Impact of Hurricanes on Mental Health

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Abstract Hurricanes are among the leading natural disasters in the USA and are associated with significant psychological distress and mental disorders. Hence, understanding the mechanism underlying the development of mental health problems during a hurricane is critical. This chapter highlights the main factors that increase the risk for hurricane-related mental health problems. Common mental disorders and popular screening instruments that are available for rapid mental health assessment of a population affected by a hurricane are described. The chapter also emphasizes the importance of disaster mental health management and surveillance during the entire disaster management cycle.

Keywords Mental health · Disasters · Posttraumatic stress disorder · Depression · Psychological stress · Disaster surveillance

1 Introduction

Hurricanes are large, circulating winds with sustained wind speed of 74 miles per hour or higher. In the USA, hurricanes occur in early June to late November, often causing significant morbidity and mortality, as well as destruction of property (Taylor et al. 2012). Regarding cost, a recent analysis by the National Oceanic and Atmospheric Administration (NOAA) found Hurricanes Katrina, Harvey, Maria, Sandy and Irma—the costliest hurricanes in America since 1980—accounted for over US$500 billion in financial loss and damages to the USA (NOAA 2018). The mental health impact of hurricanes on Americans is particularly huge, disproportionately affecting socially vulnerable populations. A pre-post assessment of mental health outcomes related to Hurricane Katrina, for example, revealed a significantly

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higher prevalence of posttraumatic stress disorder (PTSD) and other mental illnesses among participants after the disaster (Rhodes et al. 2010). Recently, a group of mental health clinicians that provided care during Hurricane Harvey, a major hurricane classified as Category 3, reported that over 200 evacuees sought mental health care; 50% reportedly had a secondary psychiatric diagnosis (Shah et al. 2017). Access to psychotropic medications and managing acute suicidality were a few of the challenges first responders faced during Hurricane Harvey. The storm surge and extreme flooding associated with most major hurricanes add to their negative impact on the mental health of affected populations (Akpinar-Elci et al. 2018). As the number and intensity of hurricanes are predicted to increase in the future, partly due to a rising mean global temperature, a corresponding increase in hurricane-related mental health problems is likely. Since Hurricane Galveston made landfall in Southern USA in 1900, Americans have experienced approximately 40 major Hurricanes. In 2017 alone, 10 hurricanes occurred in the USA, two of which were reported to be the most devastating hurricanes to hit the country in the past decade (NOAA 2017). In addition to short-term consequences, the long-term mental health impact of these hurricanes is predicted to be substantial (Shultz and Galea 2017). This chapter provides a general overview of the relationship between hurricane and mental problems, aiming to simplify the complex mechanism underlying the development of disaster-attributable psychological distress.

2 Mental Health Effects of Hurricanes

Several models for explaining the mental health impact of hurricanes exist. As it is for many chronic diseases (e.g., Alzheimer's disease), interaction between multiple risk factors are likely involved in the development of disaster-related mental health problems. In an attempt to simplify this interaction, one might adopt the Risk-Hazard-Exposure-Vulnerability equation, i.e., $Risk\ (R) = Exposure\ (E) \times Vulnerability\ (V) \times Hazard\ (H)$. It is also important to consider this equation in the context of a population's capacity to cope with a hazard. For example, the *risk* for a supposed hurricane-related mental health problem (e.g., PTSD) would depend on the extent of *exposure* of a *vulnerable* population to the *hazard*, hurricane. Indeed, individual-level factors (e.g., gene, resilience) and community-level factors (e.g., level of disaster preparedness and response, availability of social support networks) moderate the risk for developing hurricane-attributable psychological distress. A brief discussion of the components of the risk-exposure equation, in the context of disaster-related mental health, is discussed below.

3 The Hazard—Hurricanes

Hurricanes are a type of natural hazard; hazard is defined as a "process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation" (UNISDR 2017). What would make a hurricane more "hazardous" than another? For example, Hurricanes Dolly and Ike, Category 1 and Category 2 hurricanes, respectively, occurred during the same hurricane season. However, Hurricane Ike garnered more media attention because it had more negative impact on human lives and property. Hence, the category of a hurricane, which correlates with its propensity to cause severe damage and disrupt lives, defines how hazardous a hurricane is. According to NOAA, hurricane hazards include high winds, storm surge and flooding (NOAA n.d.).

4 Vulnerability Factors

Despite similar level of exposure, some individuals or populations are more likely than others to develop mental illness following a hurricane. The difference between these two groups may lie in what is considered a "vulnerability factor." World Health Organization (WHO) defines *vulnerability* as "the degree to which a population, individual or organization is unable to anticipate, cope with, resist and recover from the impacts of disasters" (WHO 2002). In general, vulnerable groups reported in the scientific literature include children, pregnant women, the elderly and those suffering from preexisting mental health problems or other chronic diseases. Certainly, these groups are likely to report significant psychological problems during the initial period following a disaster. Other vulnerability factors are also reported in the scientific literature. Thirteen to 16 months after Hurricane Sandy in 2012, a telephone survey of residents living in communities hardest hit by Sandy found that neighborhoods closest to the ocean, parental status, as well as being Asian or Black, were significant vulnerability factors among residents living in the boroughs of Brooklyn and Queens (Gruebner et al. 2015).

5 Exposure

Americans are more likely to be exposed to hurricanes during the Atlantic hurricane season, which starts on June 1 and ends on November 30 of each year. The probability of exposure also increases for people living in areas prone to hurricanes. In its analysis of hurricane data from 1944 to 1999, NOAA found the odds of exposure to a hurricane to be highest among residents of Miami, Florida; Cape Hatteras; North Carolina; San Juan, Puerto Rico; and New Orleans, Louisiana (NOAA 2014). While ***direct***

exposure might be the focus of first responders and public health decision-makers during the immediate aftermath of a hurricane, those ***indirectly*** exposed may suffer negative mental or psychological consequences as well. For example, according to the Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-5), PTSD may occur in a person who learned that a close family member or friend died or suffered life-threatening injuries during a hurricane. Additionally, single versus repeated exposure to a harmful hurricane, or its effect on others, may cause significant short-lived or lifelong psychological distress. The severity/intensity of exposure is equally crucial when determining the risk for mental illness post-disaster. This is defined by Sir Bradford Hill as *biologic gradient* or dose–response relationship. For example, exposure to a Category 2 hurricane for a protracted period of time is likely to induce psychological distress compared with brief exposure (Hill 2015). Of course, in reality, the relationship between a risk factor/cause and effect could be nonlinear because of the presence of confounding factors. For example, brief exposure to a Category 1 hurricane may cause a mental disorder in a genetically predisposed individual who has a history of childhood trauma (Romens et al. 2015; Ballard et al. 2015; Jansen et al. 2016) (Fig. 1).

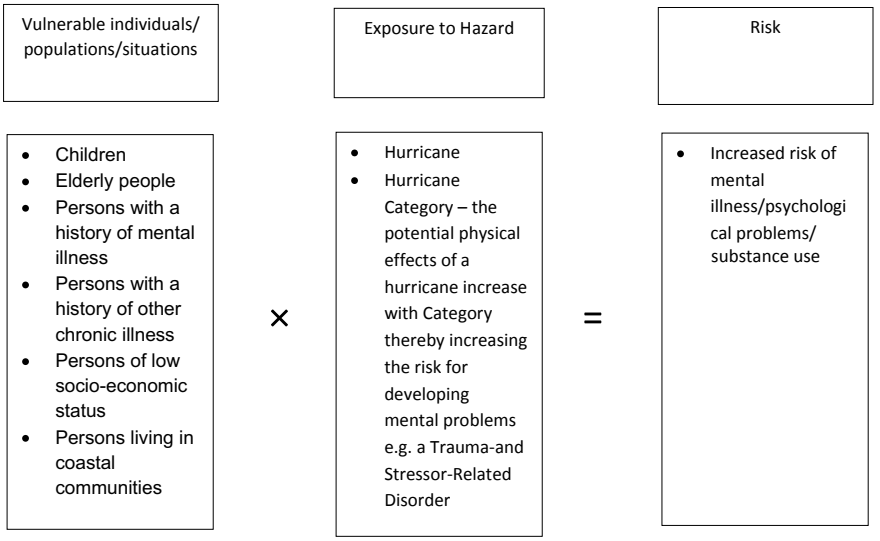

Fig. 1 The disaster risk equation

6 Disaster-Related Mental Health Issues

6.1 Posttraumatic Stress Disorder

PTSD is one of the most reported and widely researched mental disorder among hurricane-impacted populations (Foa et al. 2006; Pietrzak et al. 2012a; North and Pfefferbaum 2013; Fergusson et al. 2014). While very few, well-conducted incidence studies exist, the prevalence of hurricane-related PTSD has been found to range from 2 to 30%, depending on population characteristics, pre-hurricane factors and the period post-hurricane that a population is assessed (CDC 2006; Caramanica et al. 2015; Lowe et al. 2015; Boscarino et al. 2017; Heid et al. 2017). For example, a study found the prevalence of PTSD among police officers and firefighters, 2 months after Hurricane Katrina, was 19 and 22%, respectively (CDC 2006). Some studies have shown that a prior history of disaster-related PTSD and low socioeconomic status increase the risks for PTSD (Caramanica et al. 2015). It is worth mentioning that the prevalence of PTSD appears to decrease months after a hurricane.

Regarding PTSD assessment, most studies use the Primary Care PTSD Screen, the Impact of Events Scale-Revised, the PTSD CheckList or the Trauma Screening Questionnaire survey instruments in screening individuals. Overall, individuals diagnosed with PTSD following a hurricane must have been either directly or indirectly exposed to its traumatic effect and exhibit the following features for at least four weeks: re-experience the event (e.g., through flashbacks), actively avoid thoughts or situations associated with the event, display negative alterations in cognition and mood and suffer from hyperarousal (e.g., hypervigilance or irritable behavior) (American Psychiatric Association 2013).

6.2 Major Depressive Disorder

Clinical features of major depressive disorder (MDD) (e.g., sleep disturbance, depressed mood, suicidal ideation) are prevalent among hurricane-affected populations (Lowe et al. 2015; Akpinar-Elci et al. 2018). Individuals with MDD have five or more depressive symptoms that often interfere significantly with their ability to function socially or at work. The Patient Health Questionnaire (PHQ-9) is the most common standardized screening tool used to identify depression in epidemiologic studies. A survey of residents living in communities impacted by Hurricane Sandy in NYC found that the 13- to 17-month prevalence of probable MDD was 8.9% (Lowe et al. 2015). This is similar to the prevalence of MDD of 8.6% that was reported among 193 Galveston Bay area adult residents who were surveyed 8–20 weeks after Hurricane Ike (Pietrzak et al. 2012b). When the Galveston Bay residents were screened at 12 months after Hurricane Ike, the prevalence of MDD appeared stable compared with a decrease in PTSD rate.

6.3 Other Mental Health Issues

The intense psychological stress experienced during the immediate periods following a hurricane has been associated with various mental health issues (e.g., anxiety disorders) and substance use. However, rapid identification of disaster-related mental disorders can be time-consuming and expensive. Screening instruments that can identify probable DSM disorders are especially important as they inform clinical treatment. The K10/K6 nonspecific distress scale is a validated, easy to administer, screening instrument used in differentiating individuals with DSM-IV disorders from non-cases (Kessler et al. 2003). Of note, screening instruments based on DSM-5 disorders (e.g., the Distress Questionnaire-5) and that are culturally sensitive are being advocated (Batterham et al. 2016; Stolk et al. 2014). Based on the above, anxiety and affective disorders are some of the most commonly reported mental disorders among hurricane survivors. A telephone survey of a representative sample of residents of Hurricane Katrina-affected areas, 5–7 months after the incident, found that the 30-day prevalence of anxiety and affective disorders was approximately 30%. Of these, approximately 10 and 20% met the K6 criteria for a probable severe and mild/moderate mental illness, respectively (Galea et al. 2007).

7 Disaster Mental Health Management and Surveillance

In order to effectively address disaster-related mental health problems, one must adopt a comprehensive approach. This includes activities targeted to the different phases of a disaster which, according to the WHO Disaster Management Cycle, are the predisaster, disaster and post-disaster periods. The goal is to prepare for, mitigate, respond to and quickly recover from the negative health impact of a disaster. For instance, increasing mental health awareness in communities and educating primary health care professionals on the importance of early disease detection and management before disasters strike may increase resilience and reduce risk of disaster-related mental illness in a population. To detect hurricane-related mental disorders, non-traditional sources of data may be sought to augment existing, traditional sources (Olayinka et al. 2017).

Malilay and colleagues identified four, cross-cutting, disaster-related epidemiologic activities that are adaptable in disaster mental health management. These are "rapid needs assessments, health surveillance, tracking and registries and epidemiological investigations" (Malilay et al. 2014). For example, early detection of individuals with hurricane-related psychiatric disorders is critical for rapid allocation of mental health services. Such an approach would invariably reduce the psychological burden of hurricanes, accelerate psychological healing and help affected populations to return to pre-hurricane level of functioning. This is particularly important given that approximately 1 in 4–5 American youths and adults has a mental illness (Bagalman and Napili 2018; Merikangas et al. 2010). Population-based assessment

of disaster-related psychiatric disorders, however, is fraught with challenges. This ranges from how cases are identified in affected populations (e.g., screening instruments using differing thresholds/criteria to determine whether a subject is a probable case) to what is considered a true disaster-related mental disorder. For example, psychiatric epidemiologists and public health professionals are not clear whether mental disorders that develop several months following a disaster can be considered disaster-related. Furthermore, unlike the ease with which the physical effects of a disaster can be identified because affected populations are typically within the area where a hurricane makes landfall, the mental health of individuals in distant location may be impacted (e.g., in the case of PTSD). Additionally, areas affected by a hurricane may be inaccessible for rapid mental health surveillance, particularly during the immediate aftermath of such event. Despite the aforementioned, tremendous progress is being made in the field of disaster mental health epidemiology.

8 Conclusion

With the high probability of a hurricane making landfall in the USA annually, the risk for hurricane-related mental disorders remains a major public health concern. The risk for mental illness following a hurricane depends on a complex interaction of factors including the intensity of exposure to hazards associated with the hurricane (e.g., wind speed, flooding) as well as vulnerability factors (e.g., pre-hurricane history of mental illness). There is abundance of evidence showing an increased risk for PTSD, MDD and anxiety disorders among populations exposed to hurricane. Despite the progress made in disaster mental health surveillance, more still needs to be done to stem the negative mental health impact of hurricanes and other natural disasters in general. For example, harmonizing existing screening instruments and developing a robust case definition for hurricane-related mental disorders are lacking . More importantly, making disaster-related mental health a priority through awareness-raising and integration in disaster management policies at the local, national and global levels is crucial.

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