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Risk Factors and Hypothesis for Posttraumatic Stress Disorder (PTSD) in Post Disaster Survivors

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1. Introduction

Disasters, both natural and man-made, affect millions of people around the world every year. Natural disasters (e.g., earthquakes and hurricanes) and man-made disasters (e.g., traffic accidents, acts of terrorism and wars) can cause mental trauma with long-lasting consequences (Chou et al., 2005; Chou et al., 2007). The impact of a mass disaster or man-made trauma on the individual is a composite of two major elements: the catastrophic event itself and the vulnerability of those people affected by the event. To this end, post-disaster survivors need specific, systemic evaluation and management (Sapir, 1993).

2. The relationship between disasters and Posttraumatic Stress Disorder (PTSD)

Breslau et al. (1991) estimated that 6% to 7% of the US population is exposed to disaster or trauma every year, while Wang et al. (2000) showed that natural disasters affect an average of approximately 200 million people in China every year, several thousand of whom do not survive. In the aftermath of these catastrophic events, PTSD is one of the most common psychiatric diseases suffered by post-disaster survivors.

The prevalence of PTSD ranged from 3.0% to 34.3% in Taiwan after the 1999 earthquake (Chou et al., 2004a,b), it was approximately 25% in Turkey after the 1999 earthquake (Tural et al., 2004), and it was reported as 74% in Armenia after the 1988 earthquake (Armen, 1993). In a systemic review of the literature, Andrews, Brewin, Philpott, & Stewart (2007) found that delayed-onset PTSD in the absence of any prior symptoms was rare, whereas delayed onset that represented exacerbations or reactivations of prior symptoms accounted for, on average, 38.2% and 15.3% of military and civilian cases of PTSD, respectively. Generally, the lifetime and current prevalence rates for psychiatric disorders range anywhere from 1% to 74% (Breslau, Davis, Andreski, & Peterson, 1991; Carr et al., 1995; Chang et al., 2003; Chou et al., 2003; Tainaka et al., 1998), with women twice as likely as men to be affected. Furthermore, women report more symptoms of anxiety and depression than men (Chou et al., 2003; Chang et al., 2003).

3. The introduction of PTSD

Clinicians have recognized the juxtaposition of acute mental syndromes to traumatic events for more than 200 years. Observations of trauma-related syndromes were documented following the Civil War, and early psychoanalytic writers, including Freud, noted the relation between neurosis and trauma (Kaplan & Sadock, 1999).

The American Psychiatric Association (APA) (1952) published the “Diagnostic and statistical manual of mental disorders, first edition, DSM-I” and included in that edition gross stress reactions. However, the term PTSD was not included in the publications until the DSM-III in 1980 (Jones et al., 2003). It was then revised in the DSM-III-R (1987) and the DSM-IV (1994). According to the DSM-IV diagnostic criteria, PTSD has three core psychopathologies: (a) re-experience, (b) numbness and avoidance, and (c) hyper-arousal. The DSM-IV diagnostic criteria for PTSD allow clinicians to specify if the disorder is chronic, that is, the symptoms have lasted three months or more, or if the disorder exhibits delayed onset, that is, the onset of the symptoms was six months or more after the stressful event (Su, Tsai, Chou, et al., 2010). PTSD is an anxiety disorder that develops after a person has been exposed to a severe, life-threatening trauma. Its symptoms include a re-experiencing or reliving of the event, an avoidance or numbness toward the event, and/or hyper-arousal (American Psychiatric Association, 1994). Accordingly, PTSD is characterized by two special memory phenomena. The first is a facilitated memory of the traumatic event, including flashbacks and nightmares. The second is an inhibited memory involving the inability to voluntarily recall important aspects of the trauma (Hellawell & Brewin, 2002; Thomaes et al., 2009). These observations imply that emotional memory dysfunctions are key components in PTSD, and they include involuntary retrieval such as flashbacks and intrusions, exaggerated and context-independent fear, failure to integrate the trauma as a coherent episode into an autobiographical memory, and impaired fear memory extinction (Wolf, 2008).

4. PTSD with psychiatric co-morbidity

The majority of the research (Goenjian et al., 2000; Green, Lindy, Grace, & Leonard, 1992; Maj et al., 1989; McFarlane & Papay, 1992; Rubonis & Bickman, 1991) provides evidence of psychological sequelae that includes PTSD, major depressive episodes, sleep disorder, anxiety, and substance abuse after disasters. Furthermore, major depressive episodes and PTSD are the most common disaster-related psychiatric diagnoses and are strongly associated with one another (McFarlane & Papay, 1992; Goenjian et al., 2000; Green et al., 1992). Individuals confronted with disasters or major stressors exhibit greater psychological impairment and are more vulnerable to psychiatric diseases (Chou et al., 2005). The incidence of PTSD is higher than that of other major depressive episodes in the majority of the studies (Bromet & Dew, 1995; Chou et al., 2003; Chou et al., 2004a; Chou et al., 2004b; Chou et al., 2005; Davidson et al., 1991; Davidson 1995; Goenjian et al., 1994; Green et al., 1992; Sharan et al., 1996). In contrast to natural disasters, however, higher co-morbidity has been found with combat-related PTSD. Such co-morbidity includes drug and alcohol abuse, antisocial personality disorder, somatization disorder, and depression, and it is particularly prevalent when determined from an historical perspective (Green et al., 1992). PTSD can be triggered by a variety of traumatic events and is strongly associated with all other examined mental disorders (Brady, Killeen, Brewerton, & Lucerini, 2000; Goenjian et al., 2000;

Perkonig, Kessler, Storz, Wittchen, 2000). For example, the combination of PTSD and panic and phobic disorders is an important predictor for PTSD chronicity (McFarlane & Papay, 1992; Ursano, Kao, & Fullerton, 1992). Furthermore, the rate of psychopathology is higher in post-disaster groups than in either the same groups prior to trauma or in control groups (Maj et al., 1989; Rubonis & Bickman, 1991).

5. Psychiatric studies of post-Chi-Chi earthquake survivors

Researchers focusing on survivors of the Chi-Chi earthquake in Taiwan (Su, Chou, Lin, Tsai, 2010) have found evidence of psychological sequelae that includes posttraumatic stress disorder (PTSD), major depressive disorder, sleep disorder, anxiety, and substance abuse (Chou et al., 2004a, 2004b, 2005, 2007; Chen et al., 2001; Chang et al., 2002; Lai et al., 2004; Hsu et al., 2002; Kuo et al., 2003; Liu et al., 2006; Tsai et al., 2007; Wu et al., 2006; Yang et al., 2003). The quality of life for survivors of traumatic events who develop psychiatric illnesses or impairments is worse than that for survivors without any psychiatric illness (Chou et al., 2004b; Tsai et al., 2007; Wu et al., 2006). In addition, rescue workers such as nurses, fire fighters, and soldiers may develop physical or mental impairments (Chang et al., 2008; Liao et al., 2002; Shih et al., 2002; Yeh et al., 2002). We used PubMed to identify Chi-Chi earthquake-related papers published through June of 2009. All of the Chi-Chi earthquake papers related to psychiatry are summarized in Table 1 (cited from Su, Chou, Lin, Tsai, 2011).

6. The risk factors of PTSD

Researchers who study risk factors for PTSD have identified aspects of demographic data, psychological factors, psychiatric symptoms, and post-trauma social resource factors as important factors that contribute to the development of the disease.

6.1 Demographic data

Some researchers who have examined gender differences suggest that females are more likely than males to develop PTSD (Chou et al., 2005; Helzer, Robins, & McEvoy, 1987; Johnson & Thompson, 2008; Lazaratou et al., 2008). A possible explanation for this is the specific reactions that result from feminine characteristics to a traumatic event (Chou, Tsai, Wu, Su, & Chou, 2006). Additionally, there are previous studies that have associated old age with an increased risk of developing PTSD (Goenjian et al., 1994; Lewin, Carr, Webster, 1998). However, a recent study has suggested contradictory results (Lazaratou et al., 2008).

6.2 Biological factors

Neuroendocrine data provide evidence of insufficient glucocorticoid signaling in stress-related neuropsychiatric disorders, while Nutt (2000) has suggested that individuals develop PTSD due to neuroendocrine dysregulation. Furthermore, impaired feedback regulation of relevant stress responses, especially immune activation/inflammation, may, in turn, contribute to stress-related pathology that includes alterations in behavior, insulin sensitivity, bone metabolism, and acquired immune responses (Raison & Miller, 2003). Because the hypothalamic-pituitary gland-adrenal axis (HPA) regulates hormone reactions during stress, PTSD severity seems to decrease when individuals exposed to traumatic

Authors	Year published	Study period after earthquake	Subjects	Purpose	Method	Conclusion
Chen et al.	2001	Within 1 month	525 residents	Screening for psychiatric morbidity and post-traumatic symptoms among early-stage survivors	Purposeful sampling	Approximately 11% of the subjects reported having thoughts of death or ideas of suicide; approximately 89.9% of respondents had psychological impairment
Chen et al.	2001	Within 1 year	210 residents	The Chinese version of the Davidson Trauma Scale, a practice test for validation	Translation, back-translation and concurrent validity	The sensitivity of the instrument was 0.9, specificity 0.81, positive likelihood ratio 4.74, and negative likelihood ratio 0.12
Chang et al.	2002	6 months later	171 pregnant residents	Psychiatric morbidity and pregnancy outcome in a disaster area	Purposeful sampling	The prevalence of minor psychiatric morbidity (MPM) was 29.2%.
Hsu et al.	2002	6 weeks later	323 student residents	Post-traumatic stress disorder among adolescent earthquake victims in Taiwan	Purposeful sampling	Of the 323 students, 21.7% had PTSD. Being physically injured and experiencing the death of a close family member with whom they had lived were identified as two major risk factors
Liao et al.	2002	2 months later	1,104 rescue workers serving in the area hit by the earthquake	Association of psychological distress with psychological factors in rescue workers.	Purposeful sampling	Prevalence of general psychological distress is high among rescue workers. Personality traits and pre-disaster life adjustment had a dominant predictive effect on psychological distress
Lin et al.	2002	1 year later	368 residents with 268 ≥65 y/o	Geriatric survivors	Purposeful sampling	Lower quality of life in physical capacity, psychological well-being, and environment 12 months after the earthquake when compared to assessment prior to the earthquake were identified as risk factors

Authors	Year published	Study period after earthquake	Subjects	Purpose	Method	Conclusion
Shih et al.	2002	Within 1 year	46 nurses who worked in a hospital in the community	The impact of the 9-21 earthquake experience on Taiwanese nurses acting as rescuers	Purposeful sampling	Rescue experience strengthened most Taiwanese nurses' professional competency
Yeh et al.	2002	Within 16 days	187 young male military personnel who served as rescue workers	Characteristics of acute stress symptoms and nitric oxide concentration in young rescue workers in Taiwan.	Purposeful sampling	A significant inverse correlation observed between the severity of stress symptoms and plasma concentration of nitric oxide in rescue workers
Chang et al.	2003	5 months later	84 male fire fighters	Post-traumatic distress and coping strategies among rescue workers	Purposeful sampling	Study identified a 16.7% and 21.4% prevalence for general psychiatric morbidity and post-traumatic morbidity, respectively
Chou et al.	2003	21 months later	461 residents	Establishment of a disaster-related psychological screening test	Population survey	DRPST, administered in phase 1 of this two-phase study, may be used for effective and rapid screening for PTSD and MDE after an earthquake
Kuo et al.	2003	2 months later	120 bereaved survivors	To investigate the prevalence of psychiatric disorders and risk factors for PTSD and major depressive disorder among bereaved survivors	Purposeful sampling	The prevalence of PTSD was 37%.; that of major depressive disorder was 16%
Yang et al.	2003	3 months later	663 victims	To investigate the psychiatric morbidity and post-traumatic symptoms among earthquake victims in primary care clinics	Purposeful sampling	PTSD was 11.3%, partial PTSD was 32.0%

Authors	Year published	Study period after earthquake	Subjects	Purpose	Method	Conclusion
Chou et al.	2004a	21-24 months	461 residents	To investigate quality of life and related risk factors of Taiwanese earthquake survivors with different psychiatric disorders	Purposeful sampling	The prevalence of varied psychiatric disorders in earthquake survivors ranged from 3.3% to 18%
Chou et al.	2004b	4-6 months	4223 residents	To investigate the relationship between quality of life and psychiatric impairment	Purposeful sampling	PTSD: 7.6%, suspected PTSD: 26.7% and poor quality of life with psychiatric impairments in these respondents
Guo et al.	2004	1 month	252 rescue workers	To investigate the prevalence of post-traumatic stress disorder (PTSD) among professional and non-professional rescue workers involved in the 1999 Chi-Chi Earthquake in Taiwan	Purposeful sampling	Professional and non-professional rescue workers showed prevalence of 19.8% and 31.8%, respectively. Disaster rescue work is associated with a high level of stress, even for highly trained professionals. This work may, therefore, lead to mental health problems.
Lai et al.	2004	10 months	252 residents	Full and partial PTSD among earthquake survivors in rural Taiwan	Randomly selected from two rural communities	Prevalence rates for PTSD (n=26) and PTSS (n=48) were 10.3% and 19.0%, respectively
Chou et al.	2005	4-6 months	442 residents	To assess the development of psychiatric disorders among residents after earthquake	Population survey	Females had significantly higher rates for most psychiatric disorders compared to males
Yang et al.	2005	During a 7-year period	---	To examine the time trends of increased suicide rates	Time-series analysis	Mean monthly suicide rate for earthquake victims was higher; indicates the need for providing strengthened psychiatric services during first year following major disasters

Authors	Year published	Study period after earthquake	Subjects	Purpose	Method	Conclusion
Sepalki et al.	2006	Before and after the earthquake	1160 older individuals	To investigate variability in resilience to depressive symptoms in aftermath of 1999 Taiwan earthquake	Longitudinal survey with interviews	Persons of low socioeconomic status (SES), socially isolated individuals, and women reported higher levels of depressive symptoms than respective counterparts, as did persons who experienced damage to their homes; Psychological effects of damage were strongest among those aged 54-70
Wu et al.	2006	33-36 months	405 residents	To investigate quality of life and related risk factors in earthquake survivors diagnosed with different psychiatric disorders	Population survey	Prevalence range for psychiatric disorders in earthquake survivors was 0.2% to 7.2%; persistence of long-term economic problems was one of many important factors affecting quality of life
Chen et al.	2007	2 years later	6412 earthquake survivors whose houses were destroyed	To examine prevalence and risk factors for post-traumatic stress symptoms and psychiatric morbidity	Purposeful sampling	Estimated rates of PTSD and psychiatric morbidity were 20.9% and 39.8%, respectively; severe earthquakes can cause long-term psychological impact in survivors
Chou et al.	2007	0.5, 2, 3 years later	442, 461, 405 residents	To survey dynamic population for risk factors for PTSD and major depression and assess prevalence of different psychiatric disorders 6 months, 2 years, and 3 years after the earthquake.	Population survey	PTSD prevalence significantly decreased 3 years later; suicidal tendency and drug abuse/ dependence significantly increased

Authors	Year published	Study period after earthquake	Subjects	Purpose	Method	Conclusion
Kuo et al.	2007	1 years later	272 victims from temporary housing units	To investigate the incidence of PTSD and psychological health status among earthquake victims one year after quake	Purposeful sampling	Posttraumatic stress symptoms and psychological problems more prevalent among women (22.2% and 64%, respectively) than men (9.2% and 47.9%, respectively)
Tsai et al.	2007	3 years later	1756 respondents	To evaluate, prospectively, the relationship between clinical course of PTSD and quality of life (QOL)	Fixed cohort follow-up	Three years after earthquake, estimated rate of posttraumatic stress symptoms declined; survivor quality of life varied according to survivor's progression of PTSS
Chang et al.	2008	---	193 fire fighters	To investigate modification effects of coping strategies on relationships between rescue effort and psychiatric morbidity in earthquake rescue workers	Purposeful sampling	Older age and longer job experience (>3 years) were associated with both general psychiatric and post-traumatic morbidities

Cited from Su et al. (2011) under permission

Table 1. Summary of Chi-Chi earthquake papers related to psychiatry (PubMed search through June 2009) (cited from Su et al., with permission)

events experience decreased stress levels. Thabet & Vostanis, (2000) and Gurvits et al. (1997) found more positive soft neurological signs in PTSD participants than in participants who experienced similar trauma but did not develop PTSD. Many trauma victims complain of memory impairment, such as difficulty remembering daily activities, frequent compulsive recall of the traumatic event in detail, memory gaps, island-like memory, difficulties with declarative memory, and intrusive memories. Anderson et al. (2004) used functional magnetic resonance imaging (MRI) to identify the neural systems involved in keeping unwanted memories out of one's awareness. Controlling unwanted memories is associated with increased dorsolateral prefrontal activation (DLPF), reduced hippocampal activation, and impaired retention of those memories. Both prefrontal cortical and right hippocampal activations predicted the magnitude of forgetting. These results confirm the existence of an active forgetting process and establish a neurobiological model for guiding inquiry into motivated forgetting.

There are still gaps in our understanding of the genetic underpinnings of PTSD. For example, while Stein et al. (2002) have found moderate hereditary factors in individuals with PTSD symptoms, no single gene that causes PTSD has been identified.

6.3 Psychological factors and psychiatric symptoms

Meyer et al. (1999) indicated that some psychiatric symptoms and disorders are risk factors for PTSD (Meyer, Taiminen, Vuori, Aijälä, Helenius, 1999). For example, certain personality traits, such as neuroticism and introversion, are associated with an increased risk of PTSD (Lewin, Carr, & Webster, 1998; McFarlane, 1988) while some studies indicate that certain psychiatric disorders may be predictive of chronic PTSD (Engdahl, Dikel, Eberly, & Blank, 1998; McFarlane & Papay, 1992). Then again, other studies have examined the long-term course of PTSD. A longitudinal analysis of the mental health of school children after the great Hanshin Awaji earthquakes indicated that some survivors' psychological reactions emerged early and disappeared early (i.e., within two years after the disaster); however, this is contrary to findings from other studies (Shioyama et al., 2000). Lazaratou et al. (2008) have found that greater numbers of PTSD symptoms emerged during the first 6 months after the earthquake and were associated with a greater impact on the victims' lives 50 years after the event. Uemoto et al. (2000) posited that the best predictor of recovery from chronic PTSD was the initial level of post-traumatic reaction immediately after the accident. However, few data are available on the long-term effects caused by a disaster (Chou et al., 2007).

6.4 Post-trauma social resource factors

Inadequate social support after the trauma adds to the risk of developing PTSD (Chou et al., 2004a; Wang et al., 2000). Not surprisingly, higher levels of post-disaster life events are also related to the risk of developing PTSD (Chang, Connor, Lai, Lee, & Davidson, 2005). Similarly, social stressors such as economic or marital issues or a disruption of one's daily life, including relocation, the death of an intimate partner, or other significant loss problems are associated with a greater risk for developing PTSD.

7. Hypothesis for PTSD

Hobfoll's conservation of resources (COR) model has been well supported by previous studies on natural disasters (Sumer, Karanci, Berument, & Gunes, 2005). According to

Hobfoll's conservation of resources stress theory (Hobfoll, 1989; Chou et al., 2007), resource loss is an important determinant of individual stress and physical and mental health, including PTSD. Brewin et al. (2000) also found that the effect sizes of all risk factors were modest. Factors operating during or after the trauma (e.g., trauma severity, lack of social support, and additional life stress), however, had somewhat stronger effects than did pre-trauma factors.

Consequently, multiple risk factors constitute a network that results in psychiatric illness. According to Hobfoll's conservation of resources theory, resource loss is an important determinant of individual stress and physical and mental health, including PTSD. Our hypothesis states that an individual reaches a sub-threshold of psychiatric illness and then develops the illness due to a decreasing availability of resources, an accumulation of risk factors, and/or a major stressful event. Furthermore, unresolved, sub-clinical psychiatric symptoms caused by a disaster or major life event may increase a survivor's sensitivity to future stresses. When faced with stress, frustration (e.g., life events), or traumatic events (e.g., brain damage or deprivation of internal or external resources) individuals, either suddenly or gradually, become more vulnerable to psychiatric impairment and diseases such as PTSD. An individual might reach a sub-threshold of PTSD and then develop the illness due to a decreased availability of resources, an accumulation of risk factors (personality traits, poor social interactions, etc.) or a major stressful event. Furthermore, unresolved, subclinical psychiatric symptoms caused by a disaster may increase a survivor's sensitivity to future stresses. Other factors that tend to increase an individual's vulnerability to psychiatric problems include brain damage, heredity, personality traits, life events, and social interactions.

8. The treatment and rehabilitation of PTSD

Treatment or rehabilitation efforts should concentrate not only on severe psychiatric symptoms, emotional disturbances and personality traits or disorders, but also on interpersonal and social-environmental interactions. To treat PTSD, clinicians only use drugs and do not provide psychosocial treatment; thus, they cannot meet the true needs of the survivor. Based on the bio-psychosocial causation model of psychiatric disease as it applies to public health, we propose a model of the causation of PTSD. Issues related to PTSD that are most in need of further study include biological causation, psychosocial recovery, and long-term evaluation of psychological rehabilitation.

9. Conclusion

Although changes in emotional, cognitive, behavioral, and biologic states are transitory for most individuals after a catastrophe or major trauma, psychological trauma may persist much longer in some victims. While the psychological profiles of these victims are often altered, given their vivid and repetitive recollection of the traumatic events (Chou et al., 2004b; Chou et al., 2005; Lin et al., 2002), Wang et al. (2000) determined that prompt and effective post-disaster intervention might mitigate the impact of initial exposure and reduce the probability of PTSD occurrence. Issues related to PTSD most in need of further study include biological causation, psychosocial recovery, and long-term evaluation of psychological rehabilitation.

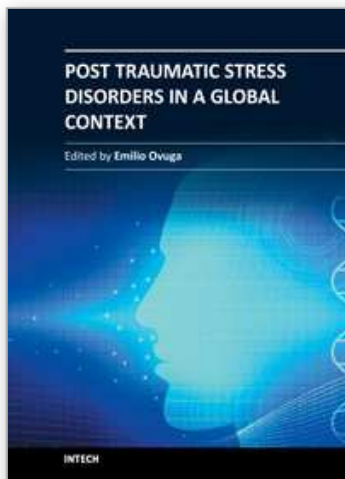
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Post Traumatic Stress Disorders in a Global Context

Edited by Prof. Emilio Ovuga, Md, PhD

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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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