loss compared to participants from HI and MI areas.

A total of 695 adolescents (339 males and 356 females) aged 12–17 years ($M = 13.85$, $SD = 1.51$) participated in this study. Gender proportions are similar across three groups ($\chi^2(2, N = 695) = 0.11, p = 0.95$). In terms of family demographics, slightly less than 40% of the participants' mothers and 67% of the fathers received junior high school or higher levels of education. In addition, 96% of the participants were from intact families; and the average size of household was four people.

Procedure

The author obtained written approvals from the Ministry of National Education as well as local offices of the Ministry in Izmit as required in Turkey. After receiving their approval, the author then contacted the principals of each potential school to explain the nature of the study. With each principal's permission and teachers' guidance, classes were randomly selected for each grade group. During the data collection, the author explained the nature of the research project. Next, a consent form was presented to each potential participant. Students were informed that there would be no adverse ramifications should they choose not to participate. They were told that they would be allowed to stay in the classroom or go to the library, if they did not wish to respond. The students were also told that if they felt unable or unwilling to continue, they could withdraw from the study at any time without suffering any penalty, aca-

demical, or any other negative consequences. Next, the participating adolescents gave their assent. The measures were administered anonymously in a group format (25–35 adolescents) during a 40-min class period.

Measures

Earthquake Exposure and Postearthquake Environment Survey. The *Earthquake Exposure Section* included questions directly related to experiences during the earthquake. Some questions were derived from the Hurricane Related Traumatic Experiences (HURTE) questionnaire designed by Vernberg, La Greca, Silverman, and Prinstein (1996). Due to differences between characteristics of the two disasters as well as cultural factors (e.g., majority of the children in Turkey do not own a pet), some questions were added (e.g., Were you trapped under ruins?), while others were omitted (e.g., Did a pet die?). The *Post-Earthquake Environment Section* included questions about living conditions (e.g., tent and/or shed living), the amount of separation from family members, and changes in daily routines, family relations, peer relations, and school. In addition, social support given by parents and friends was measured by using four items.

The Child Posttraumatic Stress Disorder Reaction Index (CPTSD-RI) (Pynoos et al., 1987). This 20-item self-report measure is the most widely administered instrument for assessing the degree of childhood PTSD. It has been used with children exposed to broad range of traumatic events such as war, school shooting, hurricane, and earthquake. This measure was translated into Turkish and tested for validity and reliability (Erden, Kılıç, Uslu & Kerimoğlu, 1999). The Turkish version of the measure has been used with children who had experienced various traumatic events, including the Marmara earthquake (Bal, 2008; Karakaya, Ağaoglu, Coşkun, Şişmanlar & Yıldız-Öç, 2004) and tornado (Ak et al., 2011).

Originally, CPTSD-RI responses were scored according to a 5-point Likert scale ranging from “none” to “most of the time” (Nader, 1997). However, to simplify the presentation and scoring of the scale, the 5-point scale was reduced to a 3-point response (e.g., Vernberg et al., 1996). The 3-point response format is scored 0, 2, and 4 as in the original 5-point scale that permits comparisons of symptom severity. According to established PTSD guidelines, scores reflect different levels of symptom severity: doubtful (0–11), mild (12–24), moderate (25–39), severe (40–59), and very severe (60–80) (Frederick, 1985).

The Behavior Problems Index (BPI) (Zill & Peterson, 1986): This 28-item questionnaire was developed to assess the frequency and range of behavior problems in children aged 4–17 years. Ratings are scored on a 3-point scale: not true (0), sometimes true (1), and often true (2). Participants were asked to respond to this questionnaire

twice (i.e., their remembered behaviors or feelings prior to the earthquake and after the earthquake). Frequency index score (i.e., the number of behavior problems) (range 0–28) measured the total number of behavior problems reported by the participants.

Results

Exposure variables

Earthquake exposure variables

Table 1 shows the item endorsement frequencies and mean and standard deviation scores for the perceived life threat, life-threatening experiences, and the loss-disruption experiences. On average, adolescents as a whole sample reported that they had experienced seven earthquake exposure events ($M = 6.56$, $SD = 3.19$); however, these experiences varied as a result of distance from the epicenter. Thus, adolescents in the HI group had been exposed to significantly more events ($M = 8.04$) than those in the MI group ($M = 6.63$); who, in turn, were exposed to significantly more events than those in the LI group ($M = 5.34$) ($F(2, 689) = 37.33$, $p < 0.001$).

Postearthquake exposure variables

In addition to earthquake exposure variables typically measured in previous studies, this study also included living conditions, school condition, and emotional relationships. When changes in the adolescents' daily routines were examined, findings revealed that 13% of the participants reported they had taken on more adult roles and responsibilities (e.g., taking care of siblings) because of the earthquake and 12% reported no longer having their own room because of changes in housing conditions (e.g., living in a tent). In terms of family relations, according to adolescents' reports, 30% reported stronger family ties (e.g., understanding the value of being a family) compared prior to the earthquake.

Regarding changes in their emotional lives, being afraid of staying home alone (33%) was reported the most frequently, followed by having fears (e.g., dark, tall buildings) (12%), and losing interest in everything or in specific things (e.g., playing games) (6%). With regard to peer relations, 63% of the adolescents were either temporarily or permanently separated from their friends following the earthquake. Regarding school changes, 36% reported that they changed schools after the earthquake. Three quarters of these teens changed schools twice during one academic year, whereas 13% changed three or more times as the family kept moving to different places.

PTSD symptoms

Table 2 shows the percentage of adolescents endorsing CPTSD-RI items. The most frequently reported symp-

Table 1. Item endorsement frequencies and means and standard deviations for the earthquake exposure variables

	Total (N = 695)	HI (n = 225)	MI (n = 191)	LI (n = 279)
	N%	N%	N%	N%
<i>Perceived life threat</i>				
To self	452 (65)	170 (76)	114 (60)	168 (60)
To family members	406 (58)	156 (69)	102 (53)	148 (53)
<i>Life-threatening experiences</i>				
Exposure to injured	495 (71)	187 (83)	140 (73)	168 (60)
Death of family members/relatives/friends	461 (66)	184 (82)	137 (72)	140 (50)
Exposure to dead	432 (62)	180 (80)	113 (59)	139 (50)
Injury to family members/relatives/friends	242 (35)	89 (40)	70 (37)	83 (30)
Physical injury to self	85 (12)	39 (17)	21 (11)	25 (9)
Trapped under ruins	30 (4)	17 (8)	7 (4)	6 (2)
<i>Loss-disruption experiences</i>				
Separation from friends	436 (63)	157 (70)	142 (74)	137 (49)
Inside home damage	428 (62)	107 (70)	128 (67)	142 (51)
Move out from home	296 (43)	122 (54)	76 (40)	98 (35)
School change	249 (36)	123 (56)	60 (31)	63 (23)
Loss of personal possessions	206 (30)	97 (43)	47 (25)	64 (23)
Separation from family	186 (27)	66 (30)	64 (33)	56 (20)
Home damage	127 (18)	60 (26)	30 (16)	37 (14)
	M (SD)	M (SD)	M (SD)	M (SD)
Perceived life threat (0–2)	1.24 (.87)	1.45 (.81)	1.14 (.90)	1.14 (.88)
Life-threatening experiences (0–6)	2.53 (1.44)	3.10 (1.31)	2.58 (1.31)	2.04 (1.45)
Loss-disruption experiences (0–7)	2.79 (1.88)	3.48 (1.87)	2.89 (1.71)	2.16 (1.79)
The total number of earthquake exposure experiences (0–15)	6.56 (3.19)	8.04 (3.01)	6.63 (2.91)	5.34 (3.00)

toms were “upset at reminders” (90%) and “upset with thoughts of the earthquake” (89%). The least frequently reported items included “somatic complaints” (44%) and “exhibiting reckless behaviors” (33%). Significant differences were found among the three impact groups for all but six items. These differences suggest adolescents in the HI group were experiencing the trauma-related symptoms (e.g., seeing pictures and hearing sounds in mind, having bad dreams about the earthquake, having memory difficulties, trying to emotionally avoid feelings about the earthquake, and having fear of recurrence) more often than did their peers in the MI and LI groups.

PTSD severity by each impact group

The total CPTSD-RI scores for the whole sample ranged from 2 to 76 with a mean of 36.97 and a standard deviation of 14.62 ($M = 41.91$, $SD = 14.46$ for HI, $M = 35.26$, $SD = 14.34$ for MI, $M = 34.12$, $SD = 13.93$ for LI). One-way ANOVA was used to test the effect of level of impact on the total CPTSD-RI scores. Findings indicated that the three impact groups significantly differed from each other ($F(2, 692) = 20.36$, $p < 0.001$).

However, Bonferroni *post hoc* comparisons revealed significant differences only between pairs of means of HI and MI, and of HI and LI (both $p < 0.001$). This finding supports the previously reported descriptive data that showed overall that the adolescents in the HI group experienced greater disruptions and more emotionally charged experiences than did their peers in the MI and LI groups. The CPTSD-RI mean scores did not significantly differ between MI and LI groups.

With regard to PTSD severity, overall adolescents reported moderate levels of symptomatology ($M = 36.97$, $SD = 14.62$). Nearly half of the adolescents reported severe to very severe levels of PTSD symptoms. While comparable percentages of participants in MI and LI groups reported severe to very severe symptoms (42 and 38%, respectively), a higher percentage (59%) was found for participants in the HI group. Analysis indicated that there was a significant difference in the distribution of adolescents in the CPTSD-RI severity categories across the three cities ($\gamma = 0.05$, $p < 0.001$). As hypothesized, higher levels of impact are associated with more severe levels of PTSD symptomatology. This finding

Table 2. Percentage of adolescents endorsing CPTSD-RI items by each impact group

CPTSD-RI Items	Total (N = 695)	HI (n = 225)	MI (n = 191)	LI (n = 279)
Upset at reminders	90	90	89	90
Upset with thoughts of	89	91 ^{a,b}	87	88
Identified as traumatic	88	90	87	87
Repetitive images	87	91 ^{a,b}	84	87
Behavioral avoidance	86	88	83	85
Fear of reoccurrence	85	87 ^{a,b}	81	86
Repetitive thoughts	80	84 ^{a,b}	77	77
Sense of foreshadowing	73	88 ^b	72	69
Easily startled	68	71 ^b	69	66
Attentional difficulties	61	70 ^b	64 ^c	50
Guilt	61	66	57	61
Emotional avoidance	60	71 ^{a,b}	52	56
Anhedonia	58	60	60	54
Bad dreams	54	64 ^{a,b}	49	49
Emotional isolation	54	62 ^b	52	49
Memory difficulties	53	68 ^{a,b}	43	48
Sleep difficulties	52	66 ^{a,b}	48	43
Emotional numbing	45	60 ^{a,b}	41	36
Somatic complaints	44	51 ^{a,b}	42	39
Reckless behavior	33	32	29	35

Note: ANOVA analysis was based on mean CPTSD-RI item scores.

^aHI versus MI; ^bHI versus LI; and ^cMI versus LI.

^{a,b,c} $p < 0.001$.

also underscores the greater number of negative experiences of the HI group during and after the earthquake.

Gender differences

When the degree of PTSD symptomatology was examined, females on average reported severe levels of symptoms ($M = 41.31$, $SD = 13.52$), whereas males reported moderate levels ($M = 32.42$, $SD = 14.36$). Females were approximately twice as likely to report severe to very severe levels of symptoms than males, 60 and 31%, respectively. Findings of a 2×3 ANOVA indicated significant main effects for impact group ($F(2, 694) = 21.80$, $p < 0.001$) and gender ($F(1, 694) = 73.32$, $p < 0.001$). However, gender by impact level interaction effect was not significant ($F(2, 694) = 0.22$, $p = 0.80$).

Prediction of PTSD symptoms

Hierarchical regression analysis was conducted to predict adolescents' PTSD symptoms (See Table 3). Adolescents' earthquake exposure experiences were entered as a set on Step 1. Together, this set of variables accounted for 22% of the variance in PTSD scores. Postearthquake exposure variable was entered as a next step. This variable resulted in significant increment in cumulative R^2 , accounting for 10% of the variance. Higher PTSD scores were reported by those who were continuing

to experience disruptions in their personal lives since the earthquake had happened. Demographic variables were entered as a set on Step 3. After controlling for exposure, gender and age accounted for 6% of the remaining variance in PTSD scores. An in-depth analysis revealed a statistically unique effect only for gender. Females reported more PTSD symptoms compared to males. On Step 4, social support from parents and friends was entered; however, it did not achieve significance. In conclusion, this model explained 39% of the total variance in adolescents' PTSD symptoms.

Behavior problems

The most frequently reported behavior problems after the earthquake include difficulty in getting one's mind off certain thoughts (89%), restless behavior (79%), and having a strong temper (79%). Note that some of the most frequently endorsed items are also similar to PTSD symptoms. The least frequently reported behavior problems included breaking things deliberately (8%), having trouble with teachers (21%), and being disobedient at home (22%).

Changes in behavior problems

The mean and standard deviations of the frequency index score before and after the earthquake are presented

Table 3. Summary of hierarchical regression ($N = 695$)

Step	Variable	r	R ² change	B	Beta
1	Earthquake exposure		0.223*		
	Perceived life threat	0.31*		2.90*	0.17
	Number of life-threatening events	0.40*		2.22*	0.22
	Number of loss/disruption events	0.31*		0.49	0.06
2	Postearthquake exposure		0.105*		
	Disruptions in daily living	0.47*		1.58*	0.33
3	Demographics		0.058*		
	Gender	-0.30*		-6.67*	-0.23
	Age	0.002		-0.67	-0.07
4	Social support		0.004		
	Parents	0.02		2.31	0.05
	Friends	0.18		1.08	0.04

Note: Cumulative $R^2 = 0.39$; Adjusted $R^2 = 0.38$.

* $p < 0.001$.

in Table 4. Findings indicated that overall the number of behavior problems significantly increased following the earthquake ($t(694) = 16.33, p < 0.001$). Significant increases were found at each of the three impact levels (HI: $t(224) = 9.86, p < 0.001$, MI: $t(190) = 9.11, p < 0.001$, LI: $t(278) = 9.38, p < 0.001$). In addition, a one-way ANOVA was conducted to determine whether the three groups significantly differed in terms of the number of behavior problems. Findings revealed significant group differences on the frequency index scores after the earthquake ($F(2, 692) = 6.06, p < 0.01$). Bonferroni *post hoc* analyses revealed that adolescents in the HI group exhibited a significantly greater number of behavior problems than adolescents in the MI and LI groups. There were no significant differences between the MI and LI groups. Regarding gender differences, findings revealed that females reported significantly greater number of problems than did males after the earthquake ($t(693) = 4.63, p < 0.001$) (See Table 4). When gender differences within three groups were investigated, girls in the HI group reported significantly higher mean frequency index scores than their peers in the MI and LI groups.

Discussion

PTSD symptoms

In general, findings of this study are comparable with PTSD symptoms reported by other researchers. For example, subsequent to a violent school sniper attack, 77% of the children who were in the playground (e.g., experienced direct life threat) and 67% of those in the classrooms (e.g., did not experience life threat) reported moderate to severe levels of PTSD symptoms (Pynoos et al., 1987). Similarly, 2 months after the Hurricane Andrew, Shaw, Applegate, and Schorr (1996) found that 87% of adolescents from the high impact and 80% of those from the low impact groups reported moderate to very severe levels of PTSD symptoms. Moreover, Pynoos et al. (1993) revealed that overall 70% of the children reported moderate to very severe levels of symptomatology 18 months after the Armenian earthquake. Indeed, 91% of the children in Spitak (e.g., closest city to the epicenter) reported severe to very severe symptoms. Lastly, Kolaitis et al. (2003) found

Table 4. Mean and standard deviation of the frequency index score for Behavior Problems Index

	Total ($N = 695$)		HI ($n = 225$)		MI ($n = 191$)		LI ($n = 279$)		Females ($n = 356$)	Males ($n = 339$)
	Before	After	Before	After	Before	After	Before	After		
	<i>M</i> (SD)	<i>M</i> (SD)	<i>M</i> (SD)	<i>M</i> (SD)	<i>M</i> (SD)	<i>M</i> (SD)	<i>M</i> (SD)	<i>M</i> (SD)	<i>M</i> (SD)	<i>M</i> (SD)
Frequency index score (Range 0–28)	10.93 (4.70)	13.14 ^a (4.69)	11.61 (4.46)	13.98 ^a (4.15)	10.71 (4.46)	13.01 ^a (4.70)	10.53 (5.00)	12.54 ^a (5.00)	13.95 ^b (4.30)	12.42 (4.81)

^aAfter versus before $p < 0.001$; ^bfemales versus males $p < 0.001$.

that 78% of the elementary school children reported mild to severe posttraumatic symptoms.

Findings indicated that the vast majority of the adolescents (96%) experienced at least some PTSD symptoms 13 months after the earthquake. This result was one of the most striking findings of this research because findings from longitudinal studies suggest that children's PTSD reactions tend to decline especially over the first year even among the highly exposed groups of children (e.g., Nader et al., 1990). In spite of an expected improvement, findings suggested that a high proportion of adolescents were severely affected by this event and were still struggling with these postdisaster experiences more than a year after the earthquake. The high incidence of PTSD symptoms can be attributed to the magnitude of the disaster experiences (e.g., loss of loved ones, exposure to dead/injured bodies) and postearthquake adversities (e.g., separation from family, lack of proper housing) as well as traumatic reminders (e.g., indescribable odor, mounds of debris) caused by extensive damage. All of these served as traumatic reminders and thus may have interfered with recovery process.

Physical proximity

Overall, adolescents in the HI group showed higher levels of PTSD symptoms and a greater number of behavior problems as compared to MI and LI groups. The differences between MI and LI were in the expected direction (e.g., youth in the MI sample had higher mean scores than youth in the LI sample) but they were not large enough to attain statistical significance. Three possible factors may have been implicated: first, some residential and public buildings in the LI area still had visible damage even more than a year after the earthquake, with debris found in areas between apartment buildings; second, approximately half of the adolescents living in the LI area reported that they lost loved ones (e.g., relatives, friends); third, there was months of long exposure to images of death and destruction from Television, radio, and newspapers. Data show that bereaved children and adolescents are more likely to exhibit increased PTSD symptoms and marked anxiety (Goenjian et al., 1995); however, this factor as well as the other two mentioned above merits additional study.

Prediction of PTSD symptoms

Regression analysis revealed that the degree of exposure to the earthquake significantly contributed to the prediction of adolescents' PTSD symptoms. Overall findings suggest that adolescents who perceived life threat to themselves or their families during the disaster experienced more life-threatening events (e.g., those who were injured), lived through more loss and disruption experiences (e.g., separated from family and friends), continued to experience changes in their daily routines as a result of

the earthquake (e.g., those who lived in a shed), and reported higher levels of PTSD symptoms. These data are consistent with previous studies showing that the level of exposure to a traumatic event was a powerful predictor of the severity of PTSD symptoms (Pynoos et al., 1993).

Findings also revealed distinct gender differences. More specifically, on average females reported severe levels of PTSD symptoms, whereas males reported moderate levels. This difference was also apparent in each of the three impact groups. These findings are consistent with studies that report gender differences among child (Pynoos et al., 1993) and adult (Sumer, Karanci, Berument & Gunes, 2005) victims of disasters. It is possible that the gender role socialization that begins at an early age may play a role as boys learn to suppress or deny psychological symptoms, whereas girls learn to reflect their feelings more and become more emotionally expressive (Korol, Green & Gleser, 1999). In addition, cross-cultural research indicates that sex roles are more traditional in Turkish culture as compared to Western cultures. For example, it is not socially acceptable for males to cry in public even after a traumatic event, or to explicitly express negative emotions. It is likely that Turkish boys early adopt the culturally defined male roles and thus they are likely to deny and/or underreport current stresses and psychological problems.

Implications for research, policy, and practice

Findings have direct clinical implications for developing and implementing effective interventions programs that target those who are at greater risk. First, data revealed that a vast majority of the adolescents reported symptoms more than a year after the major earthquake. Clinical interventions should focus not only on adolescents' immediate psychological reactions but also consider their long-term problems. Adolescents reported that they not only experienced negative events during the earthquake (e.g., physical injury) but also encountered numerous ongoing life disruptions (e.g., loss of peer contact). Long-term interventions that promote adolescents' social skills and coping styles for dealing with these ongoing stressors are likely to be beneficial. Second, adolescents who experienced the most direct impact of an earthquake (e.g., those with high levels of exposure) reported a higher number of PTSD symptoms. Consequently, these adolescents were more likely to require specific attention and careful monitoring following an earthquake. There is a need for psychosocial interventions that target adolescents and their special needs.

Limitations and directions for future research

Despite this study's contributions, it has several limitations. One involves the use of self-report for data collection. However, the developmental literature suggests that overall, children provide more reliable information about

their internalizing states than other informants (e.g., parents) (Silverman & Eisen, 1992). On the other hand, several researchers have speculated that children are more willing to exaggerate their responses and report more severe symptoms (Lonigan, Shannon, Finch, Dugherty & Taylor, 1991). Ideally, data should be obtained from multiple informants, including parents, teachers, and classmates to present a more complete picture of disaster-related experiences and reactions.

Another limitation may relate to the fact that this study was conducted 13 months after the disaster. Several major life events might have taken place during this time period and might have affected adolescents' responses. It is possible that some of these events could be closely related to the earthquake (e.g., school change), whereas other factors were not (e.g., breaking up with girlfriend/boyfriend). It was also noted that children and adolescents tend to repeatedly discuss their experiences with each other; hence, this sharing of stories might influence their reports of their own experiences. Future studies that examine adolescents' reactions over a more extended period of time are needed. These longitudinal studies may help to clarify the long-term course of PTSD symptoms as well as other reactions.

In conclusion, this study provided comprehensive information about adolescents' postearthquake experiences, posttraumatic stress reactions, and the role of level of exposure. Despite the limitations noted above, this study enhanced the existing disaster literature by focusing on adolescents and adding invaluable information about adolescent's postdisaster symptoms. Moreover, findings from this study should help in the design and implementation of effective and age-appropriate intervention programs to help to reduce the suffering of other children and adolescents who have the misfortune to experience similar traumatic events.

Conflict of interest and funding

There is no conflict of interest in the present study for the author.

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