

# Earthquake and Mental Health

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## 1. Introduction

**Earthquakes**, as a nature disaster, not only causes deaths, physical disease, damage to the infrastructure and economic loss, it also keeps long-lasting **Mental Health** effects on individuals involved. There will always be cases of psychological disorders such as Post-Traumatic Stress Disorder (PTSD), depression, cognitive disorder, personality disorders, and so on, especially with individuals dealing pre-existing conditions.

At 3:42 am on July 28 1976, a magnitude 7.8 earthquake struck Tangshan, an industrial city of 1 million people in northern China, which had been built on the unstable soil of the Luanhe River's flood plain. Ninety-three percent of residential buildings and 78 percent of industrial buildings were completely destroyed. This alluvial soil liquefied during the quake, undermining entire neighborhoods. The entire earthquake lasted approximately 14 to 16 seconds and killed at least 242,000 people.

Although earthquakes are among the most common and devastating natural disasters, relatively little attention has been paid to their mental health consequences and associated risk factors long time after earthquake. There have been few studies of post-earthquake psychological problems using randomly selected samples of earthquake survivors. Fortunately, we have done a lot of studies about mental disorders due to Tangshan earthquake in China.

### 1.1 Earthquake as a "trauma" related to mental health

An earthquake, also known as a quake, tremor or temblor, is the result of a sudden release of energy in the Earth's crust. In its most general sense, the word earthquake is used to describe any seismic event – whether natural or caused by humans – that generates seismic waves. Earthquakes are caused mostly by rupture of geological faults, but also by other events such as volcanic activity, landslides, mine blasts, and nuclear tests. For humans who live on earth, an earthquake is a trauma. "Trauma" has both a medical and a psychiatric definition. Medically, "trauma" refers to a serious or critical bodily injury, wound, or shock. This definition is often associated with trauma medicine practiced in emergency rooms and represents a popular view of the term. In psychiatry, "trauma" has assumed a different meaning and refers to an experience that is emotionally

painful, distressful, or shocking, which often results in lasting mental and physical effects.

Although earthquakes are among the most common and devastating natural disasters, relatively little attention has been paid to their mental health consequences and associated risk factors. There have been few studies of post-earthquake psychological problems using randomly selected samples of earthquake survivors. Fortunately, we have done a lot of studies about mental disorders due to Tangshan earthquake.

One of our studies was to explore the long-term effect of Tangshan earthquake on psychosomatic health of paraplegic suffers. Sixty-four paraplegic suffers of Tangshan earthquake and 64 normal controls were interviewed and assessed with self administered questionnaire for psychosomatic health, SCL-90, SAS, SDS, CMI (Cornell Medical Index) and SSRS (Social Support Rating Scale). Six patients (9.38%) were diagnosed as PTSD according to Chinese Classification of Mental Disorders, Second Edition, Revised (CCMD-2-R) in sixty-four paraplegic suffers, however, there was no body who was diagnosed as PTSD in normal controls, the incidence of PTSD in paraplegic suffers was higher than that of normal citizen experienced the earthquake. At present, patients' group had poorer mental health than control reflected by SCL-90. The total score of SCL-90 in paraplegic suffers was (143.98±49.22), and the total score of SCL-90 in normal controls was (111.20±23.13), there was significant difference in statistic ( $t=4.822$ ,  $P<0.001$ ) The severity of trauma both mentally and physically has great influence on mental health of suffers even after 25 years.

Another study was to investigate the long term effect of earthquake on mental and physical health of sufferers. Eight hundred and fifty eight first rank relatives of those who died in the earthquake 12 years ago formed the study group, as they experienced the earthquake themselves. Eight hundred and thirty-seven inhabitants who experienced the earthquake but did not lose any first rank relatives formed the control group. The research instruments included: SCL-90[study group/controls= (143.98±49.22)/ (111.20±23.13)], SAS [study group/controls= (40.05±9.47)/ (36.61±5.0)], SDS [study group/controls= (49.08±11.36)/ (42.66±11.74)]. The mental health of study group was worse than that of controls. At the same time, hypertension, ischemic brain disease were more common in study group.

#### Trauma and Disaster

The literature distinguishes between "trauma" and "disaster". Traumas are experiences that threaten individual health and well being, render one helpless in the face of intolerable internal or external danger, overwhelm coping mechanisms, violate basic assumptions about survival, and stress the uncontrollability and unpredictability in the world. Traumas may be caused by an isolated, unanticipated event or long-lasting stressful experience, due to repeated exposure to several extreme external events.

Disasters are relatively sudden, more or less time-limited, and public events that extensively damage properties and lives, engendering a systemic continuously disruptive impact on the social network and basic daily routines of children and families. The community as a whole is compromised in its capacity to negotiate the recovery of its individual members (e.g., massive displacement and relocation). Matters are often made worse when resources are over-stretched and the community's infrastructure is affected. This can result in unemployment, lack of housing and food, poor health and mental health services, school closures, school and job absenteeism, family dysfunction, and displacement of large populations.

Disasters differ in scope and schedule. Some result mainly in loss and disruption (loss of possessions and housing), whereas others involve also a threat to life. Some last a few seconds (e.g., earthquake), whereas others continue for years (e.g., war). Unlike traumas, disasters are characterized by the immediate, long-lasting and repeated exposure of victims to reminders of the disastrous event. Usually, three types of experience are combined: terror due to a danger to one's life or exposure to grotesque sights; grief following loss (e.g., human lives, basic trust, self-esteem); and the disruption of normal living. On the social level, there are shock, depression and mourning, confusion and social disarray, rage and blaming, crime and delinquent behavior, emergence of mythic ideologies, collapse of formal leadership, emergence of informal popular leadership, and social disintegration into primary affiliations. Children feel the disruption in their family, neighborhood and school. Since the pathological and recovery processes continue long after the disastrous event itself is over, even if it was restricted to a single point in time, theoretical, research and intervention studies should follow both a systemic and a long-term design.

### **1.2 Earthquake as a “trauma” in China**

The most recent large earthquake was a 9.0 magnitude earthquake in Japan, and it was the largest Japanese earthquake since records began. On March 11, 2011, an earthquake struck off the coast of Japan, churning up a devastating tsunami that swept over cities and farmland in the northern part of the country and set off warnings as far away the west coast of the United States and South America. By June 2011, the official count of dead and missing remained above 24,000. Tens of thousands of people remained housed in temporary shelters or evacuated their homes due to the nuclear crisis following this earthquake.

Although the people in China had just experienced the Wenchuan earthquake in 2008, nobody could forget the Tangshan earthquake. At 3:42 am on July 28 1976, a magnitude 7.8 earthquake struck Tangshan, an industrial city of 1 million people in northern China, which had been built on the unstable soil of the Luanhe River's flood plain. Ninety-three percent of residential buildings and 78 percent of industrial buildings were completely destroyed. This alluvial soil liquefied during the quake, undermining entire neighborhoods. The entire earthquake lasted approximately 14 to 16 seconds and killed at least 242,000 people (the official death count). Some observers place the actual toll as high as 700,000, and many more were trapped in the rubble. Coal miners working deep underground in the region perished when the mines collapsed on them.

Survivors were faced with no water, no food, and no electricity. With so much damage, recovery was not easy. Some food was parachuted in, but the distribution was uneven. Water, even just for drinking, was extremely scarce. Many people drank out of pools or other locations that had become contaminated during the earthquake.

Although earthquakes are among the most common and devastating natural disasters, relatively little attention has been paid to their mental health consequences and as social risk factors. Posttraumatic stress disorder is a common outcome of major earthquakes.

## **2. Earthquake and depression**

Depression is a popular topic these days. The New Yorker magazine once estimated that more than fourteen million Americans suffer from major depression every year, with minor

depression affecting more than three million. National Public Radio's Depression Out of the Shadows website reports that by 2020 depression will be the second most common health problem in the world. Previous assessments among survivors of earthquake have shown that depression and other mental health problems are common. Depression and posttraumatic stress disorder may arise weeks or months after earthquake. Earthquakes stir up concerns in people not directly affected. They also trigger both a desire to help and a sense of overwhelming hopelessness. This cluster of emotions, helplessness, hopelessness and a sense of being overwhelmed are classic symptoms of depression.

In 1976 a severe earthquake struck Tangshan, China, resulting in 240,000 deaths, thousands of injuries, and widespread destruction of houses and basic services. The United States Geological Survey has termed this event as the worst earthquake in the past four centuries. This catastrophic event might serve as a natural experiment since all Tangshan women who were pregnant at the time were stressed by the quake. We assessed symptoms of depression in young adult offspring exposed to the earthquake prenatally and controls that were not exposed to the earthquake. The pregnant women of Tangshan endured severe stress during the earthquake. Animal and human literature suggests that exposure to prenatal stress can alter the developing hypothalamo-pituitary-adrenal axis and have negative, long-term effects on the offspring. [E.J.H. Mulder, et al. 2002] The animal and human research has demonstrated an association between prenatal stress and adult depression. In our study we found that young adults who were exposed to the earthquake in utero demonstrated a marked increase in severe depression when compared to controls [Lu Lin, Wang Xueyi, Li Jing, et al.1999; Zhang Ben, et al. 2002a]. In addition, the effect was stronger in males than females; males exposed to the earthquake during the second trimester of fetal development exhibited the highest proportion of severe depression [Wang Xueyi, et al.2006, Zhang Ben, et al. 2002b].

In this research, we hypothesized: Firstly, a higher proportion of severe depression will be observed in the earthquake exposed subjects as compared to the non-exposed subjects; Secondly, the effect will be more pronounced in males; Thirdly, subjects exposed to the earthquake during the second trimester of gestation will exhibit higher rates of severe depression than those not exposed or those exposed during the first or third trimester; Fourthly, the second-trimester effect will be stronger in males, and the fifthly, offspring whose mothers reported higher levels of emotional stress due to the earthquake will have higher rates of severe depression.

The purpose of this study was to determine if exposure to a severe maternal stress (major earthquake) in utero increased risk for adult depression. We found that individuals who were exposed to the earthquake in utero demonstrated a marked increase in SD (as measured by the Hamilton depression scale, HAMD) when compared to age and season-of-birth matched controls; in addition, the effect was stronger in males than females. The timing of exposure to the earthquake also proved to be significantly related to the proportion of SD. Males exposed to the earthquake during the second trimester of fetal development exhibited the highest proportion of SD when compared to males exposed during trimesters one and three and females exposed during the first, second, and third trimesters. We also found that the offspring of mothers who were exposed prenatally to a severe earthquake have a lower level of emotional stress. Thus, the mothers who endorsed symptoms such as "After the earthquake, I felt sad, frightened, and/or nervous," had offspring who later reported higher rates of SD. [Zhang Ben, et al.1999]

These findings provide evidence that at least one type of SD may be related to exposure in utero to a stressful event related to maternal experience of earthquake. Furthermore, our results indicate that exposure to maternal stress related to earthquake during the first and second trimesters significantly increases the risk of developing depression in adulthood, which supports previously reported results [Zhang Ben, et al.2000;Wang Xueyi, et al.2005]. Our findings that males exposed during the second trimester exhibited the highest rates of depression and that males overall reported more depression are comparable to previous studies regarding teratogenic and affective disorders following earthquakes [Zhang Ben, et al.2001; Wang Xueyi, et al.2005]. In addition the markedly high rate of depression in the males exposed during second trimester of fetal development provides evidence for a neuro-developmental hypothesis of the etiology of depression [Zhang Ben, et al.1999; Wang Xueyi, et al.2005].

### **3. Earthquake and schizotypal personality**

In Schizotypal personality disorder, people exhibit odd behavior, respond inappropriately to social cues and hold peculiar beliefs. Schizotypal personality disorder occurs in 3% of the general population and occurs slightly more commonly in males than females. People with classic schizotypal personalities are apt to be loners. They feel extremely anxious in social situations, but they're likely to blame their social failings on others. They view themselves as alien or outcast, and this isolation causes pain as they avoid relationships and the outside world. People with schizotypal personalities may ramble oddly and endlessly during a conversation. They may dress in peculiar ways and have very strange ways of viewing the world around them. Often they believe in unusual ideas, such as the powers of Extra Sensory Perception (ESP) or a sixth sense. At times, they believe they can magically influence people's thoughts, actions and emotions. In adolescence, signs of a schizotypal personality may begin as an increased interest in solitary activities or a high level of social anxiety. The child may be an underperformer in school or appear socially out-of-step with peers, and as a result often becomes the subject of bullying or teasing. Schizotypal personality disorder typically begins in early adulthood and is likely to endure, though symptoms may improve with age.

Experiencing trauma is a factor that appears to increase the risk of schizotypal personality disorder. In a sample of 75 women recruited from the community, researchers measured trauma/maltreatment history and symptoms of schizotypal personality disorder, using both questionnaire and interview measures [Howard Berenbaum, et al. 2003]. As hypothesized, individuals with histories of trauma/maltreatment had elevated levels of schizotypal symptoms. Among types of trauma, maltreatment was especially strongly associated with schizotypal symptoms. Although posttraumatic stress disorder symptom severity, depression, dissociation, and difficulty identifying one's emotions were all associated with schizotypal symptoms, they could not account completely for the association between trauma/maltreatment and schizotypal symptoms.

Previous research has demonstrated that prenatal exposure to maternal stress is a possible risk factor for development of schizophrenia-spectrum diagnoses among adult offspring; however, research examining the effects of prenatal stress exposure on sub-threshold psychotic symptoms is lacking. Similarly, there is a paucity of research investigating

prenatal stress exposure in relation to anxiety and depression among adult offspring, and how anxiety and depression may contribute to schizophrenia-spectrum symptom outcome among prenatally exposed offspring. The present study examined a large dataset to investigate whether 18-year-old, male and female, Chinese, high school seniors exposed to the 1976 Tangshan earthquake during one of nine months of gestation demonstrated higher levels of schizophrenia-spectrum, anxiety, and depression symptoms than unexposed control participants. This study further examined the relationship between schizophrenia-spectrum, anxiety, and depression symptoms, and investigated the effects of prenatal stress exposure on schizophrenia-spectrum symptoms after controlling for anxiety and depression. Results indicated that prenatal exposure to the Tangshan earthquake did not have an overall effect on schizophrenia-spectrum, anxiety, or depression symptoms [Wang Xueyi, et al.2011; Armstrong, Nikki Panasci, 2009]. However, exposed female participants demonstrated higher negative schizotypic scores (SPQ Interpersonal scale) than unexposed females, even when anxiety and depression were controlled statistically [Wang Xueyi, et al.2007]. When anxiety and depression were included in analyses, exposed females also demonstrated higher disorganized schizotypic scores (SPQ Disorganized scale) [Wang Xueyi, et al.2007; Armstrong, Nikki Panasci, 2009]. Additionally, females exposed to the earthquake during gestational months one and five produced higher depression scores than unexposed females of the same gestational months. Finally, anxiety and depression significantly correlated with schizophrenia-spectrum scores; however, their relationships with negative and positive schizophrenia-spectrum symptom scores were relatively similar. An interesting finding in this study was that control group participants demonstrated higher levels of psychopathology symptoms on some measures. A possible explanation for such findings is that although control participants were not exposed to the earthquake, their mothers (who did experience the earthquake a year prior to pregnancy) may have experienced chronic stress that possibly resulted in more disruption to their offspring's stress response system, and ultimately to increased symptoms of psychopathology in their offspring. Future research examining the effects of prenatal exposure to acute vs. chronic stress on schizophrenia-spectrum symptom outcome is suggested.

Our research named "Adult schizotypal personality characteristics of a fetus exposed to Tangshan earthquake in its sixth month of gestation", aimed to evaluate the fetus exposed to earthquake in their sixth month of gestation with or without high risk for adult schizotypal personality characteristics. The subjects were drawn from the fourteen high schools in the Tangshan area. All 12th grade students who were 18 years were invited to participate in the research project. Discarding any data from subjects whose mothers resided outside the Tangshan area during the 1976 earthquake, 604 subjects who were born from July 28th, 1976 to April 28th, 1977 were selected as the exposure group. The control group consisted of 601 subjects who were born one year after the exposure group from July 28th, 1977 to April 28th, 1978. The recruitment and testing of exposure group took place in December of 1995 and for the control group in December of 1996. This ensured that exposure group and control group were the same age at the time of the assessment. Fully informed consent was obtained in all subjects. Raine's Schizotypal Personality Questionnaire (SPQ-B) was used as a measure of schizotypic personality. The SPQ-B of 22 True-False items made up a total score together with three sub-factors: Cognitive-Perceptual factor, Interpersonal Deficits factor and Disorganization factor. The more mean scores on SPQ-B (0-

20 points), the more possibility of schizotypal personality was. Differences of means were evaluated with t-test in the two groups. Six hundred and three in exposure group and 598 in control group completed the SPQ-B evaluation, and effective data were obtained and all were included in the analysis. Total score and score of Cognitive-Perceptual factor of SPQ-B score in fetus of sixth month of gestation in the exposure group were  $(9.1 \pm 4.6)$  and  $(13.4 \pm 2.1)$  points, respectively, which were markedly higher than those in the control group  $[(7.6 \pm 3.6), (2.7 \pm 1.6)$  points,  $t=2.04, 2.00$ ,  $P < 0.05$ ]. There was no significant difference between the Interpersonal Deficits factor and Disorganization factor ( $P > 0.05$ ). ② Comparison of total score and factor scores of SPQ-B in fetus of sixth month (different weeks) of gestation in the two groups: At week 23 the total score of SPQ-B in the exposure group was remarkably higher than that in the control group ( $t=2.1$ ,  $P < 0.05$ ). Score of Cognitive-Perceptual factor was higher than that in the control group, but there was no significant difference ( $P > 0.05$ ). Score of Disorganization factor was distinctly higher than that in the control group ( $t=2.3$ ,  $P < 0.05$ ). There was no significant difference of SPQ-B score at weeks 21, 22 and 24 in the two groups ( $P > 0.10$ ). The fetus exposed to the earthquake in their sixth month of gestation may be at high risk for adult Schizotypal personality characteristics. [Wang Xueyi, et al. 2007]

#### 4. Earthquake and cognitive function disorders

Trauma has been shown to significantly compromise cognitive development. [Levine, 2007; Perry & Szalavitz, 2006] Cognitive deficits such as poor problem solving, (unable to think things out or make sense of what is happening), low self-esteem (how one thinks of oneself - victim-thinking) and hopelessness (loss of future orientation) have all been clearly linked to traumatic events including earthquake, influenza, and so on [Stein & Kendell, 2004; William Steele, 2007]. There is evidence in two independent studies that the trauma and second-trimester influenza, is associated with deficits in cognitive ability as measured by infant habituation to visual stimuli [Wang Xueyi, et al. 2001; Watson JB, 1999; Van OS, 1998]. In both of these studies, the infants whose mothers suffered an influenza infection during their second trimester of fetal development exhibited impaired habituation to visual stimuli. The test of infant habituation of attention is excellent predictor of later intellectual development school readiness and intelligence quotients. Based on the above two studies, we hypothesized that the trauma is related to cognitive impairment. Our purpose of this investigation was to examine the long-term effects of the severe earthquake (7.8 Richter Scale) that struck Tangshan, China in July 1976 on the offspring of women who were pregnant at the time of the earthquake. The extremely severe stress of the earthquake may have resulted in a physiological response in the pregnant women of Tangshan, which adversely affected their fetuses. To determine if exposure to the earthquake as a fetus results in a negative outcome we administered a test of cognitive functioning to test the following hypotheses: 1) The stress of a severe earthquake during gestation will disrupt neural development producing deficits in cognitive functioning. Thus, the exposed group should have poorer cognitive functioning as compared to the control group. 2) Exposure to a severe stressor during a critical period of fetal brain development (the second trimester of gestation) may result in more pronounced cognitive deficits as compared to those exposed during the first or third trimesters. The exposed group consists of 606 high school seniors who were fetuses at the time of the earthquake. The birth dates of the subjects were used to

determine their stage of gestation at the time of the earthquake. The control group was assessed exactly one year after the exposed group and consists of 606 high school seniors, who were born exactly one year after the exposed group. Thus, the control subjects were not exposed to the earthquake as fetuses. The 1212 exposed and control subjects were matched for birth date so there are an equivalent number of subjects representing months one through nine of gestation. Assessment of the control subjects one year after the exposed group, resulted in an exposed and control group that were both 18 years of age at the time of testing. Both the exposed and control subjects were randomly drawn from the seniors students who attended the five high schools in Tangshan, China.

As we all know, that while in the arousal state or, not feeling safe at the sensory level, cognitive functioning and processing is altered. Short-term memory suffers; verbal memory also decreases. From our research, we can draw conclusion that: the subjects exposed to the earthquake during gestation had significantly lower scores on the Raven's Progressive Matrices at age 18 when compared to 18 year-old control subjects who were not exposed to the quake. The prenatal stress of a severe earthquake on a developing fetus is associated with lowered adult cognitive ability. Subjects exposed to a major prenatal stress (the severe earthquake of Tangshan China) during months five through nine had significantly lower score than control subjects who were born in the same months one year later. There were no differences in average Raven's scores for subjects exposed during months one through four when compared to control subjects matched for date of birth. Thus, a prenatal exposure to a severe stressor during months five through nine may adversely affect cognitive functioning at age of 18. It is probable that the stress of the Tangshan earthquake resulted in the elevation of glucocorticoids in the pregnant mothers. [Jin Guixing · Wang Xueyi · Wang Lan, et al. 2011] This elevation of glucocorticoids may have negatively affected the developing fetus. In addition vasoconstriction of the placenta may have occurred in pregnant mothers at the time of the earthquake, which could have had deleterious effects on the developing fetus. [Calvin Hobel, 2003].

Following exposure to trauma · such as earthquake, survivors may become frozen in an activated state of arousal. Research documenting the effects of arousal on cognition has become increasingly available and consistent in its descriptions of the cognitive and behavioral alterations. In the arousal state, changes in the brain are triggered by a variety of stress related functions. One researcher found that victims of trauma had lower memory volume in the left-brain (Hippocampal) area than did the non-abused (<http://www.nimh.nih.gov>). This left-brain function refers to understanding or processing information. One of these functional alterations takes place in the neocortex. On the contrary, the right brain is involved "in the vital functions that support survival and enable the organism to cope actively and passively with stress" The right hemisphere controls perception analysis of visual patterns and emotions. One study supports these and similar findings that appropriate responses to external changes (stress/crisis) can be altered by activation of the arousal state - the heightened state of fear induced by traumatic exposure.

Disorders of memory constitute one of the diagnostic categories for PTSD due to earthquake in the form of re-experiencing. Trauma-based memory phenomena often involve declarative memory in the form of variably accurate verbal and imaginal recall of the traumatic event. Declarative memory, the form of memory that relates to facts and events, initially involves hippocampal and prefrontal cortical pathways and plays an



important role in conscious recall of trauma-related events. Although declarative memory may account for much of the arousal-based cognitive symptoms of PTSD, procedural memory provides the seemingly unbreakable conditioned link that perpetuates the neural cycle of trauma and dissociation.

To study whether severe stress caused by earthquake had negative effect on fetal cognitive function, Raven's Standard Progress Matrices (RSPM) was used to evaluate cognitive function of 616 young students who experienced earthquake during their fetal stage; 616 controls who did not experience this trauma were assessed with the same instrument. Scores of RSPM of earthquake group were significantly lower than those of controls, especially for those who experienced earthquake in their second or the third trimester (Wang Xuey, et al. 2001). Earthquake has negative effect on cognitive function development of fetus.

## 5. Earthquake and Post-Traumatic Stress Disorder (PTSD)

Post-Traumatic Stress Disorder has been recognized as a formal diagnosis since 1980. However, as early as the 6th century BC/BCE, reports of battle-associated stress reactions had been reported. One of the first descriptions of PTSD was made by the Greek historian Herodotus. In 490 BC/BCE he described, during the Battle of Marathon, an Athenian soldier who suffered no injury from war but became permanently blind after witnessing the death of a fellow soldier. However, it was called by different names as early as the American Civil War, when combat veterans were referred to as suffering from "soldier's heart." In World War I, symptoms that were generally consistent with this syndrome were referred to as "combat fatigue." Soldiers who developed such symptoms in World War II were said to be suffering from "gross stress reaction," and many troops in Vietnam who had symptoms of what is now called PTSD were assessed as having "post-Vietnam syndrome." PTSD has also been called "battle fatigue" and "shell shock."

PTSD is an emotional illness that is classified as an anxiety disorder and usually develops as a result of a terribly frightening, life-threatening, or otherwise highly unsafe experience, for instance the earthquake. Traumatic events that may trigger PTSD include violent personal assaults, natural or human-caused disasters, accidents, or military combat. The rates of PTSD suffered from earthquake vary from 2 to 87%.

### 5.1 Symptoms of PTSD due to earthquake

PTSD can cause many symptoms. These symptoms can be grouped into three categories:

1. Re-experiencing symptoms:
  - Flashbacks—reliving the trauma over and over, including physical symptoms like a racing heart or sweating
  - Bad dreams
  - Frightening thoughts.

Re-experiencing symptoms may cause problems in a person's everyday routine. They can start from the person's own thoughts and feelings. Words, objects, or situations that are reminders of the event can also trigger re-experiencing of traumatic events.

2. Avoidance symptoms:
  - Staying away from places, events, or objects that are reminders of the traumatic experience

- Feeling emotionally numb
- Feeling strong feelings of guilt, depression, or worry
- Losing interest in activities that were enjoyable in the past
- Having trouble remembering the dangerous event.

Things that remind a person of the traumatic event can trigger avoidance symptoms. These symptoms may cause a person to change his or her personal routine. For example, after a bad car accident, a person who usually drives may avoid driving or riding in a car.

3. Hyperarousal symptoms:

- Being easily startled
- Feeling tense or “on edge”
- Having difficulty sleeping, and/or having angry outbursts.

Hyperarousal symptoms are usually constant, instead of being triggered by things that remind one of the traumatic event. They can make the person feel stressed and angry. These symptoms may make it hard to do daily tasks, such as sleeping, eating, or concentrating.

The emotional numbing of PTSD may present as a lack of interest in activities that used to be enjoyed (anhedonia), emotional deadness, distancing oneself from people, and/or a sense of a foreshortened future (for example, not being able to think about the future or make future plans, not believing one will live much longer). At least one re-experiencing symptom, three avoidance/numbing symptoms, and two hyperarousal symptoms must be present for at least one month and must cause significant distress or functional impairment in order for the diagnosis of PTSD to be assigned. PTSD is considered of chronic duration if it persists for three months or more.

It's natural to have some of these symptoms after a dangerous earthquake. However, not everyone who lives through an earthquake gets PTSD. In fact, most will not get the disorder. On the contrary, not everyone with PTSD has been through a dangerous earthquake. Sometimes people have very serious symptoms that go away after a few weeks. This is called acute stress disorder, or ASD. When the symptoms last more than a few weeks and become an ongoing problem, they might be PTSD. Some people with PTSD don't show any symptoms for weeks or months.

Most practitioners who examine a child or teenager for PTSD will interview both the parent and the child, usually separately, in order to allow each party to speak freely. Interviewing the child in addition to the adults in his or her life is quite important given that while the child or adolescent's parent or guardian may have a unique perspective, there are naturally things the young person may be feeling that the adult is not aware of. Another challenge for diagnosing PTSD in children, particularly in younger children, is that they may express their symptoms differently from adults.

## **5.2 PTSD due to earthquake occurred in children and teens**

Children and teens can have extreme reactions to the trauma of earthquake, but their symptoms may not be the same as adults as discussion above. In very young children, these symptoms can include:

- Bedwetting, when they'd learned how to use the toilet before
- Forgetting how or being unable to talk

- Acting out the scary event during playtime
- Being unusually clingy with a parent or other adult.

Older children and teens usually show symptoms more like those seen in adults. They may also develop disruptive, disrespectful, or destructive behaviors. Older children and teens may feel guilty for not preventing injury or deaths. They may also have thoughts of revenge. For more information, see the NIMH booklets on helping children cope with violence and disasters (<http://www.nimh.nih.gov>).

PTSD statistics in children and teens reveal that up to more than 40% have endured at least one traumatic event, resulting in the development of PTSD in up to 15% of girls and 6% of boys. Three to six percent of high school students in the United States, and as many as 30%-60% of children who have survived specific disasters develop PTSD (<http://www.nimh.nih.gov>). Up to 100% of children who have seen a parent killed or endured sexual assault or abuse tend to develop PTSD, and more than one-third of youths who are exposed to community violence (for example, a shooting, stabbing, or other assault) will suffer from the disorder.

### **5.3 Causes of PTSD due to earthquake**

Virtually any trauma, defined as an event that is life-threatening or that severely compromises the physical or emotional well-being of an individual or causes intense fear, may cause PTSD. Such events often include either experiencing or witnessing a severe accident or physical injury, receiving a life-threatening medical diagnosis, being the victim of kidnapping or torture, exposure to war combat or to a natural disaster, exposure to other disaster (for example, plane crash) or terrorist attack, being the victim of rape, mugging, robbery, or assault, enduring physical, sexual, emotional, or other forms of abuse, as well as involvement in civil conflict. Although the diagnosis of PTSD currently requires that the sufferer has a history of experiencing a traumatic event as defined here, people may develop PTSD in reaction to events that may not qualify as traumatic but can be devastating life events like divorce or unemployment.

### **5.4 Risk factors and protective factors for PTSD due to earthquake**

Issues that tend to put people at higher risk for developing PTSD include increased duration of a traumatic event, higher number of traumatic events endured, higher severity of the trauma experienced, having an emotional condition prior to the event, or having little social support in the form of family or friends. In addition to those risk factors, children and adolescents, females, and people with learning disabilities or violence in the home seem to have a greater risk of developing PTSD after a traumatic event.

While disaster-preparedness training is generally seen as a good idea in terms of improving the immediate physical safety and logistical issues involved with a traumatic event, such training may also provide important preventive factors against developing PTSD. That is as evidenced by the fact that those with more professional-level training and experience (for example, police, firefighters, mental-health professionals, paramedics, and other medical professionals) tend to develop PTSD less often when coping with disaster than those without the benefit of such training or experience.

There are medications that have been found to help prevent the development of PTSD. Some medicines that treat depression, decrease the heart rate, or increase the action of other

body chemicals are thought to be effective tools in the prevention of PTSD when given in the days immediately after an individual experiences a traumatic event.

### **5.5 Treatment for PTSD due to earthquake**

Treatments for PTSD usually include psychological and medical interventions. Providing information about the illness, helping the individual manage the trauma by talking about it directly, teaching the person ways to manage symptoms of PTSD, and exploration and modification of inaccurate ways of thinking about the trauma are the usual techniques used in psychotherapy for this illness. Education of PTSD sufferers usually involves teaching individuals about what PTSD is, how many others suffer from the same illness, that it is caused by extraordinary stress rather than weakness, how it is treated, and what to expect in treatment. This education thereby increases the likelihood that inaccurate ideas the person may have about the illness are dispelled, and any shame they may feel about having it is minimized. This may be particularly important in populations like military personnel that may feel particularly stigmatized by the idea of seeing a mental-health professional and therefore avoid doing so.

Teaching people with PTSD practical approaches to coping with what can be very intense and disturbing symptoms has been found to be another useful way to treat the illness. Specifically, helping sufferers learn how to manage their anger and anxiety, improve their communication skills, and use breathing and other relaxation techniques can help individuals with PTSD gain a sense of mastery over their emotional and physical symptoms. The practitioner might also use exposure-based cognitive behavioral therapy by having the person with PTSD recall their traumatic experiences using images or verbal recall while using the coping mechanisms they learned. Individual or group cognitive behavioral psychotherapy can help people with PTSD recognize and adjust trauma-related thoughts and beliefs by educating sufferers about the relationships between thoughts and feelings, exploring common negative thoughts held by traumatized individuals, developing alternative interpretations, and by practicing new ways of looking at things. This treatment also involves practicing learned techniques in real-life situations.

Eye-movement desensitization and reprocessing (EMDR) is a form of cognitive therapy in which the practitioner guides the person with PTSD in talking about the trauma suffered and the negative feelings associated with the events, while focusing on the professional's rapidly moving finger. While some research indicates this treatment may be effective, it is unclear if this is any more effective than cognitive therapy that is done without the use of rapid eye movement.

Families of PTSD individuals, as well as the sufferer, may benefit from family counseling, couple's counseling, parenting classes, and conflict-resolution education. Family members may also be able to provide relevant history about their loved one (for example, about emotions and behaviors, drug abuse, sleeping habits, and socialization) that people with the illness are unable or unwilling to share.

Directly addressing the sleep problems that can be part of PTSD has been found to not only help alleviate those problems but to thereby help decrease the symptoms of PTSD in general. Specifically, rehearsing adaptive ways of coping with nightmares (imagery rehearsal therapy), training in relaxation techniques, positive self-talk, and screening for

other sleep problems have been found to be particularly helpful in decreasing the sleep problems associated with PTSD.

Medications that are usually used to help PTSD sufferers include serotonergic antidepressants (SSRIs), like fluoxetine, sertraline, and paroxetine, and medicines that help decrease the physical symptoms associated with illness, like prazosin, clonidine, guanfacine, and propranolol. Individuals with PTSD are much less likely to experience a relapse of their illness if antidepressant treatment is continued for at least a year. SSRIs are the first group of medications that have received approval by the U.S. Food and Drug Administration (FDA) for the treatment of PTSD. Treatment guidelines provided by the American Psychiatric Association (Tori DeAngelis, 2008) describe these medicines as being particularly helpful for people whose PTSD is the result of trauma that is not combat-related. SSRIs tend to help PTSD sufferers modify information that is taken in from the environment (stimuli) and to decrease fear. Research also shows that this group of medicines tends to decrease anxiety, depression, and panic (<http://www.nimh.nih.gov>). SSRIs may also help reduce aggression, impulsivity, and suicidal thoughts that can be associated with this disorder (<http://www.nimh.nih.gov>). For combat-related PTSD, there is more and more evidence that prazosin can be particularly helpful. Although other medications like duloxetine, bupropion, and venlafaxine are sometimes used to treat PTSD, there is little research that has studied their effectiveness in treating this illness.

Other less directly effective but nevertheless potentially helpful medications for managing PTSD include mood stabilizers like lamotrigine, tiagabine, divalproex sodium, as well as mood stabilizers that are also antipsychotics, like risperidone, olanzapine, and quetiapine. Antipsychotic medicines seem to be most useful in the treatment of PTSD in those who suffer from agitation, dissociation, hypervigilance, intense suspiciousness (paranoia), or brief breaks in being in touch with reality (brief psychotic reactions). The antipsychotic medications are also being increasingly found to be helpful treatment options for managing PTSD when used in combination with an SSRI.

Benzodiazepines (tranquilizers) such as diazepam and alprazolam have unfortunately been associated with a number of problems, including withdrawal symptoms and the risk of overdose, and have not been found to be significantly effective for helping individuals with PTSD [Roxanne Dryden-Edwards, 2011].

Our study, "posttraumatic stress disorder in orphans caused by Tangshan earthquake", investigated the morbidity of posttraumatic stress disorder in orphans caused by Tangshan earthquake. Fifty-seven orphans were surveyed using the criteria of Acute Stress Reaction (ASR) and PTSD in Chinese Classification and Diagnostic Criteria for Mental Disorders, the Second Revised Edition. The Self-rating Anxiety Scale, Symptom Checklist 90 (SCL-90), and Minnesota Multiphasic Personality Inventory were used to assess morbidity related to the Tangshan earthquake between the orphans with PTSD and respondents without-PTSD. Twenty seven (47%) cases were diagnosed as ASR and 13 (23%) cases were diagnosed as PTSD among 57 orphans. The orphans caused by Tangshan earthquake may be in the high risk to develop to PTSD.

Another study, "Life Style and Psychosomatic Health in Paraplegic Suffers of Tangshan Earthquake", investigated the relationship between life style and psychosomatic health of paraplegic suffers of Tangshan earthquake. Paraplegic suffers of Tangshan earthquake in a rehabilitation community (RC) and in a paraplegic hospital (PH) were tested with self

report psychosomatic health questionnaire, SCL-90, CMI (Cornell medical index) and SSRS (social support rating scale). The two groups were similar in physical injuries and mental trauma caused by the earthquake. But those in RC selected a different life style from 8 years before when RC was founded. After 8 years, those in RC had better psychosomatic health, lower SCL-90 score or CMI score. None of them had PTSD, while 6 of those remained in PH had this diagnosis. This study revealed that election of a more mature way of life is helpful to psychosomatic health of paraplegic patients caused by earthquake.

## 6. Summary

This chapter has summarized the current status of information on mental disorder caused by experiencing or witnessing a life threatening severe earthquake. The traumatic earthquake was very tragic. Each earthquake phase has different mental health problems. From this chapter, we can conclude that the mental disorders due to the earthquake include depression, cognitive function disorder, PTSD, schizotypal personality.

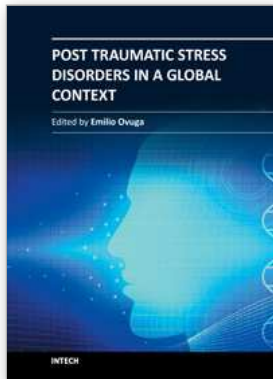
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## **Post Traumatic Stress Disorders in a Global Context**

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If, as a health care or social service provider, one was called upon to help someone who has experienced terror in the hands of a hostage taker, an irate and chronically abusive spouse or parent, or a has survived a motor vehicle accident, landslide, earthquake, hurricane or even a massive flood, what would be one's priority response? What would be considered as the most pressing need of the individual requiring care? Whatever the answer to each of these questions, people who have experienced terror, suffer considerable psychological injury. Post-Traumatic Stress Disorder in a Global Context offers some answers to meet the needs of health care and social service providers in all settings, whether in a hospital emergency room, at the war front, or natural disaster site. The take home message is, after providing emergency care, there is always a pressing need to provide mental health care to all victims of traumatic stress.

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