

The Impact of Community Disaster Trauma: A Focus on Emerging Research of PTSD and Other Mental Health Outcomes

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This paper reviews community residents' mental health following exposure to a community disaster trauma, with a focus on post-traumatic stress disorder (PTSD) and other mental health outcomes, such as emotional disorders, behavioral problems including addictive disorders, and personality as a maladaptive trait. This review concludes with recommendations to advance the field of community disaster research by exploring how natural and man-made disasters impact community residents across multiple domains. Moreover, this study suggests that residents impacted by community disaster trauma are frequently appropriate targets for mental health assessments or services in a community setting.

Key Words: *Posttraumatic Stress Disorders; Disasters; Mental Health; Personality Disorders*

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INTRODUCTION

The world has faced an increasing number of natural (i.e., earthquakes, tsunamis, and flood) and man-made disasters (i.e., wars, terrorism, and industrial crises). Such disasters cause community-level traumatic reactions and generate direct social and economic costs.^{1,2} The mental health consequences of community trauma encompass a range of emotional, behavioral, and cognitive reactions that occur in various populations with the threat of disaster.^{3,4} Victims have been categorized in various ways and we have divided them into three sample types in this study (Fig. 1). First, we have community residents who live in the trauma-affected area and are most directly affected by the trauma are primary victims. Second, we have community residents and significant associates of primary victims (e.g., family, close friend), local rescue workers, and residents who witnessed the trauma scene and experienced serious threats from community trauma are defined as secondary victims. Third, we defined residents who did not live in the trauma area but who experienced stress reactions due to their geographical and psychological proximity as tertiary victims. Although this group is not comprised of victims, as strictly applied in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders

(American Psychiatric Association),⁵ research on this group has been increasing. Previous studies on community trauma have mixed these diverse community members. Our review focuses mainly on community residents who were indirectly exposed to community trauma, including community residents who lived further away from the trauma area as secondary and tertiary victims. Secondary and tertiary victims are likely to be ignored in clinical interventions for mental health problems and psychosocial support after trauma.

Post-traumatic stress disorder (PTSD) is the most commonly studied psychopathology in the aftermath of a community disaster;^{6,7} thus, the objective of the present review was to present and summarize the prevalence of PTSD in community residents. This study reviews the causes and augmented mental health problems, including emotional symptoms, such as depression and anxiety, and behavioral symptoms, such as addictive and disruptive behaviors, of residents responding to community trauma. This review is a novel contribution to an existing body of studies that demonstrate findings from a large community sample exposed to trauma based on their residence. We hope to inform future research and planning aimed at supporting the mental health impact on community responders as secondary victims following trauma.

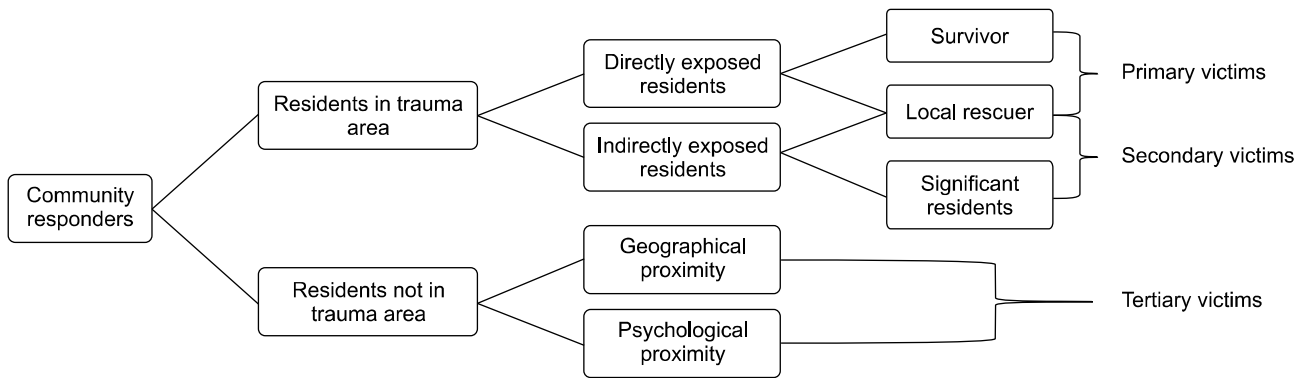


FIG. 1. Affected populations by community disaster trauma.

PREVALENCE OF PTSD AFTER A COMMUNITY DISASTER TRAUMA

Several methodological differences between investigations, samples, and scales that have been used to assess PTSD make it difficult to compare the prevalence of PTSD symptoms across studies. Furthermore, because most estimates of community mental health assessments after trauma have targeted a large community population, self-report screening instruments were applied, which may not provide valid prevalence estimates of PTSD. In particular, since mass traumatic events on the general population, such as September 11, 2001, studies have been conducted not only on directly exposed groups but also on residents living in the affected area or residing outside of the trauma area.^{8,9} The prevalence of PTSD after a community disaster based on recent studies ranges widely from 3.6% to 37% among disaster-affected community residents. Community residents not directly impacted by trauma also experience vicarious trauma as a result of the disaster's impact on the community, similar to secondary trauma experienced by first responders in post-disaster situations.¹⁰ Thus, evaluating PTSD in groups who are not directly exposed is prone to overestimation, but early intervention by finding a specific group vulnerable to trauma is important for community recovery. Table 1 shows the key studies on the prevalence of PTSD and related mental health problems investigated in a large sample of community residents following exposure to community trauma since 2000.^{8,11-24} The prevalence of PTSD among residents after a community trauma varies due to differences in the characteristics of the trauma, sample type, and location of the residents. As there is substantial heterogeneity worldwide in the estimated prevalence of PTSD, we categorized these patients according to three aspects and reviewed the characteristics of prevalence in this context.

1. Effects of trauma type

Community disasters have been broadly divided into two distinct categories comprising natural (e.g., earthquakes, tsunamis, floods, hurricanes, and disease epidemics) and man-made disasters, including technological

disasters (e.g., nuclear explosions and industrial accidents) and mass violence (e.g., terrorism). The prevalence of PTSD in disaster-focused studies on direct victims is estimated to be 5-60% for natural disasters and 25-75% for man-made disasters.^{6,25} However, the prevalence of post-disaster PTSD in the general population is much lower. In particular, this discrepancy is manifested in man-made trauma. The type of man-made trauma featured in the largest number of articles is that of terrorism, the majority of which focused on the September 11 terrorist attacks. A nationwide study of September 11 found that 17% of the US population suffered from PTSD.⁸ A population-based study on September 11 reported a 7.5% prevalence of PTSD in residents near the terrorist attacks.¹¹ The prevalence of PTSD within the first year of other man-made disasters has ranged from 1-11% in the general population.^{26,27} Compared to natural disasters, studies on community populations exposed to man-made community trauma, which are centered on specific events and limited regions, could include a significant number of indirect victims who were affected through multiple avenues, which may contribute to the lower prevalence. However, as large-scale natural disasters can affect broad geographic areas, a substantial number of residents who are not directly affected by a disaster also experience actual damage including loss of a job or destruction of their residence and sequelae of the disaster. The prevalence of PTSD after man-made trauma tends to decrease over time in community residents.^{8,28} A longitudinal evaluation of PTSD prevalence in the general population after September 11 indicated that most PTSD symptoms decreased from 7.5% to 0.6% within 6 months.²⁸ In parallel to the results of man-made disasters, some longitudinal natural disaster research has reported a decline in the prevalence of PTSD over time.^{29,30} However, other studies based on a community sample following a natural disaster show an increase or maintenance of PTSD prevalence over time.^{31,32} The factors associated with the course of PTSD include social support and cohesion, rescue effort, loss of a job, loss of property, a period of evaluation, and use of mental health facilities.^{16,29,33}

TABLE 1. Overview of studies assessing PTSD after community disaster trauma

References	Type of trauma	Region	Study design	Population (N)	Time from trauma	Assessment	Prevalence	Other mental health outcomes
Galea et al. (2002) ¹¹	September 11	Near the affected area	Cross-sectional	988 adults	1.5 mo	NWS-PTSD	7.5%	Depression
Schlenger et al. (2002) ¹²	September 11	Nationwide	Cross-sectional	2273 adults	2 mo	PCL-S	4.3%	NA
Silver et al. (2002) ⁸	September 11	Nationwide	Longitudinal	933 adults at T1 787 adults at T2	T1: 2 mo T2: 6 mo	SASRQ	T1: 17.0% T2: 5.8%	NA
Hoven et al. (2005) ¹³	September 11	Near the affected area	Cross-sectional	8236 grade 4-12 students	6 mo	DPS	10.6%	Depression Anxiety Alcohol abuse
Perrin et al. (2007) ¹⁴	WTC terror	Near the affected area	Cohort	3797 local rescuers	2-3 year	PCL-C	21.2%	NA
Acierno et al. (2007) ¹⁵	Florida hurricanes	Affected area	Cross-sectional	1452 adults	6-9 mo	NWS-PTSD	3.6%	Depression Anxiety
DiGrande et al. (2008) ¹⁶	September 11	Near the affected area	Cross-sectional	11037 adults	15 mo	PCL-C	12.6%	NA
Sakuma et al. (2015) ¹⁷	Great East Japan Earthquake	Near the affected area	Cross-sectional	1294 local workers	14 mo	PCL-S	6.6	Depression General psychological distress
Yang et al. (2017) ¹⁸	Tianjin explosion	Near the affected area	Cross-sectional	836 children	3 mo	PCL-5	4.4%	Anxiety
Chen et al. (2017) ¹⁹	Wenchuan Earthquake	Affected area	Cohort	20749 children	12 mo	UCLA PTSD-RI	19.2%	Depression
Lee et al. (2017) ²⁰	Sewol ferry disaster	Near the affected area	Cross-sectional	2298 adults (765 local rescuers)	1 mo	IES-R	Residents: 15.8% Volunteers: 19.7%	Depression Anxiety
Psarros et al. (2018) ²¹	Attica Wildfire	Affected area	Cross-sectional	102 local firefighters	1 mo	ICD-10	18.6%	Insomnia Depression
Gargano et al. (2018) ²²	WTC terror	Near the affected area	Cohort	297 adolescents	5-10 year	PCL-S	4.4	Personality Depression Smoking
Brown et al. (2019) ²³	Fort McMurray Wildfire	Affected area	Cross-sectional	3070 grade 7-12 students	18 mo	CPSS	37%	Binge drinking Depression Anxiety
Li et al. (2019) ²⁴	Great East Japan Earthquake	Affected area	Cohort	2965 adults	2.5 year	SQD-P	25.2%	Substance use Depression

NWS-PTSD: National Women's Study PTSD Module, PCL-S: PTSD checklist-Specific Stressor version, PCL-5: PTSD checklist for DSM-5, PCL-C: PTSD checklist-Civilian version, SASRQ: Stanford Acute Stress Reaction Questionnaire, DPS: Diagnostic Interview Schedule for Children Predictive Scales, UCLA PTSD-RI: The University of California at Los Angeles Posttraumatic Stress Disorder Reaction Index, IES-R: Impact of Events Scale-Revised, CPSS: Child PTSD Symptom Scale, SQD-P: PTSD subscale of the Screening Questionnaire for Disaster-Related Mental Health.

2. Effects of sample type

Special populations are particularly vulnerable to mental health problems in the aftermath of a community-disaster. Women, children, adolescents, disaster volunteers, and individuals with prior trauma or preexisting psychiatric disorders have been identified as special populations at risk.³⁴ In this study, we review the literature of school-aged children and local rescuers in which a relatively large number of subjects have been used.

Results from several studies that have assessed PTSD in children and adolescents after a community trauma suggest that the frequency of PTSD symptoms may be greater in children than adults with similar exposure, possibly because they are in a critical developmental stage, including having immature brains.^{35,36} Most research suggests the importance of the child's subjective appraisal of danger in reaction to the trauma.³⁷⁻³⁹ The influence of media and visual exposure is noteworthy in the pediatric group exposed indirectly to a community disaster. The impact of the media on community trauma responses in children has been documented previously.^{40,41} Media exposure about terrorism is strongly associated with PTSD in children geographically distant from a disaster, who did not directly report PTSD symptoms.^{42,43} Directly witnessing the rescue scene following the Sewol ferry disaster in South Korea was significantly associated with PTSD in adolescents of the disaster-affected community.⁴⁴ As such, subjective appraisals of danger and initial reactions to trauma through vivid imagery can predict PTSD as an objective measure of exposure in community children. Traumatic experiences in children may interact with factors in the family to affect the development of PTSD.^{45,46} Parental mental health and the stress response following community trauma are also related to the development of PTSD in children.^{46,47} The magnitude of the maternal stress reactions following a major natural disaster predicts PTSD symptoms in children.^{39,48} There is also evidence that parental psychopathology is consistently related to children's PTSD symptoms after man-made trauma.^{46,47}

As local rescuers play an important role in the relief of disaster-affected areas as first responders, their mental health after a large-scale trauma is a critical issue. Local rescuers are often direct victims of community trauma and, as residents, they are often troubled by the effects of trauma until the disaster recedes. First responders are an unrecognized group of "hidden" victims who are involved in community trauma. The prevalence of PTSD varies widely across different groups of rescue workers, ranging from 0% to 46%,^{49,50} even when different types of rescue workers are deployed to the same disaster.¹⁴ The prevalence of PTSD among non-professional rescuers seems to be higher than that of professional rescue workers.^{6,14} There is a lack of knowledge in the literature on the PTSD symptoms of local rescuers. Among local workers who worked in occupations less prepared for disaster, the prevalence of PTSD in municipality workers after a large-scale natural disaster was 6.6%, which is much higher than the prevalence of PTSD

in firefighters (1.6%).¹⁷ The prevalence of PTSD was highest in 3,797 unaffiliated volunteers among different local rescuers who lived near the site of the World Trade Center attacks.¹⁴ Local volunteers scored higher for PTSD than professionals.⁵¹⁻⁵³ The prevalence of PTSD was relatively high in community volunteers compared to general residents (19.7% vs 15.8%) during the Sewol ferry disaster relief work.²⁰ These results suggest that local rescuers are more vulnerable to community trauma than general populations as well as professionals.

3. Effects of trauma location

The proximity of the individual to the community trauma affects the expression of PTSD, regardless of the amount of exposure. It is important to identify the area where intensive assistance is necessary in cases of large-scale community trauma. Several studies have indicated that geographic proximity to a community disaster is significantly related to the prevalence of PTSD symptoms.^{11,54,55} In particular, residing near a trauma-affected region is a strong predictor of PTSD following a community disaster. In a national study of 2,273 community populations after September 11, the prevalence of PTSD was significantly higher in New York City (11.2%) than in other areas (2.7-4.0%).¹² Residents in areas highly exposed to September 11 were at a higher risk for PTSD compared to other areas (20% vs. 7%).¹¹ The long-term prevalence of PTSD in community residents after September 11 was consistently higher compared to that of the citywide population.²⁸ The relatively high prevalence of PTSD among populations close to the epicenter of a natural disaster supports the importance of geographical proximity as a contributing factor for the development of PTSD in community residents.⁵⁶ These results suggest that the community environment may contribute to the development or maintenance of PTSD symptoms. However, a study of two communities exposed to continuous terror reported comparable rates of PTSD between the proximal community (35.7%) and the remote community (31.5%).⁵⁷ Moreover, some studies have indicated that psychological proximity is a more important predictor of PTSD than geographical proximity.⁵⁸ After the Sewol ferry disaster in Korea, the residents of Ansan, where most of the victims lived, were more severely affected by the disaster than residents of Jindo near the disaster site.⁵⁹ These reports indicate that the meaning of a traumatic event, including having a personal connection to relatives of victims and worrying about the safety of someone close, is significantly associated with the development of PTSD.

OTHER MENTAL HEALTH PROBLEMS AFTER COMMUNITY TRAUMA

Previous studies have demonstrated that PTSD with comorbid psychiatric disorders heightens the burden of mental illness, including greater functional impairment and greater risk of chronicity compared with those with only

PTSD.^{60,61} The most studied comorbid psychiatric disorders after community trauma are those involving emotional problems, such as depression and anxiety.^{3,6,62,63} Few studies have focused on the association between community disaster exposure and behavioral problems, such as addictive symptoms and conduct problems. This study reports not only on the psychopathology, including depression and anxiety, but also on behavioral problems and cross-sectionally assessed personality as a vulnerable trait.

1. Depression

The prevalence of depression varies widely at 13-76% after a disaster worldwide,⁶⁴ which is a much higher prevalence of depression among respondents than in the general population. Although depression might be the sole manifestation of a traumatic event, several observational studies suggest that PTSD and depression are common co-occurring conditions ranging from 48% to 55%.⁶⁵⁻⁶⁷ An individual with PTSD and depression tends to report more severe and chronic symptoms, functional impairment, and a lower quality of life compared to those with either PTSD or depression alone.⁶⁸⁻⁷⁰ A recent cohort study of older community adults exposed to a natural disaster reported that post-disaster depression is associated with a risk of mortality, whereas PTSD is not associated with an increased risk of mortality.²⁴ Predictors for depression after community trauma have been reported as female gender, middle or older age, lost job due to trauma, and lack of psychosocial resources.^{11,64,71} Personality factors, such as neuroticism, also play an important role in post-trauma depression.^{19,72} The severity and persistence of depressive symptoms among community trauma-exposed residents are probably related to loss of community cohesion.

2. Anxiety

Anxiety is among the most prevalent psychiatric symptoms reported with PTSD and depression after a disaster, but less is known about how man-made disasters are related to anxiety symptoms in communities exposed to a disaster. Generalized anxiety disorder (GAD) was observed at a 50% greater prevalence than PTSD in an epidemiologically-based study on psychological sequelae resulting from hurricanes.¹⁵ A community study on 486 adult residents after the Fort McMurray wildfire reported that GAD was significantly more prevalent following the disaster and substance use was also higher in residents with GAD.⁶³ After the two large Nepal earthquakes in 2015, 33.8% of residents in affected areas reported high levels of anxiety and impaired functioning associated with anxiety symptoms rather than PTSD.⁷³ Some studies have suggested that peri-traumatic panic attacks following community disaster predict an increased risk of later psychological problems.⁷⁴ However, other studies suggest that peri-traumatic panic has limited predictive value for PTSD⁷⁵ and the significance of peri-traumatic panic was associated with only short-term PTSD status (i.e., 1 year).⁷⁶

The prevalence of anxiety was the highest among the mental health problems of 6,132 adolescents in the most severely affected earthquake area, and insufficient sleep was independently associated with anxiety symptoms.⁷⁷ In a citywide study on children exposed to September 11, the most prevalent psychopathology was an anxiety disorder, such as agoraphobia (14.8%) and separation anxiety (12.3%), followed by PTSD (10.6%).¹³

3. Addictive disorders

A recent meta-analysis of substance use in the aftermath of terrorism reported that 7.3% (95% confidence interval, 1.1-32.5%) of a population reported increased alcohol consumption in the first 2 years following a terrorist attack.⁷⁸ Several studies have reported that September 11-related PTSD symptoms among residents in the affected area subsequently resulted in binge drinking.⁷⁹⁻⁸¹ Another study indicated a marked increase in substance (alcohol, tobacco, and cannabis) use among young residents about 18 months after an earthquake.⁸² Following the Canterbury earthquakes, 24% of ex-smokers relapsed into their previous smoking habit, resulting in increased smoking prevalence.⁸³ A cross-sectional study after the Sewol ferry disaster reported that problematic internet use among children in the affected area was associated with PTSD symptoms.⁸⁴ These studies suggest that people react to emotional distress by turning to addictive behaviors in the absence of other more adaptive coping strategies.

4. Externalizing symptoms

Although most studies on mental health outcomes after a community disaster have focused on PTSD and internalized symptoms, such as anxiety and depression, recent studies have shown the presence of externalizing symptoms, such as behavioral problems (e.g., conduct problems, aggression, and oppositionality) in a considerable proportion of youth after a community disaster. Following the 2013 Boston Marathon bombing, increased conduct problems in Boston-area children (4-19 years) were reported through their caregivers.⁸⁵ Israeli adolescents exposed to recurrent terrorism reported high levels of risk-taking behaviors (fighting, stealing, disobeying, and substance use), and the severity of risk-taking was associated with greater terrorism exposure.⁸⁶ Young children (4-9 years) exposed to a technological disaster developed significantly more conduct problems (hyperactivity) than controls.⁸⁷ A study using data from the WTC health registry reported that many adolescents with behavioral problems after September 11 became chronic smokers.²² In addition, several studies have been performed on externalizing symptom outcomes among youth impacted by natural disasters.⁸⁸⁻⁹⁰ Several hypotheses have been proposed to explain the prevalence of such behavioral symptoms after a community disaster, including heightened activation of the stress-response system and the tendency for behavioral reenactment.^{88,91}

5. Personality

Personality traits can also be a contributing factor to PTSD by shaping cognitive processes, coping strategies, and the interaction with social support as a predisposing factor.^{92,93} A few studies have reported that neuroticism plays an important role in the development of PTSD among community residents after a trauma. However, as the majority of personality studies on PTSD symptoms in community residents are cross-sectional, the authors were unable to ascertain whether residents had been neurotic before the disaster or became neurotic because of the trauma. This finding is relevant given that personality variables in the context of mental health status that co-occur with PTSD in community residents after a community mass trauma. Previous studies of community adults following a natural disaster have suggested that residents with neurotic personalities tend to be associated with PTSD symptoms.^{94,95} Other research has found that neuroticism is a significant risk factor for the onset of PTSD symptoms in adolescents.⁹⁶ A study on the role of personality in PTSD among children revealed that the neuroticism trait is a risk for PTSD symptoms, but that extraversion is not associated with PTSD.¹⁹ This finding in the context of a man-made disaster is in line with previous findings on natural disasters indicating that neuroticism is significantly associated with PTSD symptoms.⁹⁷⁻⁹⁹ Neuroticism is a personality trait characterized by emotional instability and anxiousness, which can cause maladaptive coping and increase susceptibility to PTSD.¹⁰⁰

CONCLUSIONS

This review highlights the importance of conducting comprehensive population-based mental health assessments. In particular, vulnerable residents after a community trauma including local rescuers, children, and adolescents, as well as those living closest to the disaster site should be considered when targeting interventions or developing mental health preparedness protocols to mitigate PTSD. In addition, as these findings suggest important public mental health implications, we recommend consideration of a routine assessment of co-morbid mental health problems beyond PTSD after a community disaster trauma.

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CONFLICT OF INTEREST STATEMENT

None declared.

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