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Article · February 2019

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Gender Differences in Children Mental Health Disorders after Earthquakes in Iran: A Systematic Review

Hamed Seddighi ^{1*}, Ibrahim Salmani ²

1. Student Research Committee, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran
2. Department of Health in Disaster and Emergency, School of Public Health, Shahid Sadoughi University of Medical Sciences, Yazd, Iran

ARTICLE INFO

Review Article

Received: 10 Oct 2018

Accepted: 28 Jan 2019



Corresponding Author:

Hamed Seddighi

ha.seddighi@uswr.ac.ir

ABSTRACT

Introduction: Earthquake occurs in the world every year and Iran is one of the most earthquake-prone countries in the world with the ranking of 15 between 120 countries. Children are the most vulnerable group in disasters and they have a number of negative symptoms after a disaster.

Methods: This study used the systematic review method and followed systematic review principles. Mental health, earthquake, psychosocial, PTSD, post-traumatic stress disorder, and stress were the keywords used to search in the Iranian scientific information database (SID), Noor Specialized Magazines (Noormags) and Google Scholar. The language of the search was Farsi and just Farsi articles were included in the review.

Results: The result were presented in five sections (Psychosocial interventions, Signs of disorder, Gender, Age, Geographical area). It showed psychosocial interventions of those studied in reviewed papers were effective and there were gender differences in children mental health disorders after earthquakes in Iran. In addition, PTSD group, girls reported all the symptoms of PTSD more than the boys except anger symptoms, but the prevalence of PTSD symptoms in males was higher than in girls.

Conclusion: Iranian studies just focused on male and female gender and found that disorders are higher in girls of different ages in childhood. In the age group of 13 to 18 years, the frequency of each disorder was less than that of the seven to twelve-year old group.

Keywords: Children, Mental Health, Earthquake, Natural Disaster, PTSD, Gender

How to cite this paper:

Seddighi H, Salmani I. Gender differences in children mental health disorders after earthquakes in Iran: a systematic review. Journal of Community Health Research. 2019; 8(1): 54-64.

Introduction

Earthquake occurs in the world every year and are different from too weak to strong ones which can cause damage (1). Significant earthquake is those which are large enough to cause notable damage. Iran being located in the active Alpine-Himalayan seismic belt is an earthquake-prone country that has experienced more than 130 strong earthquakes with a magnitude of 7.5 or more in the past centuries (2). Global Seismic Risk by Countries introduced Iran as one of the most earthquake-prone countries in the world with the ranking of 15 between 120 countries and the average magnitude of 7.1 Richter (3). In the last decades, strong earthquakes have claimed more than 100,000 lives, destroyed many towns and thousands of villages, and caused extensive economic damages (3). The recent earthquake in Iran has shown Iran's seismicity as well as its vulnerability to earthquakes (4). Evidence indicate that most major cities of Iran have been located in a very high hazard zone(5). Low resiliency of Iran (Iran score in the world ranking resiliency is 21.8 with rank 114) is another cause for more damages on human lives, economy, infrastructures and other aspects of the country (4).

Children are the most vulnerable group in disasters (6). In developing countries, children hold a high percentage of the population (7). For example, in Haiti, 40% of the total population is under 18 years old (7). Physiologically and psychologically, children have less chance to cope and survive in acute and chronic traumatic incidences (8). For example, in Bam earthquake in Iran, tragically 46% of the total death toll belonged to children in comparison with the 15% share before the earthquake (9). Children are dependent on their parents or caretakers for access to food, cloth, shelter, medical care, security, etc. Children during disaster situation are more sensitive to malnourishment, so they are more vulnerable nutritionally during disasters (9). Because of consequences of climate change, the number of natural disasters is raising and every year around 400 disasters occur globally affecting the most vulnerable groups, among them children (10).

More than 530 million children are living in disaster-affected areas; i.e., a quarter of child population in the world (10, 11).

It is important to note that children have some negative symptoms after a disaster (12). A large and growing literature as linked disaster exposure with mental health symptoms associated with posttraumatic stress, depression, and anxiety (6, 7, 13-29). After a natural disaster, children may also show educational problems (28) and physical health problems (27, 30), which may be due to emotional distress. These problems may persist more than a year after the disaster (25, 26) and in fact, it can have long-term effects in severe conditions (24).

Children after disasters have a wide range of mental health disorders and emotional reactions like depression, anxiety, functioning, behavior problem, anger, somatic complaints, fear, and traumatic grief(22). Many studies have shown additional risk factors for developing posttraumatic stress disorder (PTSD) including being a child at the time of disasters, female gender, lower socioeconomic status, premorbid personality characteristics, preexisting anxiety, lack of social support which increase the risk of mental health disorders (19-21, 29).

Many pieces of evidence in the world indicate the effect of disasters on child mental health but there is little evidence in Iran. With the cultural difference between different countries, the question is about gender differences in mental health disorders after earthquakes in Iran. Also, this study tried to discover what the knowledge gap is in Iran as a disaster-prone country with many strong earthquakes. The result of this study will help different Iranian stakeholders in disasters. It can help policymakers for better planning and policies on child psychosocial support in disasters, the humanitarian organization for better responding after earthquakes and also the researchers for working on knowledge gaps.

Methods

This study used a systematic review method and followed systematic review principles (31). Mental

health, earthquake, psychosocial, PTSD, post-traumatic stress disorder and stress were the keywords used to search in the databases (Table 1). Children was not a keyword for search because most of the papers were not written specifically for children. Two of the authors (H.S and I.S) separately read the titles and abstracts of 136 searched papers and then selected related papers for final consideration.

The articles were searched in Iranian scientific information database (SID), Noor Specialized

Magazines (Noormags) and Google Scholar by combining the keywords mentioned in Table 1. The language of the search was Farsi and just Farsi articles were included in the review. After reviewing the articles and deleting repetitive articles, titles and abstracts were reviewed separately by two authors to determine relevance. Figure 1 depicts methods of the search and selection. The search strategy was developed according to Stark & Landis method (Stark & Landis, 2016).

Table 1. Keywords used in searching the databases

Keywords						
Mental	Disorders	PTSD	Psychological	Psychosocial	Earthquake	Health

When an article was found with the above descriptions, the title and summary were reviewed to determine whether the article was relevant to the main purpose of the reviewer not. In the case of

ambiguity, the authors referred to the full text for the final decision. Figure 1 displays the process of selecting articles.

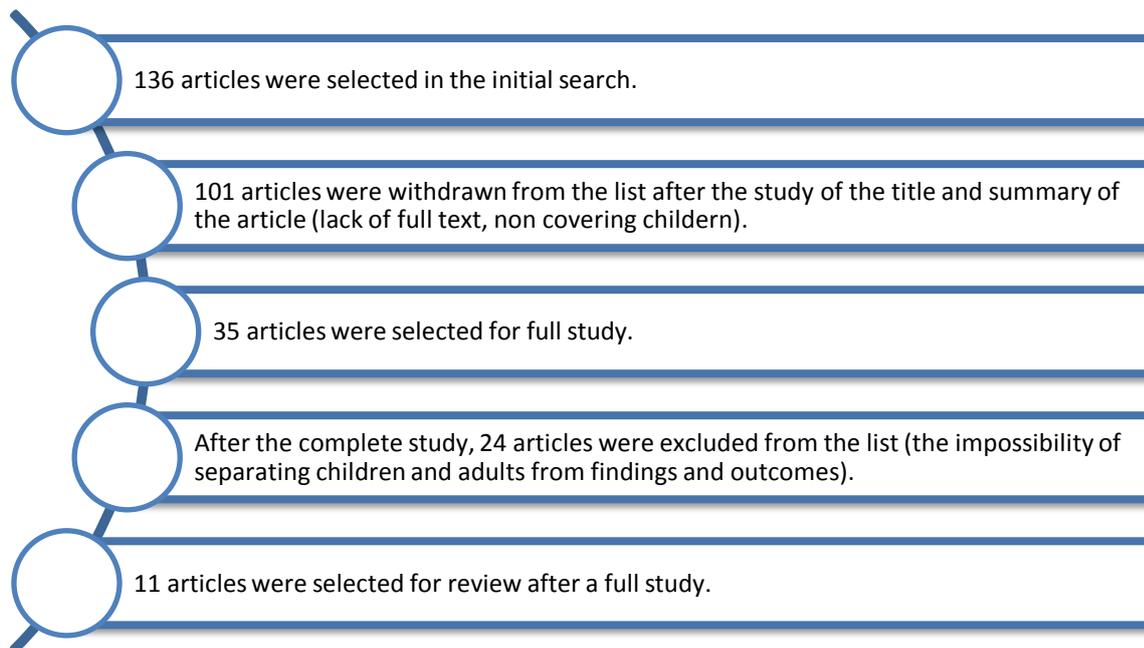


Figure 1. Process for selecting articles for review

Results

Psychosocial interventions

Study (10) showed that cognitive behavioral therapy of CBT was effective in children under the age of 6 in Damghan earthquake and had a significant reduction in stress. The study also identified psychosocial interventions on mothers of

cognitive-behavioral therapies on reducing the symptoms of post-disaster stress disorder among children. In another study (32), 7,200 adolescents were subjected to cognitive behavioral and cognitive behavioral interventions. The results showed that there was a significant difference between the group of cognitive behavioral

interventions and the control group in reducing the mean total PTSD symptoms and reducing the mean avoidance symptoms. In a study (33), 19 children aged between 3 to 6 years, a group therapy game which focused on symptoms of mourning and injury was found to be effective in reducing behavioral symptoms and signs of empathetic stress in post-traumatic stress disorder (PTSD).

Gender

Study (34) showed that PTSD in children under 15 years varies according to gender and is higher in girls. However, there was no gender difference between the ages of 15 to 18. In the study (35) on 94 teenagers lived in Bam town, the results showed the most disorders that were caused by the earthquake were anxiety, depression, and physical problems, and boys, in comparison with girls, scored higher in all nine dimensions of psychological disorders. The most common disorders in boys were paranoid disorder, depression, and anxiety. However, in girls, depression and compulsive obsession were the most common disorders. Patients experiencing baldness scored higher scores in forced obsession, interpersonal relationships, and anxiety.

In comparison with the bereaved boys and girls with earthquake-stricken people who did not experience bereavement, females scored a higher score in depression and boys in compulsive obsessions. Study (32) showed that PTSD rates among girls under 15 years of age were higher than the boys. Study (36) compared the coping strategies, happiness and future hope in adolescents who survived in Bam earthquake with normal adolescents in their findings showed that gender differences were observed in the studied variables. Study (37) showed that there was a significant relationship between the level of depression and gender, the loss of one of the family members during the earthquake, the occurrence of physical problems for themselves or one of the family members, and satisfaction with their living conditions. Study (38) also showed that in the PTSD group, girls reported all symptoms of PTSD, except anger symptoms, more than boys, but the prevalence of PTSD symptoms in males

was higher than in girls, although this difference was significant. Study (39) showed the scores obtained from girls in Rudbar were more than those in Rasht, but differences in phobic dimensions and anxiety were significant.

Age

Based on the age group classification including infancy and early childhood (0 to 8 years old), middle childhood (9-11 years old), and adolescence (12-18 years old) (Stark & Landis, 2016), five studies were on early childhood, 3 studies on middle childhood (9-11 years old) and nine studies on adolescence (12-18 years old). Studies have shown that psychiatric disorders under the age of 15 are more than over 15 years old. Study (40) showed that in the age group of 13 to 18 years, the frequency of each disorder was less than that of the seven to 12-year old group. In the group of over seven years being unaware of the location of parents, fear of child death and parents' sense of disability were significantly correlated with the diagnosis of PTSD. Study (34) showed that in students under the age of 15 years, the rate of PTSD was 52.2% for boys and 59% for girls, which is a statistically significant difference ($p < 0.01$). In students over the age of 15, 37.5% were boys, and 33.5% were girls with PTSD, which was not significantly different. Study (37) showed that 74.2% of the subjects had a degree of depression (mild to severe). There was a significant relationship between depression and gender, the loss of one of the family members during the earthquake, physical or mental problems ($P < 5$) for themselves or one of the family members and satisfaction with their lifestyle. However, there was no significant relationship between depression, age, and residential demolition during the earthquake. Of the 472 students studied, 8.64% were female, and the rest were male. The age group of people in this study was 14 to 18 years old.

Signs of disorder

Study (35) showed earthquake cause anxiety, depression, psychosomatic (physical illness or other condition caused or aggravated by a mental

factor such as internal conflict or stress), compulsive obsession, interpersonal relationships, respectively. In study (36), survivors of earthquake survive less problem-oriented coping strategies and use more emotional-focused coping strategies. The rate of happiness and hope for the future was lower than those of normal adolescents. In study (38), teenagers who had a traumatic event reported more depression, anxiety, post-traumatic stress, anger, and degradation than the normal adolescents. In study (39), 83% of the students in Rudbar were in the category of a tendency to psychological disorders. The highest and lowest percentages were paranoid dimensions of 95% and phobia 68%. 95% of the students in Rudbar suffered from PTSD (from mild to severe grades).

Geographical region

Of 11 reviewed papers, nine studies focused on children mental health after Bam earthquake, one study on Damghan earthquake and one study on Rudbar earthquake. The 2010 Damghan earthquake damaged and destroyed some small

villages in a sparsely populated region near Alborz mountain range. It left four people dead, forty injured, and about 800 people without homes. The deaths and injuries in this moderate event were attributed to the low-quality construction styles that are typical of the area. The 1990 Manjil–Rudbar earthquake occurred on June 21 in northern Iran. The shock had a moment magnitude of 7.4. Widespread damage occurred to the northwest of the capital city of Tehran, including the cities of Rudbar and Manjil. The National Geophysical Data Center estimated that \$8 billion damage occurred in the affected area. Other earthquake catalogs presented estimates of the loss of life in the range of 35,000–50,000, with a further 60,000–105,000 that were injured. The 2003 Bam earthquake struck the Kerman province of southeastern Iran on December 26. The shock had a moment magnitude of 6.6. The earthquake was particularly destructive in Bam, with the death toll amounting to at least 26,271 people and injuring up to 30,000.

Table 2. Findings extracted from the studies

Study	Findings	Place of earthquake
Dorostian et al. (10)	The purpose of this study was to examine the effect of behavioral-cognitive-behavioral therapy (CBT) and analysis of interpersonal behavior (TA) on mothers and the reduction of PTSD symptoms in children under the age of 6 (65 children) who experienced Damghan earthquake. Signs of PTSD were measured before and after intervention by the Pulse Rate of Pulse Rate (UPI) PTSD. The results of this study showed a significant reduction in post-traumatic stress disorder in children ($P < 0.03$). The mean scores of PTSD <i>yol</i> statistically indicate that psychosocial interventions on mothers using behavioral-cognitive-behavioral therapy (CBT) and interactive analysis (TA), on reducing the symptoms of post-traumatic stress disorder in pre-school children is effective from the elementary school age.	Damghan earthquake

Study	Findings	Place of earthquake
Parvaresh et al. (32)	<p>Students in Kerman, from primary school, guidance, high school, who left after Bam earthquake in Kerman, were enrolled in the study. The statistical methods of the central index - T-test and Student's t-tests and analysis of variance were used and analyzed using SPSS-12 software.</p> <p>160 high school students aged 15 years (56 females and 104 males) and 343 students under the age of 15 (175 females and 68 males) were enrolled in the study. In people over 15 years of age, 94.4% of the total numbers of relatives were missing and 89.4% of them had a complete destruction of the house. In people under the age of 15 years, 90.8% lost one relative, and 81% had complete house destruction. The prevalence of PTSD in subjects over 15 years of age was higher with increasing age ($P < 0.04$) and in subjects with physical harm, but the prevalence of PTSD was not significant in the two sexes. The prevalence of PTSD in subjects under 15 years increased with increasing age, although, there was no significant difference in the prevalence of PTSD between the two sexes in subjects under the age of 15 years and was higher in girls ($P < 0.001$). The association of PTSD with complete house destruction ($P < 0.0001$) was significant, but with loss of the relatives had no significant difference. The behavioral disorder was found in 69.4% of cases in girls and 68.5% in the boys under the age of 15 years.</p> <p>In the study, 35.4% of subjects over 15 years old and 47.8% of subjects under the age of 15 years had PTSD. One month after the earthquake, the rate of PTSD was 55.8% and seven months after the earthquake, it was 55.3% in the 15 year old subjects and 87.9% in the subjects under the age of 15, which is consistent with the higher prevalence of PTSD in people under 15 years of age. The lower prevalence of PTSD in both age groups can be due to the absence of earthquake victims. Relatives in PTSD have no significant difference, which may be because the number of missing persons did not have a close relationship with the subjects.</p>	Bam earthquake
Haji Maghsoudi et al. (35)	<p>A total of 259 pre-university students (17-18 years old) who were resettled after Bam earthquake in Yazd province were evaluated by the SCL-90-R questionnaire and PTSD questionnaire. Ninety-four of them had experienced the death of one of the first-degree relative members in Bam earthquake, and in 165 others it was not (earthquake-only).</p> <p>The results showed that most of the disorders caused by the earthquake were anxiety, depression, and physical problems, and boys in comparison with girls had higher scores in all nine psychological abnormalities. The most common disorder in boys was paranoid disorder, depression, and anxiety. However, in girls, depression and compulsive obsession were seen. Patients experiencing baldness scored higher scores in forced obsession, interpersonal relationships, and anxiety. In comparison with the bereaved boys and girls with earthquake-stricken people who had no experience of bereavement, the bereaved girls gained a higher score in depression and poor boys in compulsive obsession.</p> <p>More than half of the studied population suffered from a post-traumatic stress disorder. There was a positive correlation between mental disorders and the severity of earthquake effects on the person. Anxiety was the most commonly diagnosed disorder in the subjects. The prevalence of disorders in boys was more than the girls.</p>	Bam earthquake
Motlagh et al. (40)	<p>This cross-sectional study was carried out on 48 children and adolescents under 18 years of age who were referred to a field clinic located in the area during the third to fourth week after Bam earthquake. The instruments used in this study were CPSS and STEPP questionnaires.</p> <p>The prevalence of posttraumatic stress disorder in the age group of fewer than seven years, seven to 12 years and 13 to 18 years old was 85%, 74.1%, and 84.6%, respectively. In the age group of 13 to 18 years of age, the frequency of each disorder was less than that of the seven to 12-year group. In the group of over seven years who were unaware of the location of parents, fear of child death and</p>	Bam earthquake

Study	Findings	Place of earthquake
Afshari et al. (36)	<p>parents' sense of disability were significantly correlated with the diagnosis of PTSD.</p> <p>Frequency and severity of PTSD symptoms in different age groups of children and adolescents were different. Therefore, it seems necessary to use more accurate diagnostic tools to diagnose this disorder in children and adolescents.</p>	Bam earthquake
Parvaresh et al.(34)	<p>PTSD questionnaire for parents was provided to 243 students under the age of 15 (175 males and 68 females) to be completed by their parents at home. The Watson PTSD questionnaire was completed by 160 high school students over 15 years of age (56 males and 104 females) at the school. The demographic questionnaire, information on physical injury, house demolition, and the loss of relatives were also completed by both age groups.</p> <p>90.8% of students under the age of 15 had lost one of their first-degree relatives in earthquakes, 81% of their homes were destroyed in general, and 89.4% had physical injuries. 94.4% of students over the age of 15 had lost one of their first-degree relatives in earthquakes, 89.4% reported destruction of their houses, and 80.6% were physically injured. In students under the age of 15 years, PTSD was found in 52.2% of boys and 59% of girls, with a statistically significant difference ($p < 0.01$). In students over the age of 15 years, 37.5% were boys, and 33.5% were girls with PTSD, which was not significantly different.</p> <p>Finally, the rate of PTSD in children and adolescents following a severe earthquake is significant and planning for diagnosis and intervention therapy seems necessary.</p>	Bam earthquake
Mahmoudi et al.(33)	<p>In a multi-controlled field trial, adolescents who had symptoms of post-traumatic stress disorder in Bam earthquake and who did not require medication were grouped into group interventions including psychological counseling and cognitive-behavioral therapies and artistic-sports support interventions, and were compared to the control group.</p> <p>Two hundred people were enrolled in the study and were divided into intervention and control groups. Thirty-one persons were excluded from the study due to immigration or a personal desire. There were only significant differences between cognitive-behavioral groups and control group in mean reduction of total symptoms of PTSD and reduction of mean avoidance symptoms. There was no significant difference between the other groups with the control group and with each other.</p> <p>Cognitive-behavioral group interventions can affect some of the symptoms of PTSD.</p>	Bam earthquake
Mahmoudi et al.(41)	<p>In a previous study, the effect of group play therapy on children aged 3 to 6 years after Bam earthquake was investigated. Subjects were referred for emotional symptoms and behavioral changes caused by earthquake damage and experience of loss of family members. Therapeutic interventions included 12 sessions of group therapy, focused on symptoms of bruises and injuries.</p> <p>A total of 19 children aged 3-6 years old were enrolled in the study. Six were out of the study and 13 patients participated in at least two-thirds of the sessions.</p> <p>Group game therapy focused on the symptoms of mourning and injury can be</p>	Bam earthquake

Study	Findings	Place of earthquake
Siamand et al. (37)	<p>effective in reducing the symptoms of post-traumatic stress disorder and behavioral symptoms.</p> <p>This was a cross-sectional study that was carried out in a sample of 472 high school students in Bam. The research tool was a Beck questionnaire (Beck) with personal data which were analyzed by SPSS software version 11 and descriptive and inferential statistics.</p> <p>From 472 students, 8.64% were female, and the rest were male. The age group of people in this study was 14 to 18 years old. 2.74% of people had a degree of depression (mild to severe). There was a significant relationship between depression and gender, the loss of one of the family members during the earthquake, physical or mental problems ($P < 5$) for themselves or one of the family members and satisfaction with their lifestyle. However, there was no significant relationship between the amount of depression, age and the destruction of residential buildings during the earthquake.</p> <p>Considering the high prevalence of depression among high school students in Bam, comprehensive planning of mental health after natural and human events seems necessary.</p> <p>10 Post-traumatic stress disorder syndromes and its association with other disorders in adolescents aged 11-16 years old in Bam.</p>	Bam earthquake
Mohamadi et al.(38)	<p>One thousand students aged 11-16 years old in Bam (300 boys and 700 girls) were selected by multi-stage cluster sampling in two educational levels as the experimental group and 3042 students aged 11-16 years in Tehran as the target group. Data were collected by two tools of the Childhood Accident Scale (Form A) and Post Traumatic Stress Scale (interview form).</p> <p>Adolescents who had a traumatic event reported more than normal adolescents, depression syndrome, anxiety, post-traumatic stress, anger and degeneration ($p \leq 0.01$). In the PTSD group, the girls reported all symptoms of PTSD except the symptoms of anger, they reported more than boys, but the frequency of PTSD symptoms was more in males than females (T^365), although this difference was not significant. The frequency of PTSD in the experimental group was 20%.</p> <p>There was a high association between post-traumatic stress disorder syndrome and other syndromes that can lead to a high incidence of post-traumatic stress disorder. Although psychological vulnerability was more common in boys than in girls, gender role expectations in expressing emotional emotions and how to express mental symptoms in this regard seems to be involved.</p>	Bam earthquake
Mirabzadeh et al.(39)	<p>To compare the psychological complications of the students of the earthquake-stricken areas of Gilan in four variables (degeneration, gender, underlying history and history of mental illness in the family), 302 third-year high school students in Rasht and Rudbar were selected by cluster random sampling from high schools of Rasht, Rudbar, Manjil, and Loshan. The subjects responded to the questionnaire of SCL90 and PTSD. After collecting the questionnaires and extracting information, the data were analyzed by Chi-square test. The results showed that 1-83% of students in Rudbar were in the category of a tendency to psychological disorders. The highest and lowest percentages were paranoid dimensions of 95% and phobia 68%. 95% of students in Rudbar suffered from PTSD (from mild to severe grades). 3 - The difference between students of Rudbar and Rasht in terms of psychological dimensions and PTSD was significant at 1% level (frequency of Rudbar students is higher). 4 - The score obtained in terms of a tendency to psychological disorders by girls in Rudbar was more than the boys, but differences in phobic dimensions and anxiety were significant. 5 - The difference between students of Rudbar was not significant in terms of a tendency to psychological disorders in subordinate variables and history of mental illness in the family.</p>	Rudbar earthquake

Discussion

Since 1900, at least 126,000 fatalities have resulted from earthquakes in Iran. From 1990 until 2018 more than 28 severe earthquakes (more than 6 Richter) happened in Iran. Kermanshah 2017, North Khorasan 2017, Fars 2017, Ilam 2014, Bushehr 2013, East Azerbaijan 2012, Kerman 2011, Lorestan 2006, Kerman 2005, Mazandaran 2004, South Khorasan 1997, and Kerman 1981 were major ones. In reviewed papers in recent thirty years, researchers focused on children mental health just in 3 major earthquakes in Bam, Damghan, and Rudbar. It seems children mental health researches were neglected in other earthquakes.

The result of this study showed the most disorders caused by an earthquake were anxiety, depression, and physical problems, and boys, in comparison with girls, scored higher in all nine dimensions of psychological disorders. In the PTSD group, girls reported all symptoms of PTSD, except anger symptoms, more than the boys, but the prevalence of PTSD symptoms in males was higher than the girls, and this difference was significant. The most common disorder in boys was a paranoid disorder, depression, and anxiety. However, in girls, depression and compulsive obsession were observed. In comparison with the bereaved boys and girls with earthquake-stricken people who did not experience bereavement, females scored higher in depression and boys in compulsive obsessions. The finding also showed that PTSD rates among girls under 15 were higher than the boys.

Another point is that gender differences were observed in the coping strategies, happiness and future hope in adolescents who survived from earthquakes. The relation between depression and gender, the loss of one of the family members during the earthquake, was shown in the finding. Most of the studies reported higher rate mental health disorders in women after disasters (7, 10, 12, 14, 16, 17, 19, 21, 26, 27, 42).

Reviewed Studies in the present study have shown that psychiatric disorders under the age of 15 are more than over 15 years old and in the

childhood is more than middle age. This is similar to other studies on children and mental health (7, 12, 13, 24, 27, 28, 42). Balaban (43) in his article mentioned that there are many pieces of evidence that younger children are more likely to develop mental health disorders than adolescents and adults. However, there is a need for data on the effects of post-disaster stress on children less than eight years old. Also, Rhee (44) emphasized that instruments for researching on early childhood should be carefully constructed using appropriate language and concepts. In addition, evidence showed that the physical symptoms reporting in children are influenced by the level of cognitive development like family, parents, and peers.

Conclusion

- Mental health interventions on children of all ages were effective in Iranian studies after earthquakes in Iran.
- Mental health disorders after an earthquake in Iran has gender-based difference. Iranian studies just focused on male and female gender and found that the disorders are higher in girls of different ages of childhood.
- Reviewed studies on child mental health after earthquakes in Iran showed that in the PTSD group, girls reported all symptoms of PTSD, except anger symptoms, more than boys, but the prevalence of PTSD symptoms in males was higher than the girls, although this difference was significant
- In the age group of 13 to 18 years, the frequency of each disorder was less than that of the seven to 12-year old group.
- In recent thirty years in Iran, studies on children mental health after the earthquake just focused on three earthquakes in three towns between many strong earthquakes and most of the studies were just in one town. Researchers should work on several earthquakes in different towns because of diversity in context and ethnicity in different regions of Iran.

Acknowledgments

We sincerely thank those who cooperated with us in conducting this study. The study was

conducted by the ethical guidelines of the declaration of Helsinki.

Conflict of interest

Authors declare no conflict of interests.

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