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Risk Factors for Long-Term Post-Traumatic Stress Disorder among Medical Rescue Workers Appointed to the 2008 Wenchuan Earthquake Response in China

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Degree to be awarded: MPH
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Risk Factors for Long-Term Post-Traumatic Stress Disorder among Medical Rescue Workers Appointed to the 2008 Wenchuan Earthquake Response in China

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2008

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An abstract of
A thesis submitted to the Faculty of the Rollins School of Public Health of Emory University
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Abstract

Risk Factors for Long-Term Post-Traumatic Stress Disorder among Medical Rescue Workers Appointed to the 2008 Wenchuan Earthquake Response in China

Post-Traumatic Stress Disorder (PTSD) is a psychological consequence experienced by many disaster survivors. Risk factors for PTSD among this population have been extensively documented. Most recently, studies have acknowledged the psychological impact disasters also have on responders. Common consequences for this population also include PTSD but few studies have examined the risk factors associated with PTSD in this population. This study aims to determine the prevalence of as well as risk factors for PTSD among Chinese medical rescue workers one year after their response to the 2008 Wenchuan earthquake in China.

A sample of 337 medical rescue workers who had performed response work within the first three months after the earthquake completed a website questionnaire 14-17 months after their response work. The questionnaire included questions on rescue work experience, pressure management strategies, general health, the impact of the events, coping style, personality traits and demographic factors. Presence of PTSD was determined by a score greater than 33 on the Impact of Event Revised-Scale.

Seventeen percent (95% CI: 13%-21%) of the responders tested positive for clinical PTSD after an average of 14 months. Similar to the survivors of disasters, responders' PTSD is associated with getting injured or sick and a lack of social support. The multivariate regression showed that neurotic personality, passive coping style, communication with relief headquarters, and having been injured while performing response work were significantly associated with PTSD.

Future research should further examine the relationship between these variables and PTSD and identify preventive measures that could mitigate their impact. For example, additional logistical measures could ensure that the rescue workers have regular contact with headquarters during the response. Similarly, the number of injuries might be reduced with safety training and equipment.

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Chapter 1

Introduction and Rationale

Worldwide, in the last 40 years, the number and severity of disasters (i.e., events that overwhelm local capacity and necessitate external assistance) have dramatically increased (ECHO, 2002; International Federation Red Cross and Red Crescent societies, 2002; Oliver-Smith, 1996; Schnelle, 2006). Each year, these disasters kill thousands of people and affect millions. In 2006 alone, 426 natural disasters killed 23,000 and affected 143 million people (CRED, 2008). Disasters are especially a threat to the public's health when they happen in heavily populated areas such as the Sichuan province of China (World Bank, 2005) during the 8.0 earthquake of 2008. The Sichuan earthquake was responsible for 69,229 deaths, 374,643 injured and 17,923 missing persons (ACT Alliance, 2010).

The impact of disasters on the mental health of the survivors has been well documented over the years (Demi & Miles, 1983; Lehman & Taylor, 1988; Michenbaum, 1997; Wimbush & Courban, 2006). Common negative psychological consequences range from mild anxiety to clinical disorders such as panic disorder, major depression, post-traumatic stress disorder (PTSD) and substance addictions (Altindag, et al., 2005; Lai et al., 2004; Salcioglu, et al., 2003; Wang, et al., 2009).

PTSD is the most studied of these consequences. Many studies have shown that certain demographics (e.g., gender, age, marital status, and education), personality traits (e.g., introversion), social factors (e.g., social support) and environmental circumstances (e.g., injury and illness) are strongly associated with PTSD in survivors of disasters. Female survivors are more likely than males to experience PTSD. Similarly, being single or older, being introverted, having a low level of education, having been injured or ill

during the response, and not having social support are associated with higher levels of PTSD (Altindag, et al., 2005; Lai et al., 2004; Salcioglu, et al., 2003; Wang, et al., 2009).

More recently, studies have acknowledged the impact disasters also have on emergency responders and have shown that common negative psychological consequences for responders include anxiety, depression, PTSD, and substance addiction (Green et al., 2000). For example, PTSD was diagnosed in 25% of search and rescue workers after the May 2003 Bingol earthquake in Turkey (Ozen & Sir, 2004), and in 19.8% of professional and 31.8% of non-professional rescue workers involved in the 1999 Chi-Chi earthquake in Taiwan (Guo et al., 2004).

A few studies have examined factors that are associated with PTSD among disaster response workers (e.g., Cetin et al., 2005; Ehring et al., 2011; Wang et al., 2010). Preliminary evidence suggests that PTSD, for example, is related to being a volunteer rather than professional rescuer (Guo et al., 2004; Hagh-Shenas et al., 2005). PTSD among rescue workers is also associated with personality attributes such as high levels of anxiety sensitivity (Hagh-Shenas et al., 2005) and using avoidant coping strategies (Chang et al., 2003). In addition, environmental factors such as having worked longer as a rescue worker (Chang et al., 2003, 2008), high levels of identification with the dead and their families (Cetin et al., 2005), having been involved in the evacuation of bodies and body parts, and rescuing persons from rubble where amputation is the only means for rescue (Labbate et al., 1998; Ursano & McCarroll, 1990; Witteveen et al., 2007) have also been found to be associated with PTSD in disaster workers.

Problem Statement

Protecting the mental health of rescue workers who respond to disasters is key to saving lives and to being able to adequately respond to the increasing number of disasters happening worldwide. The paucity of research on the factors associated with PTSD in rescue workers makes it difficult to implement evidence-based preventive measures for the rescue worker population.

Purpose Statement

The purpose of this study is to narrow the gap that currently exists in the literature regarding the identification of risk factors for PTSD among rescue workers participating in a disaster response. The study examines 13 different risk factors: 1) demographic risk factors that have been previously studied (i.e., sex, marital status, age group, years of education, and years worked), 2) social support (i.e., contact with family and friends, receiving support from teammates), 3) factors directly related to the management and organization of the disaster response (i.e., having food or water shortage, planning to rest after returning home, having received pressure management training, communication with relief headquarters), and 4) individual characteristics (i.e., coping style and personality traits). The study provides recommendations for preventive measures that should be studies in an effort to mitigate PTSD among rescue workers.

Research Hypothesis

Question 1: Are demographic characteristics found to be associated with PTSD in other studies also associated with PTSD in the rescue workers of the Wenchuan earthquake?

Null Hypothesis: Being female, single, younger, less education, and having worked more years in emergency response are not associated with PTSD.

Question 2: Is social support associated with PTSD among the studied population?

Null Hypothesis: Contact with and support from family, friends or teammates are not associated with PTSD.

Question 3: Is experiencing certain rescue work conditions associated with higher rates of PTSD?

Null Hypothesis: Experiencing food or water shortage and witnessing body disposal are not associated with PTSD.

Question 4: Are passive coping style, introverted personality, and neuroticism in rescue workers associated with PTSD?

Null Hypothesis: Passive coping style, introverted personality, and neuroticism are not associated with PTSD.

Significance Statement

While the current literature extensively describes risk factors for PTSD among the survivors of disasters, little is known about the risk factors for rescue workers. This

study helps to confirm the findings from previous research and proposes factors that should be studied further.

Finally, the study promotes the understanding of the impact of these factors to identify individuals that might be at higher risk for PTSD prior to deployment and to develop practical preventive interventions to protect rescue workers.

Chapter 2

Literature Review

There is an abundance of literature that assesses the impact of disasters on the mental health of disaster survivors. One of the most studied dependent variables is PTSD. This psychological consequence has been found to be present across a variety of disaster types and cultures. Studies have identified factors that are consistently associated with PTSD.

In recent years, it has become apparent that the impact of disasters on mental health is not limited to the survivors of the disaster itself, but also to the rescuers and first responders who come to the aid of the survivors after the disaster. Even if the body of knowledge on the factors associated with PTSD among rescuers is much smaller than the one on the actual survivors of disasters, some of the variables studied with survivors also seem to be associated with PTSD among rescuers and first responders. Many of these studies, just as this one, have been conducted on populations affected by earthquakes.

Prevalence of and Risk Factors for PTSD among Earthquake Survivors

There is an abundance of literature that examines PTSD in earthquake survivors. Studies have found rates of PTSD in earthquakes survivors ranging from 10.3% to 95% (Altindag et al., 2005; Armenian et al. 2000; Goenjian et al., 1994; Lai et al., 2004; Laio et al., 2000; McMillen et al., 2000; Salcioglu et al., 2003; Sharan et al., 1996; Tang et al., 2000; Udomratn, 2008; van Griensven et al., 2006; Wang et al., 2000).

Many demographic factors, psychological attributes, social factors and environmental circumstances have been found to be associated with PTSD. Demographic factors include being female (Basoglu et al., 2002; Carr et al., 1997; Lai et al., 2004;

Salcioglu et al., 2003; Sharan et al., 1996), having a low level of education (Armenian et al., 2000; Basoglu et al., 2002), and being older (Carr et al., 1997; Salcioglu et al., 2003). Psychological attributes include having had a personal history of psychiatric illness (Basoglu et al., 2002; Nolen-Hoeksema and Morrow, 1991; Salcioglu et al., 2003), and having experienced high levels of anxiety (Lai et al., 2004) or high levels of fear (Salcioglu et al., 2003). Social factors include having less social support (Altindag et al., 2005; Bland et al., 1997) or having experienced a lack of governmental support (Wang et al., 2000). Finally, environmental circumstances include trauma exposure (Lai et al., 2004), having participated in rescue work (Salcioglu et al., 2003), having been trapped under rubble (Salcioglu et al., 2003), having been injured during the earthquake (Altindag et al., 2005; Armenian et al., 2000; Basoglu et al., 2002; Goenjian et al., 1994), and having lost significant resources or money because of the earthquake (Armenian et al., 2000; Bland et al., 1996; Carr et al., 1995; Freedy et al., 1994; Lima et al., 1989; Maj et al., 1989).

Prevalence of and Risk Factors for PTSD among Earthquake Rescue Workers

In comparison to the literature available on earthquake survivors, there is a dearth of literature that assesses the impact of earthquakes on the development of PTSD in rescue workers. The fact that participation in rescue work was found to be a risk factor for PTSD in the study by Salcioglu and colleagues (2003) indicates that rescue work might increase the likelihood of developing PTSD and raises the question as to whether or not mental health consequences are the same for responders when compared to survivors. Studies have found a higher prevalence of PTSD among rescue workers than disaster survivors with the rates ranging from 19.8% to 34.2% among response workers

of earthquakes (Bayam et al., 2002; Chang et al., 2003; Firth-Cozens et al., 1999; Guo et al., 2004; Hagh-Shenas et al., 2005; McFarlane et al., 1988; Ozen & Sir, 2004; Tainaka et al., 1998) compared to 10.3% to 95% in earthquake survivors.

Some demographic factors, psychological attributes, social factors and environmental circumstances that are associated with PTSD among rescue workers in earthquakes are also found to be associated with PTSD among earthquake survivors. Demographic factors include being female (Ehring et al., 2011; Wang et al., 2010), and being older (Chang et al., 2008; Chang et al., 2003). Psychological attributes include experiencing other psychiatric disorders (Ozen & Sir, 2004), having high levels of anxiety sensitivity (Hagh-Shenas et al., 2005), and having experienced traumas in the past (Ehring et al., 2011). Social factors include having low social support (Ehring et al., 2011), and environmental circumstances include being injured during the response (Wang et al., 2010).

Additional factors that have found to be positively associated with PTSD only among the rescue workers in an earthquake include being a volunteer rescuer versus a professional (Guo et al., 2004; Hagh-Shenas et al., 2005), a higher number of work-related stressors (Ehring et al., 2011), a higher intensity of initial fear (Wang et al., 2010), identification with the deceased survivors (Cetin et al., 2005; Ursano et al., 1999; Wang et al., 2010), having a distancing or escape-avoidance coping style (Chang et al., 2003), and having worked more than three years in emergency response (Chang et al., 2008; Chang et al., 2003).

While earthquake studies show a considerable rate of PTSD among survivors, on average, rescue workers have higher rates of PTSD. Factors, such as being female, being

older, having little social support, and being injured are associated with PTSD and are common to both earthquake survivors and earthquake disaster workers. However, the difference in the average rates of PTSD between survivors and earthquake disaster workers implies that additional factors are at play.

Risk Factors for PTSD among Different Types of Earthquake Response Workers

The aforementioned literature commonly studies earthquake response workers as a homogenous group. Nevertheless, there are many types of response workers (e.g., police officer, firefighter, medical professional, drivers). Among the types of response workers, the literature shows that health care workers can be particularly susceptible to the psychological consequences of earthquake response work. Nevertheless, responders vary greatly in background and experience. Even if earthquake response requires all responders to work in a high-stress environment, for some responders such as firefighters or policemen, this environment resembles more closely the regular work environment. For the vast majority of health care providers, the disaster environment shares few commonalities with the regular work environment (Benedek et al., 2007).

Time since Response Work and Risk Factors for PTSD

Few studies have examined the longitudinal course of PTSD in earthquake survivors and rescue workers. A prospective cohort study (Goenjian et al., 2000) that examined the rates of PTSD in Armenian earthquake survivors with high trauma exposure 1.5 and 4.5 years after the disaster found rates of 87% and 73%, respectively. Following the 1989 Newcastle earthquake, 48% of the survivors who had PTSD at 6 months post-earthquake still had PTSD at 2-year assessment (Carr et al., 1997). This study showed that earthquake-related morbidity declined over time and stabilized at about 18 months post-disaster. While the rate of PTSD has generally shown to decrease

with time, evidence strongly suggests that it is still persistent over time. (Bland et al.,1996; Kato et al.,1996). The majority of the present literature on earthquake rescue workers examines PTSD prevalence within 6 months after the earthquake response. Given the health threats of long-term PTSD, there is, therefore, the need to study the risk factors for PTSD that persists longer than one year after the response work.

Mental Health Implications of the Wenchuan Earthquake in China

Multiple studies have been conducted specifically on the presence of PTSD after the 2008 Wenchuan earthquake in China. These studies have predominantly focused on PTSD among earthquake survivors.

Prevalence of and Risk Factors for PTSD among Survivors. The prevalence of PTSD among adult survivors of the Wenchuan earthquake just one month after the earthquake has been documented at rates similar to other studies, ranging from 35.6% to 62.8% (Gao & Luo, 2009; Wang et al., 2010c). The rate of PTSD among adult survivors two months after the earthquake was found to be 43% (Wang et al., 2009b). Furthermore, the rate three months after the earthquake has been found to range from 9.40% to 45.5% (Kun et al., 2009a; Wang et al., 2009a). No study has examined the rates of PTSD among the Wenchuan earthquake survivors longer than three months after the earthquake response work.

The risk factors associated with PTSD were similar among the surviving population one through three months after the earthquake. The risk factors that were similar to the aforementioned literature on earthquake survivors included low household income (Kun et al., 2009b), death in the family (Kun et al., 2009b; Wang et al., 2009b; Wang et al., 2010c), household damage or loss of possessions (Kun et al., 2009b; Wang

et al., 2010c), being female (Wang et al., 2009a; Wang et al., 2009b; Wang et al., 2010c), having a low level of education (Wang et al., 2009a; Wang et al., 2009b; Wang et al., 2010c), having little social support (Wang et al., 2009a), being single (Wang et al., 2010c), and having had a higher initial exposure level to the earthquake (Wang et al., 2009a). Furthermore, the literature on the Wenchuan earthquake also found that being from an ethnic minority or sub-nationality (Wang et al., 2009a; Kun et al., 2009b), and being evacuated or living in a shelter or temporary house (Gao & Luo, 2009; Kun et al., 2009b) were significantly associated with PTSD among the earthquake survivors.

Prevalence of and Risk Factors for PTSD among Rescue Workers. Only one study has been conducted on the mental health of medical rescue workers who responded to the Wenchuan earthquake. The prevalence of PTSD among these workers was found to be 19% three months after the earthquake (Wang et al., 2010a). The significant risk factors identified for PTSD included being female, being bereaved, and being injured, yielding similar findings to that among the survivors of the Wenchuan earthquake, with the exception of the additional variable studied with the survivors of having a higher intensity of initial fear.

As with the broader literature, the study of rescue workers in the Wenchuan earthquake mirrors the findings of the earthquake survivors. However, the literature did not explore the relationship between additional factors, such as the rescue work experience, social support, pressure management strategies, and mental health interventions and PTSD.

Summary of Current Problem and Study Relevance

The literature extensively explores the impact that earthquakes have on the development of PTSD among the surviving population. Recent studies on the impact of the earthquake response on the development of PTSD among rescue workers highlight similar findings related to the relationship between certain demographic risk factors and PTSD in survivors. However, the higher average rates of PTSD among the rescue workers seem to indicate that for this population, additional factors are at play.

China is regularly affected by earthquakes. Five of the twenty-two deadliest earthquakes of recorded history have happened in China (USGS, 2011). Population growth in China also makes it likely that more and more people will be affected by earthquakes. China provides an ideal setting to extensively investigate the risk factors for PTSD.

While several studies have explored PTSD among the local population affected by the Wenchuan earthquake in China, only one has studied PTSD medical rescue workers, leaving a gap in the current literature. The current study aims to confirm findings from the present literature on factors related to PTSD and to explore additional factors that have not been considered in the medical rescue worker population.

Chapter 3

Manuscript formatted for the *Journal of Psychiatric Research*

Risk Factors for Long-Term Post-Traumatic Stress Disorder among Medical Rescue Workers Appointed to the 2008 Wenchuan Earthquake Response in China

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The student cleaned a pre-collected database, conducted an in-depth literature review, proposed the research questions, analyzed the data, revised the proposed a format for the tables, and drafted the manuscript.

Abstract

This study aims to determine the prevalence of as well as risk factors for Post-Traumatic Stress Disorder (PTSD) among Chinese medical rescue workers one year after their response to the 2008 Wenchuan earthquake in China. A sample of 337 medical rescue workers who had performed response work within the first three months after the earthquake completed an on-line questionnaire within 14-17 months after their response work. The questionnaire includes information on demographics, social support, factors related to the management and organization of the disaster response, and assessment for clinical PTSD. Seventeen percent of the study participants were determined to have clinical PTSD after an average of 14 months. Some of the risk factors significantly associated with PTSD in the bivariate analysis included being injured, falling ill, having food shortage, having water shortage, not regularly keeping in touch with family or friends, and not having regular supportive talks with teammates during the disaster response. Furthermore, having a passive coping style, being introverted, and having a neurotic personality were also associated with PTSD among the rescue workers. Factors that cannot be easily changed (e.g., introverted personality, passive coping style) should be considered to ensure that rescue workers at higher risk for PTSD are provided adequate support. In addition, further studies should investigate the effectiveness of implementing interventions that could mitigate the impact of more easily modifiable factors (e.g., water shortage and injury during the rescue).

1. *Introduction*

Each year, disasters kill thousands of people and affect millions. In 2006 alone, 426 natural disasters killed 23,000 and affected 143 million people (CRED, 2008). Disasters are especially a threat to the public's heath when they happen in heavily populated areas such as happened during the 2008 8.0 earthquake of the Sichuan province of China (World Bank, 2005). The Sichuan earthquake was responsible for 69,229 deaths, 374,643 injured and 17,923 missing persons (ACT Alliance, 2010).

The impact of disasters on the mental health of the survivors has been well documented across a wide variety of disasters. The consequences of earthquakes in particular have been extensively studied over the years (Demi & Miles, 1983; Lehman & Taylor, 1988; Michenbaum, 1997; Wimbush & Courban, 2006). The most studied consequence of earthquakes on mental health is PTSD. Many studies have shown that certain personality traits, social factors and environmental circumstances can increase the likelihood of PTSD in survivors of disasters. Such factors include being female, having an introverted personality, being older, being injured or ill during the response, having a low educational level, and lacking in social support (Altindag, et al., 2005; Lai et al., 2004; Salcioglu, et al., 2003; Wang, et al., 2009).

Studies done on emergency responders have also shown high rates of PTSD (Green et al., 2000). PTSD was diagnosed in 25% of search and rescue workers that were interviewed two months after the May 2003 Bingol earthquake in Turkey (Ozen & Sir, 2004). Similarly, the prevalence of PTSD among professional and non-professional rescue workers involved in the 1999 Chi-Chi earthquake in Taiwan was determined to be 19.8% and 31.8% respectively (Guo et al., 2004). Understanding the main risk factors that lead to the development of PTSD can be used to create preventive measures to

identify medical rescue workers who might be at higher risk of developing PTSD after one year and can also be used to develop clinical interventions.

China is one of the countries most affected by natural disasters and has been home to some of the world's deadliest earthquakes (USGS, 2011). Furthermore, China has one of the fastest growing populations in the world, causing more and more people to be exposed to the potential effects of disasters. Protecting the mental health of the medical workers responding to such disasters is critical to the sustainability of a response force and to the long-term psychological health of the rescue workers. The challenging and sizable response to the 2008 Wenchuan earthquake presents an opportunity to confirm the relevance of risk factors studied in other populations to rescue workers. Considering the paucity of research done on rescue workers, it also provides an opportunity to study factors that have not been previously studied.

2. *Methods*

2.1. *Participants*

Data was collected on a random sample of 337 Chinese medical rescue workers from the 4053 workers registered with the earthquake relief headquarters of China. The workers were not natively from Sichuan Province and were appointed to respond to the Wenchuan earthquake area during the first three months after May 12, 2008. Two hundred and forty, or 71%, of the rescue workers were male. Only 56 of the rescue workers were single or divorced, and 81% of the study participants were between 25 to 44 years. The workers gave telephone consent to participate in the study and completed an online questionnaire. Ethics approval for this study was obtained from both the

Guangzhou Centers for Disease Control and Prevention in China and the Instutitional Review Board of Emory University in the United States.

2.2. *Instrument*

2.2.1. *Rescue work experience*

Rescue experience was assessed through eleven items. Workers were asked about: 1) the number of days they performed rescue work; 2) the earthquake damage at the response location, as determined by the number of collapsed buildings, injuries, and deaths; 3) the frequency of communication with relief headquarters; 4) having a child (<18 years) or an elder (>60 years) in the family; 5) the number of times he or she had performed rescue work prior to the Wenchuan earthquake; 6) whether or not the appointment was voluntary; 7) the longest time working in one day; 8) the occurrence of injury, sickness, food shortage, or water shortage; 9) witnessing body disposal; 10) receiving a mental health intervention during or after the response; and 11) planning to rest after returning home.

2.2.2. *Pressure management strategies*

To assess worker's ability to manage pressure, the workers were asked: 1) whether or not they kept in touch with family or friends during the response, 2) had supportive conversations with their teammates, 3) showed concern for their teammates, and 4) received pressure management training before or during the rescue work.

2.2.3. *PTSD assessment*

The Impact of Events Scale-Revised (IES-R) Chinese version contains 22 items grouped into 3 subscales related to symptoms of intrusion, avoidance and hyperarousal. Responses were scored on a 5-point Likert scale ranging from 0 to 4. A total score of 33 or greater indicated clinical PTSD (Asukai et al., 2002; Creamer et al., 2003), and the reliability and validity of the Chinese version has been verified for intrusion (Cronbach's α=0.89), avoidance (Cronbach's α=0.85), and hyperarousal (Cronbach's α=0.83) (Wu & Chan, 2003).

2.2.4. *Coping style*

Workers' coping style was determined by using the 20-item Simple Coping Style Questionnaire (SCSQ). SCSQ uses a 4-point Likert scale with choices ranging from 0 points for not adopting the behavior to 3 points for often adopting the behavior.

2.2.5. *Personality trait*

Personality trait was assessed via the Revised Eysenck Personality Questionnaire Short Scale for Chinese (EPQ-RSC) (Mingyi et al., 2000). The EPQ-RSC is divided into four 12-item subscale scores for Extroversion (E), Neuroticism (N), Psychoticism (P), and Lie (L).

2.3. *Statistical Analysis*

The data was cleaned and analyzed using PASW Statistics version 18 and Epi Info version 3.5.3. Univariate analyses were conducted by χ^2 test or χ^2 test for trend at (α=0.05) to test for association between PTSD and the factors of demographic

information, rescue experience, and pressure management. Two sample t-tests (α=0.05) were used to test for association between the mean EPQ-RSC score for each personality trait or coping style and PTSD. The demographic, rescue experience, pressure management, personality trait, and coping style variables that yielded a precision of α=0.10 from the bivariate analysis with PTSD underwent a logistic regression analysis through the backwards elimination procedure with indication of PTSD as the dependent variable. The variables that were found to be significant (α=0.05) in the model were then tested for collinearity and interaction.

3. *Results*

Three-hundred and thirty-seven rescue workers completed the online questionnaire. Of the workers who participated in this study, 17% (95% CI: 13%~21%) showed indication of clinical PTSD (IES-R scores≥33). PTSD was not found to be significantly associated with any of the demographic variables (**Table 1**).

Some variables related to the rescue workers' experience were significantly associated with PTSD (**Table 2**). PTSD was statistically significantly associated with being injured (p=0.002), falling ill (p=0.038), experiencing a shortage of food (p=0.016), and a shortage of water (p=0.007). Forty-one, 12% of the total rescue workers, experienced a water shortage during their rescue work and were 2.1 times (p=0.007) as likely to be diagnosed with PTSD.

Some pressure management strategies were also associated with PTSD (**Table 3**). These included not regularly keeping in touch with family or friends during the rescue work (p=0.018) and not having regular supportive talks with teammates (p=0.05). Workers who regularly had supportive talks with their teammates were 38% less likely to

test for clinical PTSD compared to workers who did not regularly talk with their teammates for support (p=0.05).

The personality traits and coping styles that were statistically significantly associated with testing for PTSD were passive coping (p<0.001) and neuroticism (p<0.001) (**Table 4**). Workers who tested positive for PTSD scored lower in the passive coping category with a mean of 11 (SD=4.6) than workers who did not test for PTSD with a mean of 8.1 (SD=4.4) (p<0.001). In terms of Neuroticism, workers who tested positive for PTSD scored higher than those who did not with a mean of 6.2 (SD=3.2) (p<0.001).

A backwards elimination multiple logistic regression analysis was conducted in order to reduce the model to a simpler form. From the bivariate analysis, the 14 variables that met the criteria of having a p value of less than 0.1 were included in the saturated model (**Table 5**) and eliminated one at the time according to the highest p value, until all remaining variables were significant (p=0.05). In the final model (**Table 6**), neuroticism, passive coping, not having regular communication with relief headquarters, and injured during rescue work were found to be significantly associated with PTSD. Among these factors, there was also significant interaction between being injured during rescue work and having a passive coping style.

4. *Discussion*

Medical rescue workers are at high risk for developing PTSD (Basoglu et al., 2005; Raphael et al., 1983; Weiss et al., 1995). While the specific risk factors for PTSD among the survivors of natural disasters is well-documented (Lai et al., 2004; Salcioglu, et al., 2003; Altindag, et al., 2005; Wang, et al., 2009), the information on the risk factors

for medical rescue workers is limited and little is known about the association between PTSD and the type of support and the rescue work experience (Cetin et al., 2005; Chang et al., 2008; Ehring et al., 2011; Wang et al., 2010). This study set out to further explore the potential demographic, work experience, pressure management, and personality factors related with PTSD one year after responding to the Wenchuan earthquake. This information can be used to direct future research on mental health prevention programs for medical rescue workers as well as serve to identify workers who are potentially at higher risk of developing PTSD and should receive additional support.

The rate of PTSD in this study is similar to the 21% reported in the study by Chang et al. (2003) of 84 firefighters five months after responding to the 1999 Chi-Chi-earthquake in Taiwan. However, the present survey took place nearly twice as long after the response work as the survey by Chang et al. (2003). Some of the variables identified as associated with PTSD in this study might offer a partial explanation for this difference, but more research needs to be done to better understand the higher rates of PTSD among the Chinese medical rescue worker population.

In terms of the aspects of the rescue work experience, this study found that being injured (p=0.0020), falling ill (p=0.038), having food shortage (p=0.016), and having water shortage (p=0.0070) were significantly associated with clinical PTSD. The study by Wang et al. (2010) also found being injured to be significantly associated with clinical PTSD. In this response, 23% of workers were injured, and 44% became ill during their rescue work, highlighting the need for better preventive health services for medical rescue personnel. Comparing these factors to the few published studies in the literature that have assessed the impact of rescue work on the mental health of responders, the

majority of the studies did not extensively assess the rescue experience factors that the present study explored. This highlights the need for future studies to further understand the relationship between these factors and PTSD.

There are several limitations to this study that warrant caution in interpreting the results. First, only 337 (51%) of the 659 workers who were contacted agreed to participate to the study. This introduces the possibility of a selection bias. Biases that factored into whether or not the eligible study population chose to respond to the survey are unknown to the authors. In certain instances, the sample size might not have been large enough and might hide some significant results. For example, the majority of rescue workers were male. This might explain why this demographic variable was not significantly associated with PTSD as it is in most of other studies. Second, there are several factors that should be taken into account when comparing the results of this study with other research in order to account for possible discrepancies. These factors include any difference in methodologies or mental health assessment tools, difference in scope or time frame of the study, as well as environmental differences between the studies. Such differences complicate the potential of creating a standard study design that can be used to compare mental health prevalence rates and risk factors across disasters and countries. Tailoring instruments to the local situation can result in a lower generalizability to other disasters and other populations.

Efforts should be made to put in place preventive interventions for rescue workers. Only 60 workers, 17.8% of the total study group, received some type of mental health intervention prior to or during their rescue work. Additionally, special attention

and possibly additional preventive interventions should be given to rescue workers who have a passive coping strategy, are introverted or have a neurotic personality.

This study also yields information that can be utilized for planning response operations. Workers who experienced water shortage were 2.1 times more likely than those who did not to experience PTSD. Rescue workers who experienced food shortage were 1.9 times as likely to experience PTSD after a year. Therefore, strengthening efforts to ensure that response workers have adequate supplies of food and water is one strategy to prevent the development of PTSD. Furthermore, food and water shortage can be used as screening indicators post-disaster work to ensure that any workers who experienced such shortages are tested for mental health problems and referred to appropriate support resources.

In terms of support and pressure management, less than 6% of the surveyed rescue workers received some type of pressure management training. Additionally, workers who regularly had supportive talks with their teammates were 38% less likely to experience PTSD compared to workers who did not regularly talk with their teammates for support. Furthermore, regular communication with the relief headquarters was significantly associated with PTSD in the multivariate logistic regression analysis. Therefore, increasing the training available for managing the pressures of disaster work, increasing team building tactics to create a support system within the disaster response team, as well as ensuring that communication means exist for rescue workers to regularly contact their relief headquarters for support or assistance represent several strategies for preventing the development of long-term PTSD.

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References

ACT Alliance. 2010. Extension of period for coordination and evaluation components of the appeal only due to delays in the timing of the evaluation. Retrieved December 13, 2010 from http://www.act-intl.org/appeals.php?uid=114/

Altindag, A., Ozen, S., Sir, A. 2005. One-year follow-up study of posttraumatic stress disorder among earthquake survivors in Turkey. Comprehensive Psychiatry 46(5), 328-333.

Asukai, N., Kato, H., Kawamura, N., Kim, Y., Yamamoto, K., Kishimoto, J., et al. 2002. Reliability and validity of the Japanese-language version of the impact of event scale-revised (IES-R-J): Four studies of different traumatic events. Journal of Nervous and Mental Disease 190, 175-182.

Basoglu, M., Salcioglu, E., Livanou, M. 2002. Traumatic stress responses in earthquake survivors in Turkey. Journal of Traumatic Stress 15, 269-276.

Cetin, M., Kose, S., Ebrinc, S., Yigit, S., Elhai, J.D., Basoglu, C. 2005. Identification and posttraumatic stress disorder symptoms in rescue workers in the Marmara, Turkey, Earthquake. Journal of Traumatic Stress 18(5), 485-489.

Chang, C. M., Lee, L.C., Connor, K.M., Davidson, J.R., Jeffries, K., Lai, T.J. 2003. Posttraumatic distress and coping strategies among rescue workers after an earthquake. Journal of Nervous and Mental Disease 191(6), 391-8.

Chang, C. M., Lee, L.C., Connor, K.M., Davidson, J.R., Lai, T.J. 2008. Modification effects of coping on post-traumatic morbidity among earthquake rescuers. Psychiatry Research 158(2), 164-71.

Chung, M.C., Easthope, Y., Farmer, S., Werrett, J., Chung, C. 2003. Psychological sequelae: post-traumatic stress reactions and personality factors among community residents as secondary victims. Scandinavian Journal of Caring Sciences 17(3), 265-70.

Creamer, M., Bell, R., Failla, S. 2003. Psychometric properties of the Impact of Event Scale-Revised. Behaviour Research and Therapy 41:1489-1496.

CRED CRUNCH. 2007. 8th newsletter: Occurrence and impact of natural disasters in 2006. Retrieved December 13, 2010, from www.cred.be

Demi, A. S., Miles, M. S. 1983. Understanding psychological reactions to disaster. Journal of Emergency Nursing *9*(1), 11-16.

Ehring, T., Razik, S., Emmelkamp, P.M. 2011. Prevalence and predictors of posttraumatic stress disorder, anxiety, depression, and burnout in Pakistani earthquake recovery workers. Psychiatry Research 185(1-2), 161-6.

Green, B.L., Goodman, L.A., Krupnick, J.L., Corcoran, C.B., Petty, R.M., Stockton, P., Stern, N.M. 2000. Outcomes of single versus multiple trauma exposure in a screening sample. Journal of Traumatic Stress 13(2), 271–286.

Guo, Y.J., Chen, C.H., Lu, M.L., Tan, H.K.L., Lee, H.W., Wang, T.N. (2004). Posttraumatic stress disorder among professional and non-professional rescue workers involved in an earthquake in Taiwan. Psychiatry Research 127(1-2), 35-41.

Lai, T.J., Chang, C.M., Connor, K.M., Lee, L.C., Davidson, J.R.T. 2004. Full and partial PTSD among earthquake survivors in rural Taiwan. Journal of Psychiatric Research 38(3), 313-322.

Lehman, D. R., Taylor, S. E. 1988. Date with an earthquake: Coping with a probable, unpredictable disaster. Personality and Social Psychology Bulletin 13, 546-555.

Michenbaum, D. 1997. Treating PTSD: A Handbook and Practice Manual for Therapy. Brisbane, United Kingdom: John Wiley and Sons.

Mingyi, Q., Guocheng, W., Rongchun, Z., Shen, Z. 2000. Development of the revised Eysenck personality questionnaire short scale for Chinese (EPQ-RSC). Acta Psychologica Sinica 32, 317-323.

Ozen, S., Sir, A. 2004. Frequency of PTSD in a group of search and rescue workers two months after 2003 Bingol (Turkey) earthquake. Journal of Nervous and Mental Disease 192(8), 573-575.

Raphael, B., Singh, B., Branbury, L., & Lambert, F. 1983. Who helps the helpers: The effect of a disaster on the rescue workers. OMEGA—Journal of Death and Dying, 14, 9-20.

Salcioglu, E., Basoglu, M., Livanou, M. 2003. Long-term psychological outcome for non-treatment-seeking earthquake survivors in Turkey. Journal of Nervous and Mental Disease 191(3), 154-160.

Shi, Q.C., Zhang, J.M., Xu, F.Z., Phillips, M.R., Xu, Y., Fu, Y.L., et al. 2005. Epidemiological survey of mental illness in people ages 15 and older in Zhejiang Province, China. Zhonghua Yu Fang Yi Xue Za Zhi 39(4), 229-36.

Wang, L., Zhang, J., Zhou, M. 2010. Symptoms of posttraumatic stress disorder among health care workers in earthquake-affected areas in Southwest China. Psychological Reports 106 (2), 555-561.

Weiss, D. S., Marmar, C. R., Metzler, T. J., Ronfeldt, H. M. 1995. Predicting symptomatic distress in emergency services personnel. Journal of Consulting and Clinical Psychology 63, 361-368.

Wimbush, T. E. & Courban, C. C. 2006. Psychological impact of disaster. In G. R. Ciottone (Ed.), Disaster medicine (3rd ed., ʿpp.59-63). Philadelphia: Elsevier Mosby.

World Bank. 2005. Natural Disaster Hotspots: A Global Risk Analysis. Washington, D.C.: The International Bank for Development and Reconstruction/ The World Bank and Columbia University.

Wu, K.K., Chan, K.S. 2003. The development of the Chinese version of Impact of Event scale—Revised (CIES-R). Social Psychiatry and Psychiatric Epidemiology 38, 94-8.

Appendix of Tables

Table 1: Chi-squared tests for association of worker demographics with PTSD among medical rescue workers appointed to respond to the Wenchuan earthquake

PTSD (IES-R≥33)					
Characteristics	Total	No.	%	Prevalence Ratio	p
Sex					
Male	240	42	18	1.13	0.65
Female	97	15	16		
Marital status					
Married	281	47	16.7	0.94	0.84
Single or divorced	56	10	17.9		
Age group					
≥ 40 years	115	18	15	0.89	0.66
< 40 years	222	39	18		
Years Worked					
< 10	87	11	13	0.65	0.16
≥ 10	238	46	19		
Years of education					
< 18	220	36	16	0.91	0.71
≥ 18	117	21	18		
Total	337	57	17		

* χ^2 test for trend

Table 2: Chi-squared tests for association of rescue work experience with PTSD among medical rescue workers appointed to respond to the Wenchuan earthquake

PTSD (IES-R≥33)					
Characteristics	Total	No.	%	Prevalence Ratio	p
Severity of earthquake damage in the response location					
High	274	227	83	0.98	0.97*
Medium	25	21	84	0.99	
Low (R)	38	32	84	1.00	
Regular communication with relief headquarters					
At least once per day	201	31	15	3.86	0.056*
Once ever 2-3 days or fewer	111	25	23	5.63	
Not clear** (R)	25	1	4	1.00	
Duration of rescue work					

≥ 16 days	143	24	17	0.99	0.96
1-15 days	194	33	17		
Had a child (<18 years) in the family at the time of the disaster					
Yes	217	43	20	1.7	0.056
No	120	14	12		
Had an elder (>60 years) in the family at the time of the disaster					
Yes	304	54	18	2.0	0.21
No	33	3	9.1		
Frequency of prior rescue work experience					
≥2 times	89	14	16	0.91	0.78
0-1 time	248	43	17		
Voluntary appointment					
Voluntary	141	23	16	0.94	0.80
Not voluntary	196	34	17		
Longest working day while in the disaster area					
1-12 hours	108	13	12	0.63	0.10
13-24 hours	229	44	19		
Was injured during rescue work					
Yes	63	19	30	2.2	0.0020
No	274	38	14		
Fell ill during rescue work					
Yes	103	24	23	1.7	0.038
No	234	33	14		
Had food shortage in response area					
Yes	53	15	28	1.9	0.016
No	284	42	15		
Had water shortage in response area					
Yes	41	13	32	2.1	0.0070
No	296	44	15		
Witnessed body disposal					
Yes	37	10	27	1.7	0.082
No	300	47	16		
Received a mental health intervention during or after the rescue work					
Yes	60	12	20	1.2	0.48
No	277	45	16		
Planned to rest after returning home					
Yes	147	22	15	0.81	0.40
No	190	35	18		
Total	337	57	17		

* χ^2 for trend
(R) reference group

Table 3: Association of pressure management strategies with PTSD among medical rescue workers appointed to the Wenchuan earthquake

PTSD (IES-R≥33)					
Characteristics	Total	No.	%	Prevalence Ratio	p
Kept in touch with family or friends during rescue work					
Every day	171	21	12	0.50	0.018*
Once every 2-3 days	113	23	20	0.83	
Once ever ≥4 days (R)	53	13	25	1.00	
Had regular supportive talks with teammates					
Yes	248	36	15	0.62	0.050
No	89	21	24		
Regularly showed concern for other teammates					
Yes	265	45	17	1.0	0.95
No	72	12	17		
Received pressure management training before or during rescue work					
Yes	19	3	16	0.93	0.89
No	318	54	17		
Total	337	57	17		

*χ^2 test for trend
(R) reference group

Table 4: Association of PTSD (IES-R ≥ 33) with personality coping styles of medical rescue workers appointed to the Wenchuan earthquake

Item	**IES-R ≥ 33 Workers Mean (SD)**	**IES-R < 33 Workers Mean (SD)**	**T-value**	**p-value**
Active coping	25 (5.9)	23 (6.9)	1.6	0.11
Passive coping	11 (4.6)	8.1 (4.4)	4.0	0.000
Psychoticism (P)	1.9 (1.6)	2.0 (1.5)	-0.28	0.78
Extroversion (E)	7.3 (2.8)	8.0 (2.6)	-1.8	0.065
Neuroticism(N)	6.2 (3.2)	4.3 (3.2)	4.2	0.000
Lie (L)	6.1 (2.6)	6.6 (2.7)	-1.3	0.20

Table 5: Variables associated ($p<0.10$) with PTSD entered into the saturated multivariate logistic regression analysis

POTENTIAL RISK FACTORS
Neuroticism
Extroversion
Active Coping Average Score
Passive Coping Average Score
Regular communication with relief headquarters
Had a child (< 18 years) in the family at the time of the disaster
Longest working day while in the disaster
Was injured during rescue work
Fell ill during rescue work
Experienced food shortage
Experienced water shortage
Witnessed body disposal
Kept in touch with family during the rescue work
Had regular supportive talks with teammates

Table 6: Associative multivariate logistic regression analysis between PTSD and significant risk factors among the medical rescue workers appointed to the Wenchuan earthquake

RISK FACTORS	***B***	**S.E. *B***	**Wald**	**P**	**R^2**
Neuroticism	-0.13	0.050	6.25	0.012	0.125
Passive Coping Average Score	1.87	1.10	2.91	0.088	
Regular communication with Relief Headquarters	0.29	0.14	4.56	0.033	
Injured during Rescue Work	-1.58	0.62	6.42	0.000	
Injured during Rescue Work *Passive Coping Average Score	-2.62	1.40	3.49	0.011	

Chapter 4

Discussion

Medical rescue workers are at high risk for developing PTSD (Basoglu et al., 2005; Raphael et al., 1983; Weiss et al., 1995). While the specific risk factors for PTSD among the survivors of natural disasters is well-documented (Altindag, et al., 2005; Lai et al., 2004; Salcioglu, et al., 2003; Wang, et al., 2009), the information on the risk factors for medical rescue workers is limited and little is known about the association between PTSD and the type of support and the rescue work experience (Cetin et al., 2005; Chang et al., 2008; Ehring et al., 2011; Wang et al., 2010). This study set out to further explore the potential demographic, work experience, pressure management, and personality factors related with PTSD one year after responding to the Wenchuan earthquake. This information can be used to direct future research on mental health prevention programs for medical rescue workers as well as serve as identify workers who are potentially at higher risk of developing PTSD and should receive additional support.

The rate of PTSD in this study is similar to the 21% reported in the study by Chang et al. (2003) of 84 firefighters five months after responding to the 1999 Chi-Chi-earthquake in Taiwan. However, the present survey took place nearly twice as long after the response work as the survey by Chang et al. (2003). Some of the variables identified as associated with PTSD in this study might offer a partial explanation for this difference, but more research needs to be done to better understand the higher rates of PTSD among the Chinese medical rescue worker population.

Another discrepancy lies in the study by Ehring et al. (2011), which documented a much higher prevalence of PTSD of 42.6% among rescue workers 24 months after the

earthquake in Pakistan, possibly due to the fact that the response workers of interest in this study were rehabilitation and reconstruction workers whose work continued long after the earthquake. Many of the study participants had also experienced the earthquake themselves, which is in contrast to the present study in which the medical rescue workers surveyed were not from the province affected by the Wenchuan earthquake.

In contrast with literature on disaster survivors and some on response workers, this study did not find female gender to be associated with PTSD. The study by Ehring et al. (2011) found that female gender among the rehabilitation and reconstruction workers was associated with symptoms of PTSD. Likewise, a similar study on 343 health care workers from Sichuan province showed that female gender was associated with PTSD three months after responding to the Wenchuan earthquake. In both of the aforementioned studies, the response workers of interest were also disasters survivors, which is consistent with research done on disaster survivors that found that female gender to be associated with negative psychological consequences (Wang, et al., 2009). The finding in the present study could be explained by the fact that the medical rescue workers were not from the area affected by the Wenchuan earthquake or by the small sample size of the study or by the fact that most study participants were male. A larger sample size might have showed a significant difference between males and females.

Previous literature is in accordance with the findings from this study showing that marital status is not associated with PTSD following a disaster. Chang et al. (2003) found that marital status is not associated with psychiatric morbidity or posttraumatic morbidity. Several studies have shown that marital status is associated with mental health problems among the surviving populations of natural disasters (Lai et al., 2004,

Salcioglu, et al., 2003), which shows that the risk factors among rescue workers are different and therefore warrant separate research.

There have been mixed findings in the literature regarding age and any relation to mental health. Chang et al. (2008) found that older age was associated with both general psychiatric problems and post-traumatic morbidities among rescue workers five months after responding to the Taiwan Chi-Chi earthquake. The finding by Chang et al. (2008) is not consistent with the results of this study and might be explained by the fact that PTSD was tested only five months after the earthquake, whereas the present study examines PTSD after one year.

Many factors of the rescue work experience were associated with PTSD. Being injured, falling ill, having food shortage, and having water shortage were associated with PTSD. Also, not regularly communicating with the relief headquarters was associated with PTSD. The study by Wang et al. (2010) also found being injured to be significantly associated with clinical PTSD. Comparing these factors to the few published studies in the literature that have assessed the impact of rescue work on the mental health of responders, the majority of the studies did not extensively assess the rescue experience variables that the present study explored. This study highlights a few additional factors that should be further studied.

In the current study, witnessing body disposal was not found to be a risk factor of long-term clinical PTSD. This finding stands in contrast with the study by Cetin, et al. (2005), which found that identification with deceased survivors is the risk factor of concern for PTSD among rescue workers after the 1999 Marmara Turkey earthquake. This discrepancy could be due to the fact that the study by Cetin, et al. (2005) focused on

whether or not the rescue workers had avenues to identify with any deceased earthquake survivors, such as a family member or friend. The survey of the Chinese earthquake only asked the medical workers whether or not body disposal was witnessed without regard to whether or not the workers could identify with the bodies being disposed. Furthermore, medical rescue workers are likely to take a minimal role in body disposal as compared to other types of rescue workers (e.g., firemen and search and rescue teams) on which other literature has focused.

In terms of managing pressure, not keeping in touch with family or friends as well as not having supportive talks with teammates were two factors that were found to be associated with clinical PTSD in this study. Previous research (Dyrogrov et al., 1996), confirms the finding that receiving support from other teammates is associated with the rescue workers' mental health, but the literature has not explored the other specific types of support that were tested in this study as risk factors for PTSD.

This study also found that rescue workers with neurotic personalities experienced higher rates of PTSD. While previous research on rescue workers in a natural disasters have not explored this type of personality trait, this finding is consistent the research by Chung, et al. (2003) on community residents that were exposed to a train disaster.

Limitations

There are several limitations to this study that warrant caution in interpreting the results. First, only 337 (51%) of the 659 workers who were contacted agreed to participate to the study. This introduces the possibility of a selection bias. Biases that factored into whether or not the eligible study population chose to respond to the survey are unknown to the authors. In certain instances, the sample size might not have been large enough and might have hidden some significant results. For example, the majority

of rescue workers were male. This might explain why this demographic variable was not significantly associated with PTSD as it is in most of other studies. Second, there are several factors that should be taken into account when comparing the results of this study with other research in order to account for possible discrepancies. These factors include any difference in methodologies or mental health assessment tools, difference in scope or time frame of the study, as well as environmental differences between the studies. Such differences complicate the potential of creating a standard study design that can be used to compare mental health prevalence rates and risk factors across disasters and countries. Tailoring instruments to the local situation can result in a lower generalizability to other disasters and other populations.

Conclusion and Future Directions for Public Health

Efforts should be made to put in place preventive interventions for rescue workers. Only 60 workers, 17.8% of the total study group, received some type of mental health intervention prior to or during their rescue work. Additionally, special attention and possibly additional preventive interventions should be given to rescue workers who have a passive coping strategy, are introverted or have a neurotic personality. This study also yields information that can be utilized for planning response operations. Workers who experienced water shortage were 2.1 times more likely than those who did not to experience PTSD. Rescue workers who experienced food shortage were 1.9 times as likely to experience PTSD after a year. Therefore, strengthening efforts to ensure that response workers have adequate supplies of food and water is one strategy to prevent the development of PTSD. Furthermore, food and water shortage can be used as screening indicators post-disaster work to ensure that any workers who experienced such shortages are tested for mental health problems and referred to appropriate support resources.

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References

ACT Alliance. (2010). Extension of period for coordination and evaluation components of the appeal only due to delays in the timing of the evaluation. Retrieved December 13, 2010 from http://www.act-intl.org/appeals.php?uid=114/

Altindag, A., Ozen, S., & Sir, A. (2005). One-year follow-up study of posttraumatic stress disorder among earthquake survivors in Turkey. *Comprehensive Psychiatry*, *46*(5), 328-333.

Armenian, H.K., Morikawa, M., Melkonian, A.K., Hovanesian, A.P., Haroutunian, N., Saigh, P.A., et al. (2000). Loss as a determinant of PTSD in a cohort of adult survivors of the 1988 earthquake in Armenia: implications for policy. Acta *Psychiatrica Scandinavica, 102*, 58–64.

Asukai, N., Kato, H., Kawamura, N., Kim, Y., Yamamoto, K., Kishimoto, J., et al. (2002). Reliability and validity of the Japanese-language version of the impact of event scale-revised (IES-R-J): Four studies of different traumatic events. *Journal of Nervous and Mental Disease, 190,* 175-182.

Bayam, G., Okay, T., Dilbaz, N., & Acıkgoz, C. (2002). Sivil savunma birlig˘I c¸alisanlarinda, kaygi, umutsuzluk ve og¯renilmis guc¸luluk duzeyleri ve posttravmatik stres bozuklugu sikligi. *Kriz Dergisi, 10*,1–10.

Basoglu, M., Salcioglu, E., & Livanou, M. (2002). Traumatic stress responses in earthquake survivors in Turkey. *Journal of Traumatic Stress, 15*, 269-276.

Benedek, D.M., Fullerton, C., Ursano, R.J. (2007). First responders: Mental Health consequences of natural and human-made disasters for public health and public safety workers. *Annual Review of Public Health, 28*, 55-68.

Bland, S.H., O'Leary, E., Farinaro, E., Jossa, F., Krogh, V., Violanti, J.M., & Trevisan, M. (1996). Long term psychological effects of natural disasters. *Psychosomatic Medicine, 58*, 18–24.

Carr, V.J., Lewin, T.J., Webster, R.A., Kenardy, J.A., Hazell, P.L., & Carter, G.L. (1997). Psychosocial sequelae of the 1989 Newcastle earthquake: II. Exposure and morbidity profiles during the first 2 years post-disaster. *Psychological Medicine, 27*, 167–178.

Cetin, M., Kose, S., Ebrinc, S., Yigit, S., Elhai, J.D., & Basoglu, C. (2005). Identification and posttraumatic stress disorder symptoms in rescue workers in the Marmara, Turkey, Earthquake. *Journal of Traumatic Stress*, *18*(5), 485-489.

Chang, C.M., Connor, K.M., Lai, T.J., Lee, L.C., & Davidson, J.R.T. (2005). Predictors of posttraumatic outcomes following the 1999 Taiwan earthquake. *Journal of Nervous and Mental Disease, 193*(1), 40-46.

Chang, C. M., Lee, L.C., Connor, K.M., Davidson, J.R., Jeffries, K., & Lai, T.J. (2003). Posttraumatic distress and coping strategies among rescue workers after an earthquake. *Journal of Nervous and Mental Disease*, *191*(6), 391-398.

Chang, C. M., Lee, L.C., Connor, K.M., Davidson, J.R., & Lai, T.J. (2008). Modification effects of coping on post-traumatic morbidity among earthquake rescuers. *Psychiatry Research*, *158*(2), 164-171.

Chung, M.C., Easthope, Y., Farmer, S., Werrett, J., & Chung, C. (2003). Psychological sequelae: post-traumatic stress reactions and personality factors among community residents as secondary victims. *Scandinavian Journal of Caring Sciences*, *17*(3), 265-270.

Creamer, M., Bell, R., Failla, S. (2003). Psychometric properties of the Impact of Event Scale-Revised. *Behaviour Research and Therapy, 41*:1489-1496.

CRED CRUNCH. (2007). 8th newsletter: Occurrence and impact of natural disasters in 2006. Retrieved December 13, 2010, from www.cred.be

Demi, A. S., & Miles, M. S. (1983). Understanding psychological reactions to disaster. *Journal of Emergency Nursing, 9*(1), 11-16.

Ehring, T., Razik, S., & Emmelkamp, P.M. (2011). Prevalence and predictors of posttraumatic stress disorder, anxiety, depression, and burnout in Pakistani earthquake recovery workers. *Psychiatry Research, 185*(1-2), 161-6.

European Commission Humanitarian Aid Office (ECHO). (2002). *Disaster preparedness and prevention: State of play and strategic orientations for EC policy*. Belgium, European Commission.

Firth-Cozens, J., Midgley, S.J., & Burges, C. (1999). Questionnaire survey of post-traumatic stress disorder in doctors involved in the Omagh bombing. *BMJ, 319*, 1609.

Freedy, J.R., Saladin, M.E., Kilpatrick, D.G., Resnick, H.S., & Saunders, B.E. (1994). Understanding acute psychological distress following natural disaster. *Journal of Traumatic Stress, 7*, 257–273.

Gao, X., & Luo, X. (2009). PTSD-positive screening and factors influencing the mental state in victims evacuated/ not evacuated from Wenchuan earthquake area within 1 month. *Zhong Nan Da Xue Xue Bao Yi Xue Ban, 34*(6), 504-509.

Goenjian, A.K., Najarian, L.M., Pynoos, R.S., Steinberg, A.M., Manoukian, G., Tavosian, A., et al. (1994). Posttraumatic stress disorder in elderly and younger

adults after the 1988 earthquake in Armenia. *American Journal of Psychiatry, 151,* 895–901.

Green, B.L., Goodman, L.A., Krupnick, J.L., Corcoran, C.B., Petty, R.M., Stockton, P., & Stern, N.M. (2000). Outcomes of single versus multiple trauma exposure in a screening sample. *Journal of Traumatic Stress, 13*(2), 271–286.

Guo, Y.J., Chen, C.H., Lu, M.L., Tan, H.K.L., Lee, H.W., & Wang, T.N. (2004). Posttraumatic stress disorder among professional and non-professional rescue workers involved in an earthquake in Taiwan. *Psychiatry Research, 127*(1-2), 35-41.

Hagh-Shenas, H., Goodarzi, M.A., Dehbozorgi, G., & Farashbandi, H. (2005). Psychological consequences of the Bam earthquake on professional and non-professional workers. *Journal of Traumatic Stress, 18,* 477-483.

International Federation Red Cross and Red Crescent societies. (2002). World Disaster Report 2002: Focus on Reducing Risk. Geneva, Switzerland: International Federation Red Cross and Red Crescent societies. Reference code: DRR4542.

Kato, H., Asukai, N., Miyake, Y., Minakawa, K., & Nishiyama, A. (1996), Post-traumatic symptoms among younger and elderly evacuees in the early stages following the 1995 Hanshin-Awaji earthquake in Japan. *Acta Psychiatrica Scandinavica, 93,* 477–481.

Ke, X., Liu, C., & Li, N. (2010). Social support and Quality of Life: a cross-sectional study on survivors eight months after the 2008 Wenchuan earthquake. *BMC Public Health, 10,* 573.

Kun, P., Chen, X., Han, S., Gong, X., Chen, M., Zhang, W., & Yao, L. (2009a). Prevalence of post-traumatic stress disorder in Sichuan Province, China, after the 2008 Wenchuan earthquake. *Public Health, 123*(11), 703-707.

Kun, P., Han, S., Chen, X., & Yao, L. (2009b). Prevalence and risk factors for posttraumatic stress disorder: A cross-sectional study among survivors of the Wenchuan 2008 earthquake in China. *Depression and Anxiety*, *26*(12), 1134-1140.

Labbate, L.A., Cardena, E., Dimitreva, J., Roy, M., & Engel, C.C. (1998). Psychiatric syndromes in Persian Gulf War veterans: An association of handling dead bodies with somatoform disorders. *Psychotherapy and Psychosomatics*, *67*(4-5), 275–279.

Lai, T.J., Chang, C.M., Connor, K.M., Lee, L.C., & Davidson, J.R.T. (2004). Full and partial PTSD among earthquake survivors in rural Taiwan. *Journal of Psychiatric Research*. *38*(3), 313-322.

Lehman, D. R., & Taylor, S. E. (1988). Date with an earthquake: Coping with a probable, unpredictable disaster. *Personality and Social Psychology Bulletin*, *13*, 546-555.

Liao, S.C., Lee, Y.J., Liu, S.K., Lee, M.B., Wang, S.C., Chen, J.S., et al. (2000). Acute stress syndromes in patients at an emergence medical station after a major earthquake. *Taiwanese Journal of Psychiatry*, *14*, 31– 40.

Lima, B.R., Chavez, H., Samaniego, N., Pompei, M.S., Pai, S., Santacruz, H., & Lozano, J. (1989). Disaster severity and emotional disturbance: Implications for primary mental health care in developing countries. *Acta Psychiatrica Scandanavica, 79*, 74–82.

Maj, M., Starace, F., Crepet, P., Lobrace, S., Veltro, F., De Marco, F., & Kemali, D. (1989). Prevalence of psychiatric disorders among subjects exposed to natural disaster. *Acta Psychiatrica Scandanavica, 79*, 544–549.

McFarlane, A.C. (1988). The longitudinal course of posttraumatic morbidity: The range of outcomes and their predictors. *Journal of Nervous and Mental Disease, 176*, 30–39.

McMillen, J.C., North, C.S., & Smith, E.M. (2000). What parts of PTSD are normal: intrusion, avoidance, or arousal? Data from the Northridge, California earthquake. *Journal of Traumatic Stress, 13*, 57–75.

Michenbaum, D. (1997). *Treating PTSD: A Handbook and Practice Manual for Therapy.* Brisbane, United Kingdom: John Wiley and Sons.

Mingyi, Q., Guocheng, W., Rongchun, Z., & Shen, Z. (2000). Development of the revised Eysenck personality questionnaire short scale for Chinese (EPQ-RSC). *Acta Psychologica Sinica, 32*, 317-323.

Nolen-Hoeksema, S., & Morrow, J. (1991). A prospective study of depression and posttraumatic stress symptoms after a natural disaster: The 1989 Loma Prieta earthquake. *Journal of Persian Social Psychology, 61*, 115–121.

Oliver-Smith, A. (1996). Anthropological research on hazards and disasters. *Annual Review of Anthropology, 25*, 303-328.

Ozen, S., & Sir, A. (2004). Frequency of PTSD in a group of search and rescue workers two months after 2003 Bingol (Turkey) earthquake. *Journal of Nervous and Mental Disease, 192*(8), 573-575.

Raphael, B., Singh, B., Branbury, L., & Lambert, F. (1983). Who helps the helpers: The effect of a disaster on the rescue workers. *OMEGA—Journal of Death and Dying, 14*, 9-20.

Salcioglu, E., Basoglu, M., & Livanou, M. (2003). Long-term psychological outcome for non-treatment-seeking earthquake survivors in Turkey. *Journal of Nervous and Mental Disease, 191*(3), 154-160.

Schnelle, D. D. (2006). Introduction to natural disasters. In G. R. Ciottone (Ed.), *Disaster medicine* (3rd ed., pp. 473-475). Philadelphia: Mosby.

Sharan, P., Chaudhary, G., Kavathekar, S.A., & Saxena, S. (1996). Preliminary report of psychiatric disorders in survivors of a severe earthquake. *American Journal of Psychiatry, 153*, 556–8.

Shih, F.J., Liao, Y.C., Chan, S.M., Duh, B.R., & Gau, M.L. (2002). The impact of the 9–21 earthquake experiences of Taiwanese nurses as rescuers. *Social Science & Medicine, 55*(4), 659– 672.

Tainaka, H., Oda, H., Nakamura, S., Tabuchi, T., Noda, T., & Mito, H. (1998). Workers' stress after Hanshin-Awaji earthquake in 1995-symptoms related to stress after 18 months. *Sangyo Eiseigaku Zasshi, 40*, 241–249.

Tang, H.W., Kuo, C.J., Chen, C.T., Tsay, C.J., Lin, S.K., Chien, C.L., et al. (2000). Acute psychiatric disorders in the bereaved survivors of a disastrous earthquake. *Taiwanese Journal of Psychiatry, 14*, 218–27.

Ursano, R.J., & McCarroll, J.E. (1990). The nature of a traumatic stressor: Handling dead bodies. *Journal of Nervous and Mental Disease, 178*(6), 396 –398.

US Geological Survey (2011, April4). Earthquakes with 50,000 or More Deaths. Retrieved April 15, 2011, from http://earthquake.usgs.gov/earthquakes/world/most_destructive.php

Udomratn, P. (2008) Mental health and the psychosocial consequences of natural di sasters in Asia. *International Review of Psychiatry, 20,* 441-444.

van Griensven, F., Chakkraband, M. L. S., Thienkrua, W., Pengjuntr, W., Cardozo, B. L., Tantipiwatanaskul, P., Mock, P. A., Ekassawin, S., Varangrat, A., Gotway, C., Sabin, M., & Tappero, J. W. (2006) Mental health problems among adults in tsunami-affected areas in southern Thailand. *Journal of the American Medical As sociation, 296,* 537-548.

Wang, B., Ni, C., Chen, J., Liu, X., Wang, A., Shao, Z., Xiao, D., Cheng, H., Jiang, J., & Yan, Y. (2010c). Posttraumatic stress disorder one month after 2008 earthquake in China: Wenchuan earthquake survey. *Psychiatry Research,* Article in press.

Wang, L., Zhang, Y., Wang, W., Shi, Z., Shen, J., & Li, M. (2009a). Symptoms of posttraumatic stress disorder among adult survivors three months after the Sichuan earthquake in China. *Journal of Traumatic Stress*, *22*(5), 444-450.

Wang, L., Zhang, Y., Shi, Z., Wang, W. (2009b). Symptoms of posttraumatic stress disorder among adult survivors two months after the Wenchuan earthquake. *Psychological Reports*, *105*(3 Pt 1), 879-885.

Wang, L., Zhang, J., & Zhou, M. (2010a). Symptoms of posttraumatic stress disorder among health care workers in earthquake-affected areas in Southwest China. *Psychological Reports, 106*(2), 555-561.

Wang, L., Zhang, J., Shi, Z., Zhou, M., Huang, D., & Liu, P. (2010b). Confirmatory factor analysis of posttraumatic stress symptoms assessed by the Impact of Event Scale-Revised in Chinese earthquake victims: Examining factor structure and its stability across sex. *Journal of Anxiety Disorders*, Article in press.

Wang, X., Gao, L., Shinfuku, N., Zhang, H., Zhao, C., & Shen, Y.. (2000). Longitudinal study of earthquake-related PTSD in a randomly selected community sample in North China. *American Journal of Psychiatry, 157*, 1260–6.

Wimbush, T. E. & Courban, C. C. (2006). Psychological impact of disaster. In G. R. Ciottone (Ed.), *Disaster medicine* (3rd ed., ˙pp.59-63). Philadelphia: Elsevier Mosby.

Witteveen, A.B., Bramsen, I., Twisk, J.W., Huizink, A.C., Slottje, P., Smid, T., & Van Der Ploeg, H.M. (2007). Psychological distress of rescue workers eight and one-half years after professional involvement in the Amsterdam air disaster. *Journal of Nervous and Mental Disease*, *195*(1), 31– 40.

World Bank. (2005). Natural Disaster Hotspots: A Global Risk Analysis. Washington, D.C.: The International Bank for Development and Reconstruction/ The World Bank and Columbia University.

Wu, K.K., & Chan, K.S. (2003). The development of the Chinese version of Impact of Event scale—Revised (CIES-R). *Social Psychiatry and Psychiatric Epidemiology*, *38*, 94-8.

Letter of Exemption from Emory IRB Review

EMORY UNIVERSITY

Institutional Review Board

January 21, 2011

Ellen Schenk
Rollins School of Public Health
1518 Clifton Road
Atlanta, GA 30322

RE: Determination: No IRB Review Required
IRB00048391 – *Mental Health Status of Medical Rescue Workers Appointed to the 2008 Wenchuan Earthquake Response in China*
PI: Ellen Schenk

Dear Ms. Schenk:

Thank you for requesting a determination from our office about the above-referenced project. Based on our review of the materials you provided, we have determined that it does not require IRB review because it does not meet the definition(s) of "research" involving "human subjects" or the definition of "clinical investigation" as set forth in Emory policies and procedures and federal rules, if applicable. Specifically, in this project, you and your study team will obtain de-identified data from the Guangzhou Centers for Disease Control and Prevention. With the data set you receive, you will be unable to determine any individuals' identities.

This determination could be affected by substantive changes in the study design, subject populations, or identifiability of data. If the project changes in any substantive way, please contact our office for clarification.

Thank you for consulting the IRB.

Sincerely,

Tom Penna
IRB Analyst Assistant
This letter has been digitally signed

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