

Extreme Weather: Mental Health Challenges and Community Response Strategies

Jyotsana Shukla

Abstract The health of populations is inseparably linked with weather and climate. Extreme weather events like heat waves, storms, droughts, and dangerous flooding, bring damage and destruction in their wake. Damages to infrastructure and other built environment are easily visible after an extreme weather event. Beside the risks of physical injury and death, extreme weather events create many mental health consequences. It is the developing countries and the poor and vulnerable sections of their populations that are affected most. The capacity of a community to prepare and plan for such extreme weather is an important determinant of the severity of the health consequences. The existing public health and safety systems are significant factors in responding to extreme weather disaster emergencies. Other factors that need attention while responding to extreme weather events include the age, gender, education, medical condition and socio economic status of the affected populations. It must be noted that the extreme weather events also affect agriculture yields and the long-term food security of nations. Therefore, governments, community institutions, non-governmental organizations, international agencies, and individual citizens must give priority to preparing for and adapting to the impacts of all future extreme weather events. This chapter presents an overview of but one often overlooked human health consequence of extreme weather events: mental health following natural disasters and the efforts taken by government, community, and the agencies extant that rush to help, to deal effectively with present and future extreme weather events. The chapter also looks at some of the best practices adopted in response to extreme weather events.

Keywords Extreme weather · Heat waves · Floods · Drought · Typhoons · Cyclones · Mental health impacts · India · Community engagement · Best practices · Psychosocial · Psychological

J. Shukla (✉)

Amity Institute of Behavioral and Allied Sciences, Amity University,
Lucknow, Uttar Pradesh, India
e-mail: jshukla@lko.amity.edu

1 Introduction

Extreme weather events are rare stochastic events. Easterling (2000) defines two categories of extreme weather. The first refers to extremes in terms of very low or very high temperatures, and the second refers to more complex event driven extremes such as droughts, floods, or hurricanes. We will show that both categories place considerable burden upon people and their ability to cope.

In the recent past, the world has witnessed many extreme weather events, such as droughts, heat waves, floods and cyclones (Knutson et al. 2010). In 2013, in Australia, parts of central Asia, coastal Africa, Central America, and central South America, southern Russia, northwest Kazakhstan, south India, and southern Madagascar observed record warm temperatures (National Center for Environmental Information, State of the Climate 2013). Some other costly weather disasters were witnessed in 2013, including central European flooding in June, the Uttarakhand flash flood in India, Typhoon Fitow in China and Japan, and a drought in much of China. In 2014, typhoon Haiyan killed more than 6100 people and caused \$13 billion worth of damages in the Philippines and Vietnam (Heilprin 2014).

2 Extreme Weather and India

The world's largest democracy and second most highly populated country, India, has faced "extreme weather events" at regular intervals in the recent past and continues to face them today. Mumbai, India, attained its highest measured daily rainfall record of 39 in. It flooded the city in July 2005. The heavy rainfall brought a deluge that continued for about a week. This unprecedented extreme weather event killed hundreds of citizens and resulted in the displacement of around 1 million people (Maharashtra Floods 2005; Fact Finding Committee on Mumbai Floods 2006).

The Leh (Ladakh) cloudburst in 2010, in the north of India, with 14 in. rainfall in 2 h, cost more than 200 lives and vast devastation (Ashrit 2010). Many were injured and many went missing, perhaps washed away. Over a thousand houses were destroyed (Gupta and Kapoor 2012).

Flash floods resulting from extremely intense rainfall caused by cloudbursts in Uttarakhand on 16–17 June 2013 affected 12 of the 13 districts of Uttarakhand, with 4 district being most affected. The unprecedented flash floods swept away mountainsides, villages and towns, thousands of people, animals, agricultural fields, irrigation canals, domestic water sources, dams, roads, bridges, and buildings ... everything that stood in its way. It devastated more than 200 villages. The villagers whose homes, lands, and animals were swept away were reported to be in a state of shock, after losing their livelihood and all assets (The Hindu 2013).

The state of Jammu and Kashmir, in India, faced its worst floods in over a century, caused by heavy rains, in the first week of September 2014 (National Remote Sensing Centre, Indian Space Research Organisation 2014). The floods led to more than 200 deaths and left more than 150,000 people stranded. Many animals were swept away, along with huge damages to property (Mahr and Bukhari 2014).

As of the writing of this chapter in 2015, the latest in the series of extreme weather events is the heat wave that swept across many states in India, with record high temperatures, more than 10 °F above normal. The heat wave caused more than 2500 deaths. It was one of the five deadliest on record. The victims of this heatwave were mainly the elderly, homeless, and construction workers (Earth Observatory 2015).

Working Group II of the Intergovernmental Panel on Climate Change (IPCC) Assessment Report (AR5) (Intergovernmental Panel on Climate Change 2014) anticipates that heat waves, floods and droughts will occur frequently in India as current climate trends continue. According to the IPCC report there will be fewer rainy days, but those days will have heavy rains. It also anticipates more extreme rainfall during monsoons. The report also points out that the agricultural sector in India may be affected adversely, with risks of greater food insecurity and threats to public health (www.teleSURtv.net/english, Mall et al. 2006).

3 Extreme Weather and Mental Health

Direct impacts of extreme weather, i.e. death and injury, are easily visible. People are aware of them. However, extreme weather events also lead to indirect health problems, caused by damaged infrastructure, displacement of population, and change in ecological systems. Both direct and indirect affects may harm the public health system and lead to psychological and social problems. Health care services may become less accessible due to infrastructure damages (Greenough et al. 2001).

Indirect psychosocial (mental health) impacts of extreme weather events require greater attention of government, as well as the general population, to administer to those who are currently affected, and to prepare for even greater casualties should we be facing even more extreme weather events with increasing frequency and intensity as many predict (IPCC 2014). Recent studies show that extreme weather events have many adverse mental health consequences. The general public and policy making bodies need to become aware of these impacts (Shukla 2013).

Extreme weather related catastrophes such as wild fires, severe drought, and flooding, may damage the human psyche. Extreme weather events may cause acute trauma (Weems et al. 2007). People may experience post-traumatic stress disorder (PTSD), depression, and anxiety (Union of concerned Scientists 2010). Feelings of distress following a disaster include being “scared, sad, depressed, numb, helpless and hopeless, frustrated or angry.” People may even deny the existence of any problem or may not perceive the intensity of the problem if they find the problems too difficult to face. They may become resigned to the situation and become cynical (Australian Psychological Society (APS) 2007). Extreme weather may also result in

generalized worry, substance abuse, family issues and even intergroup conflict (Doherty and Clayton 2011).

Mental health outcomes in the form of PTSD, prolonged depression, and domestic violence may manifest in days, months and years after the severe event (Doherty and Clayton 2011). In the case of a massive disaster like Hurricane Katrina, no decline in cases of PTSD symptoms was observed even after more than two years (Kessler et al. 2008). Such trauma has also been reported in people who suffered during the Uttarakhand flash floods in India. The PTSD symptoms were present more than two years after the disaster. According to media reports, a few victims who were tracked after more than one year by their relatives had suffered memory loss and required psychiatric interventions.

Research points out that 25–50 % of a population that experiences an extreme weather disaster may suffer adverse mental health effects. An individual's age, coping capacity, and nearness to the event site will also affect the severity of symptoms (Weems et al. 2007a). The intensity of the extreme weather and the type of trauma experienced, e.g. watching someone die, will also determine the severity of adverse mental health. The closer a person is to the site of the disaster, the worse are the impacts on mental health. Other factors include timing and distance of evacuation, the extent of damage to one's home or community, and the extent of family and community support available (Weems et al. 2007b). Research says that for people who lose their jobs post disaster, there is greater vulnerability to psychological symptoms when compared to those who did not experience job loss or disruption (Peek-Asa et al. 2012).

The people who are most vulnerable to adverse mental health impacts of severe weather are those who already have a mental illness, those who are poor, those who do not have survival or comfort resources, and the marginal sections of the society. This differential vulnerability is also apparent globally, where those who live in poor nations are more vulnerable than those who live in wealthier nations. In addition, inside any country, poorer people are more vulnerable to adverse mental health impacts (Doherty and Clayton 2011).

Extreme weather events may also aggravate existing mental health problems in the affected communities or may even cause more mental health problems, thus increasing the responsibility of mental health institutions and systems (Fritze et al. 2008). In vulnerable and affected communities, the social, economic, and environmental determinants of mental health may be disrupted in the wake of extreme weather events (World Health Organization 2003; Fritze et al. 2008).

4 Impacts of Extreme Weather Events on Communities

4.1 Floods

Floods are one of the most common of extreme weather events when compared to other events such as heat waves, droughts, and cold waves. Floods are held

responsible for almost 53,000 deaths in the last decade alone. The nature and character of floods and the vulnerability of the affected populations determine the short and long term consequences of this extreme weather phenomenon (Alderman et al. 2012). Floods affect about 30 million people in India every year. The Indian states of Assam, Bihar, Orissa, Uttar Pradesh and West Bengal face floods regularly. It has been observed in recent years that parts of the country that had not previously been prone to flood, now become inundated. For example, the normally drought-prone areas of Rajasthan experienced severe floods in 2006 (Sharma 2009) and again in 2013.

Floods lead to an increase in psychological morbidity, primary care attendance and referrals and admissions to hospitals (Bennet 1970; Abraham et al. 1976; McMichael 2003). There is an increase in psychological symptoms and post-traumatic stress disorders, along with suicides, as reported in the two months after a major flood in Poland in 1997 (International Federation of Red Cross and Red Crescent Societies 1999).

Studies have shown that psychological distress prevails in 8.6–53 % of the population, even after two years of the flood. This psychological distress could cause worse physical illness in the affected populations (Alderman et al. 2012; Wind et al. 2013). The PTSD symptoms do not fade away quickly, even after floods have receded (Health Protection Agency 2011).

Several human factors are especially connected to mental illness after a flood, including the extent of exposure to the flood event and the person's gender, age, and socio-economic status (Health Protection Agency 2011). Thus, flooding can greatly affect people's psychosocial needs and mental health. These consequences of flooding, are a major challenge for public health (Health Protection Agency 2011).

4.2 Cyclones

The term 'cyclone' refers to different types of storms that rotate around an atmospheric low pressure center. Tropical cyclones occur over tropical ocean regions such as the South Pacific and Indian oceans. They are known as Hurricanes in the Atlantic and Northeast Pacific ocean regions and as Typhoons in the Northwest Pacific (GA 2008; BOM 1994).

Low lying, economically poor, environmentally degraded areas along coasts with high population density are particularly vulnerable to tropical cyclones, where the majority of deaths occur from drowning during cyclone storm surge (Noji 2000). Bangladesh has had the most serious consequences of tropical cyclones in the past century due to a combination of meteorological and topographical variables and the intrinsic vulnerability of its people as a low-income country (Pan American Health Organization 1999).

Eight percent of the land in India is vulnerable to cyclones. The coastal areas of India on average experience two or three tropical cyclones every year. India's eastern coasts experience more severe storm impacts than do India's western coasts. Peninsular India is known to be the worst cyclone-affected part of the world (Sharma 2009). At times, the indigenous communities in coastal areas suffer from mental health consequences because their traditional way of life has been disrupted, especially when forced migration or relocation from their historical habitat is a factor (Green 2006).

4.3 Drought

Drought is “a period of abnormally dry weather that persists long enough to produce a serious hydrologic imbalance” (National Oceanic and Atmospheric Administration 2002). It has also been defined as a “period of deficiency of moisture in the soil such that there is inadequate water required for plants, animals and human beings” (Office of U.S. Foreign Disaster Assistance/Centre for Research on the Epidemiology of Disasters 2001).

A worldwide disaster database maintained by the Centre for Research on the Epidemiology of Disasters, covers drought disasters from 1900–2012 and highlights the adverse impacts of drought in nations throughout the world. India and China faced the greatest number of droughts during this period. Countries with the highest drought related mortality rates were China, Bangladesh, India, Soviet Union, Ethiopia and Sudan, in that order (Stanke et al. 2013).

India, one of the most vulnerable and drought prone countries in the world, has been experiencing prolonged and widespread droughts since the mid 1990s and, in subsequent years, with increased frequency (Mishra and Singh 2010; Food and Agriculture Organization 2013; World Bank 2003). It is difficult to document the health impacts of drought. Deciding upon a beginning and end date of the drought is problematic, and drought impacts tend to accumulate over time. Most health consequences are indirect since they are mediated by other factors such as loss of jobs and infrastructure (Stanke et al. 2013).

The main drought related worries are financial wellbeing, household income business pressure and occupational concerns. Other factors include residential mobility, employment, personal relationships, social life and family time, health and family functionality, and mental and physical health (Edwards et al. 2008; Stain et al. 2011). The drought also leads to psychological issues involving inequities in water distribution and conflicts among water users. School attendance is often interrupted, affecting students, their families, as well as school staff, teachers and administrators. Populations often must migrate to safer ground, disrupting bonds of family, friends and familiar environment. There is often poor physical and mental

health and a hopelessness and sense of loss (Udmale et al. 2014; Keshavarz et al. 2013; Guha 2012; Karpisheh et al. 2010). Drought has significant social impacts in terms of community social cohesion and participation. Drought triggers anxiety or depression related to less access to recreational activities, higher incidents of heat stroke, and loss of human life (National Oceanic and Atmospheric Administration 2002).

Drought-triggered mental illness mostly affects farmers and farm workers. For those whose earnings sink to lowest levels after drought, higher rates of mental health problems and lower mental health wellbeing scores occur (Edwards et al. 2014).

Attempted suicide is highest among farmers who are particularly vulnerable to drought (Alston and Kent 2008). According to National Crimes Records Bureau of India, the state of Maharashtra registered the highest number of farmer suicides each year in the last decade, most in the Vidarbha region, showing an increasing trend in the worst drought-affected area of India (Patel 2005). However, farmers in the region blame increase in farmers' suicides on inadequate government policies and the ecological and social issues arising from drought, rather than drought itself (Udamale 2014; Keshavarz et al. 2013; Guha et al. 2012; Karpisheh et al. 2010; Bryan et al. 2010).

Psychological responses to prolonged drought also affect one's outlook and sense of hope, including one's sense of connection to their environmental surroundings (Stain et al. 2011). Rural communities and inhabitants are more connected to their environment than urban dwellers, both socially and economically. It is not only the intensity of drought that matters for the mental health of these inhabitants, but the pattern of drought matters too. Specifically, recurrent and long, unbroken periods of drought are more damaging across the entire community (O'Brien et al. 2014). In India, it is said that a typical rural household spends about 15 % of its annual income during festivals (Rao 1999). Since drought affects the income of low-income farmers, they cannot participate as much in festivals when droughts occur. This negatively impacts their social life and mental health (Udamale et al. 2014). A study undertaken in India found that a majority of farmers believed they were not ready or unable to mitigate the impacts of drought. This shows the low resilience and high vulnerability of farmers to drought (Udamale et al. 2014; Ashraf and Routray 2013; Paul 1998; Wilhite et al. 2000).

When drought-related experiences of young people were studied, the mental health impacts of drought were largely reported as negative. Consequences included relationship issues at school and in homes, worrying about families, communities, their futures, money and possible isolation. They sought help from schools, friends and others, and sought information about mental health (Carnie et al. 2011). Young people who had experienced a long-term drought also had higher emotional distress scores than those who had not experienced the long-term extreme drought (Dean and Stain 2010).

5 Displacement Due to Extreme Weather Events

There is a fear that extreme weather events and the consequent destruction of local economies will displace millions of people across the globe in the near future (Brown 2008b; Myers 2015). Population displacement due to climate change is projected to be 200 million people by the year 2050 (Centers for Disease Control and Prevention 2010). This displaced population might face place-based distress due to involuntary migration and loss of connection to their home environments, a phenomenon known as “Solastalgia” (Centers for Disease Control and Prevention 2010). Migrating communities are seen by those who receive them as “a threat to their culture ... and as competitors”. Migrants are believed to be vulnerable to cultural and racial discrimination in the receiving communities and may experience negative mental health impacts (Myers 2005) such as anxiety, depression, and PTSD (WHO 2002).

Extreme weather phenomena may lead to wars and conflicts. In a study that compared ENSO (El Niño, Southern Oscillation) data for 1950–2004, a two-fold increase was discovered in the probability of wars and conflicts during years affected by El Niños (ENSO is a phenomenon relating large-scale atmospheric wind patterns and warming of tropical Pacific Ocean temperatures that affect climate patterns in widely spaced quarters of the world). The study concluded that El Niño might have a role to play in 21 % of civil strife across the world over the past 50 years (McCarthy 2011).

6 Extreme Weather Events and Community Engagement

A new model for disaster preparedness should include disaster response, preparedness and mitigation policy. It should emphasize preparedness above all, with mitigation as a goal and improved Early Warning Systems (EWS) an important means to achieve it. While emergency response and immediate relief are clearly important, true disaster preparedness includes being able to anticipate the wide range of possible threats and to heed the warning signs (Wilhite 2002). This is why the IPCC activities today are so important for disaster preparedness now and for our children and grandchildren tomorrow.

We must find new ways to adapt and mitigate health risks from extreme weather events (McMichael 2007) and to understand that mental health programs developed in urban contexts need not necessarily apply, and must be modified before adaption in rural situations (Carnie et al. 2011).

Engagement with communities for disaster preparedness has rarely been consistently effective, no matter where one lives. This is a common shortcoming in spite of the personal and tragic consequences of extreme weather events. One explanation for this is that the news media, the usual outlet for community engagement in this context, show images that underscore the helplessness of the

ongoing situation. In some cases it is because the sad images shown are of a distant place, giving the impression that the threat is not imminent. Yet another possible explanation is that resources allocated for the many competing social, economic and environmental factors are insufficient, and that the authorities distributing these resources have not explained their allocations in a manner acceptable to the community.

The notion that scarce resources should be allocated to a “what if” type of scenario—for instance, *what if* major extreme weather hits a particular area—does not spur people to action when there are multiple demands on resources. This is one reason why it is difficult to rouse public support to address unspecific *potential* disasters that *may* accompany climate change. Lehmann (2014) touches upon this point, that it is difficult for communities to face the economic and environmental reality of disasters and it might be easier to ignore climate change and the many environmental, economic and social challenges that accompany it.

Adaptation to extreme weather is not a high priority of governments, even though the adverse impacts caused by these events beg a heightened sense of emergency for a long time. Adequate preparation for extreme weather events requires effort and coordination from a number of government departments, agencies and local community focused groups. There is a need to make adaptation to extreme events a mainstream practice by raising the level of awareness and concern among public policy makers and decision-makers, whether in government, in business, in Non-Governmental Organizations (NGOs), or in the home. To deal with emergencies related to extreme weather events, governments must recruit more career emergency responders, such as firefighters (United Firefighters Union—Queensland 2013).

The research community has a responsibility as well: evidence-based research should inform all levels of policy makers of progress while developing tools intended to minimize the psychosocial and mental health impacts of disasters (Health Protection Agency 2011).

Effective policies are needed to curtail flood-related impacts, among the worst of which are morbidity and mortality. This requires an adequate understanding of the potential health impacts of floods. In order to be prepared for dealing with floods and mitigating their devastating impacts, nations need to deal with problems such as refugees driven from famine-plagued neighboring communities, urbanization, increasing burden of diseases, high rates of malnutrition and poor maternal and child health (Alderman et al. 2012).

Comprehensive long-term action plans must be prepared in order to mitigate the impacts of drought. A shift in public policy from drought management to drought preparedness and drought mitigation is much needed. Early warnings of drought with continuous monitoring and decision support systems should be incorporated. Social and community processes to help communities prepare for drought need to be conveyed to everyone, especially in vulnerable regions (National Academy of Agricultural Sciences 2011).

Currently, India is practicing a drought management mechanism that includes institutional and social welfare programs, along with employment generation

schemes, with the support of State and Central governments. Communities would be well advised to participate with government to enhance the effectiveness of government planning, mitigation and relief efforts. Steps are taken in India to manage drought impacts by involving local self-government institutions, for example, the Gram Sabha/Panchayat. Taking such steps will reveal the most practical relief work needed, for example, in districts and block-level committees, for sanctioning the necessary funds and monitoring the relief operations, and in NGOs that play such a big role through training and motivating the affected population (Gupta et al. 2011).

Drought mitigation is also managed in India by rural institutions, tribes, international aid agencies and in private sector, philanthropic organizations, community groups, farmers and herders. These efforts are backed by research and development in weather forecasting and in vulnerability and preparedness studies, rainwater and soil management, contingency crop planning and mid-season corrections, along with alternate and diversified land use systems (National Academy of Agricultural Sciences 2011). A case study is shown in the following box. A number of multi-national pilot projects could be undertaken to test the effectiveness of drought management programs and to train emergency responders everywhere as to best practices.

Successfully Managing Drought during 2002

An Indian drought in 2002 was one of the most severe (NAAS 2011). Rainfall was 51 % of normal in July. Its impact was felt over 56 % of the land and it affected 300 million people in 18 out of 29 states in India (NAAS 2011). In addition to the appropriated strategies used by policy makers at state and central levels, in terms of optimum use of available resources and institutional services already in place, the Panchyati Raj Institutions (the local self government institutions) and rural and local self help groups proved to be of great assistance in carrying out community-based drought relief operations. The central government gave large amounts of money to the states. Millions of tons of food grains were given in relief. Billions of rupees were spent on servicing the debt liability and crop insurance claims of suffering farmers. Employment generation schemes were implemented. Fresh water was supplied through roads and railways to over 90 million people (NAAS 2011).

A start has been made to promote awareness and concern for psychosocial impacts of drought. India's drought-prone, cotton-growing belt, the Vidarbha region in eastern Maharashtra, is at the core of drought crises faced regularly by India. A community-based pilot program there, known as 'The Vidarbha stress and health program,' or Vishram, is supporting farmers and their family members in distress in the region since 2011 (Patel 2015).

Efforts should be made to make drought preparedness comprehensive, so that it includes safety nets, such as insured losses and staged levels of enforced water conservation as the drought worsens. Preparedness must become part of normal farm management plans and activities. Timely forecasting of drought, including probable location, and the likely duration and extent of its impacts should be provided. Most importantly, the forecasts should be coordinated with various stakeholders that could be impacted by the drought. This is being done in India by the Indian Meteorological Department, which predicts rainfall patterns for the Indian sub continent. There is also the need to make others aware of droughts before they recur. Having this a priori awareness would help in drought preparedness for outreach and education. This communication with the public is essential for gaining trust and cooperation in drought mitigation strategies, including staged water conservation efforts of government.

7 Best Practices for Extreme Weather Community Engagement

When widespread flooding struck India and Pakistan in September 2014, the relief agency, *'Islamic Relief,'* provided community health services. In coordination with the NGO, *'Doctors For You,'* Islamic Relief provided psychosocial support by organizing meetings with women and youth groups. The program was spread over 20 villages and included measures such as training of community volunteers to provide support to the local populace. More than 1000 children who faced these floods benefitted from *'Child Friendly Centre,'* set up in more than 12 locations (Islamic Relief 2014).

Efforts by international agencies such as the United Nations Development Program (UNDP) have gained rich dividends in terms of collective action. The case of people residing in the vicinity of the Mahanadi River delta in the Indian state of Odisha, who face extreme weather regularly, is notable. Widespread flooding occurred here for 6 months from July to December 2014. However, after three months, agricultural water supplies were reduced, leading to declining crops. In the Mahanadi River Delta, the community managed water drainage systems three times in one year to increase the crop yield during flooding. When three of the villages in the Puri district pooled resources to identify their most urgent problems and discover ways to address the increasingly erratic rainfall patterns, they responded with a joint renovation of the Kharbar Canal, a 12-km-long channel that had not been used for a long time. By renovating and cleaning out the river channel the water could drain out much faster, preventing water-logged fields during floods. In the summer months when there is less or no rain, the water flow is reversed to help irrigate their lands. This effort was funded by the Australian Agency for International Development (AusAID). It helped build the resilience of poor men and women to extreme weather events and to reduce the risks they face (UNDP 2012b; Turnbull et al. 2013).

7.1 Enhancing Preparedness, Reducing Vulnerabilities and Building Resilience

Research suggests that communities must adapt to severe weather risks using ‘cost-effective, nature-based approaches’ to be better equipped to cope with both unexpected and expected extreme weather events. Past research has illustrated that taking preventive action today may help protect communities and save much money (Davies et al. 2009). The Multi-hazard Mitigation Council (2014) reported that for every dollar spent on preventive action, the United States will save \$4 from the future costs of disaster (Grant 2014). Moreover, when there is equitable distribution of resources within a community, nation, or the world, there is greater adaptive capacity (World Health Organization 2005a, b).

In Bangladesh, households with poor physical conditions, less education or income, and insufficient access to weather forecasts and training for coping with disasters were found to be more vulnerable during severe storms than households with these resources; the latter were able to cope with a recent cyclone, for example, by having accessed forecasts, prepared themselves for the cyclone, and had quick access to a storm shelter (Hossain 2015). Thus, reduction of population vulnerability to disasters can be the first line of action for “effective and fruitful” disaster management. A household’s level of intrinsic vulnerability to disaster, such as cyclones and storm surges, is significantly determined by socioeconomic and physical factors (Hossain 2015).

Traditional methods for responding to extreme weather events, such as assessment, mitigation and preparedness that have yielded rich dividends in many cases need to be complimented by sociological or community-based measures, which take a multi-stakeholder approach. It becomes important to involve various sectors and interests from the community to build a stakeholder group that is more representative of community perspectives. Various community oriented and community based solutions have evolved across the world as a result of community representatives and governing authorities working together to deal with extreme weather events.

There is a need to uncover ways and means that help prevent and mitigate the suffering from extreme weather events and assist people in adapting to these events (Kovats et al. 2000; Patz et al. 2000). Emphasis on psychological and psychosocial support and intervention is increasing as part of overall responses to disasters (Kuo et al. 2003). Communities should realize the importance of adopting low cost, feasible and functional risk-mitigation activities, and manage the costs of such activities themselves. This will go a long way in sustaining community risk mitigation practices (Davies et al. 2009).

It is true of many countries that the response to drought is mainly reactive, i.e. crisis management. The result is generally poor disaster relief planning. This re-active crisis management strategy should be replaced by a more pro-active strategy (Udmale 2014; Kiem and Austin 2013). Low education, small parcels of land, and low income appear to be major obstacles to farmers’ strategies to adapt to

the impacts of drought. Attention must be paid to these constraints as policies for community resilience to drought events are framed (Udmale 2014).

Media coverage and appeals for aid sometime generate huge amounts of aid immediately following an extreme weather event or disaster. At times, considerable aid is wasted due to the haste in delivering emergency aid without benefit of prior planning and organization. Preparation ahead of the disaster will allow responsibility for disseminating resources to fall to the experts who understand community needs and priorities. One should not overlook the role of well-organised and experienced institutions for disaster management, such as the military, especially when long-term recovery is anticipated.

International NGOs who work in tandem with local NGOs and community-based organizations can be very successful in delivering and managing aid. Experienced external aid agencies are recommended to complement recovery efforts and to help avoid the traps of undue haste. They must be prepared to hand over the work they began only when local agencies demonstrate fool-proof arrangements that lead to continued efforts in an organized manner, even after the external aid agencies depart. Disbursal and effective utilization of aid needs a long term, thoughtful and all encompassing approach (Mulligan 2013).

7.2 Importance of Early Warnings, Timely Evacuation, and Emergency Planning

It has been said that, “preparedness pays.” If preparedness is given its due, and preparation is made well in advance, the damaging consequences of extreme weather may be reduced significantly. Much effort must be given to train people in the community for extreme weather challenges and responses. This training, of course, will apply as well to emergencies triggered by other events. Local administrative bodies and other stakeholders need to promote these emergency response training activities jointly at school, hospital, institutional and community levels. Training can be on themes such as search and rescue and first-aid, both medical and psychological. This training should be organized regularly, in phases, so as to cover the entire community.

Preparatory efforts should include building capacity in terms of resources, inculcating local leadership and relief and rescue equipment, medicines, food stocks, and drinking water—all to be monitored, replenished and maintained at regular intervals. Research has shown that women may be excellent ‘disaster managers,’ as many of them actually manage household activities, especially where men traditionally leave the home for work for extended periods of time. Institutes already working at national and regional levels in the area of training may be involved in providing training in a big way. It is also suggested that civil society groups such as NGOs, indigenous groups, community groups, etc. could help monitor emergency preparations and assist community capacity building to follow through.

Improved technologies have led to a decline in the harm delivered by cyclones in recent years (Pan American Health Organization 1999a): satellite-based observation systems and Doppler weather radars are able to detect severe thunderstorms and provide early warnings. In hilly regions, flash floods may happen with very little time to prepare. Since community members and even the staff of some aid agencies are not accustomed to interpreting information from advanced tools such as radars and satellite-based sensors; there is often a delay in analyzing and disseminating important information derived from them. Too often, people have very little time to act. Thus, creating and operating Early Warning Systems (EWS) become a priority, which generally must come from well-funded and interdisciplinary teams extant. An effective EWS would be designed and operated with full communication and participation of all affected parties, including community representatives, local and regional governments, and aid agencies. The effectiveness of any EWS will be judged by the time it would take for people to respond to these warnings—and that requires full and sustained engagement of those being served.

Changes in temperature and precipitation, as well as droughts and floods, may also affect agricultural yields and production. It is known that in some regions of the world the impacts of extreme weather, such as droughts and floods, may undermine food security and endanger human health and well being by causing spread of infectious diseases, malnutrition, and food poisoning. Some of the worst effects may be seen in developing countries and among poor and vulnerable sections of these countries (Confalonieri et al. 2007). An example of creating effective early warning systems for overcoming food insecurity and famine is the Famine Early Warning Systems Network (FEWS NET), which is a collective effort at the global level to deliver early warnings about hazards, food insecurity, and famine (Brown 2008a). The network was created in 1985 by the US Agency for International Development (USAID). The objective and research-based analysis provided by FEWS NET helps governments and relief agencies to plan action to deal with potential famine. With its network of analysts and specialists spread over 22 field offices working in coordination with US government science agencies, national government ministries, international agencies, and NGOs, it produces futuristic reports related to more than 36 of the world's countries most vulnerable to food insecurity. The FEWS NET program helps develop national and regional emergency early warning systems and monitoring and assessment capabilities regarding famine (www.chemonics.com). We recommend that institutions and projects such as FEWS expand to provide information and data to convey warnings, alerts and the implications of drought to communities and stakeholders around the world. These networks need to be extended to include many more countries and regions of the world, so that hazards like famine, may be predicted earlier and the havoc caused by its humanitarian impact can be mitigated.

Evacuation from whatever the disaster, in advance, helps to reduce mental health challenges that appear in the aftermath of severe weather events (Weems 2007b). When the dreaded cyclone Phailin reached the Odisha coast in 2014, the loss to life and property was minimal compared to 15 years earlier when a similar storm, in the

same state, led to loss of 10,000 lives. The reason for this low damage was effective storm warnings over several days by the Indian Meteorological Department that provided realistic information about the cyclone and motivated people to prepare and respond. This turned out to be the largest, timely storm evacuation by India. Some 900,000 people were moved to shelters in schools and government offices (Samenow 2013).

In India, the army has carried out most immediate rescue and relief operations. After the flash floods hit the city of Leh in 2010, the civil hospital of Leh was badly damaged and rendered dysfunctional. Search and rescue operations were launched by the Indian Army immediately after the disaster. The injured and the dead were shifted to the Army Hospital in Leh, and mass casualty management was started by the army doctors while relief work was mounted by the army and civil administration (Gupta and Kapoor 2012). Over 200,000 people were rescued by the Armed forces and the National Disaster Relief Force (NDRF) from different parts of Jammu and Kashmir during its worst floods in September, 2014. Three teams of Naval Marine Commandos were also involved in rescue operations (Pandit 2014). Similar operations, on a war footing, were conducted during Uttarakhand floods in June, 2013.

In 2014, another tropical cyclone, Hudhud, slammed into the Andhra Pradesh coast, with torrential rain, great waves, and gale force winds reaching 120 miles per hour, creating widespread damage to infrastructure, affecting communication and power lines, roads, rail, and air traffic in many coastal districts. The immediate impact of the cyclone was greatly reduced by the disaster preparation conducted many days in advance. The most important was the evacuation of some 150,000 residents living in areas along the coast (Hannah 2014).

Emergency planning is one of the most important components of disaster preparedness. Communities must collectively understand what needs to be done before, during and after a disaster. For developing such an understanding, planning would require active participation of women, children and elderly, especially since demographic patterns indicate that many men folk often migrate to cities in search of employment leaving the elderly and very young at home in the more rural areas. After such extreme-weather events, it is also suggested that emergency planning must help build special task forces to address specific tasks. The capacity of these task forces could be increased over time, through training and mock extreme-weather drills. This sort of planning identifies emergency evacuation pathways and possible shelters needed when an extreme weather event or disaster actually strikes. Local government institutions need to work in close coordination with communities during emergency planning.

It usually helps if people have a plan for keeping themselves safe in the event of a severe weather event. A good plan includes where they will meet others, and supplies they may need, such as food, water, and flashlights. This preparedness can help people cope. Osofsky (2007) documents that anxiety is less for children and families who are prepared.

In Australia, Queensland's response to the floods and to Cyclone Yasi was "extremely good" (Cleary 2011) because Queensland's Emergency Services and

Premier had well-developed plans that were communicated and updated regularly. They used concise, clear and repetitive messaging. Hence the public could get the needed information. The three critical elements of this exemplary response were excellent planning, good communication and a strong community response—essential for surviving such extreme events (Cleary 2011).

The Australian government finds its best leaders to guide community pre and post disaster response to the growing number of bushfires, floods and cyclones in the 40–50-year age group (Cleary 2011). Involving people with sufficient experience in disaster preparedness and response is crucial at the very beginning of planning.

7.3 Creating Awareness Through Interdisciplinary Teaming

Everyone should be made aware of the hazards of extreme weather events on public mental health. If communities understand the connection between mental health and extreme weather, their governments may be led to create institutional mechanisms that provide psychological support to affected populations. This would guard against mental health challenges from becoming major public health issues. The health sequence to avoid is allowing stress to adversely affect social and vocational well being that, in turn, feeds back to increase stress and mental health problems. Developing interdisciplinary teams of scientists, health professionals, and community and government leaders will go far in preparations to combat the health challenges associated with extremes of drought and flooding. Shukla (2013) urges psychologists, government leaders, and community organizations to act earnestly now to prepare for mental health issues that may emerge because of changes in the character of severe weather events in periods of climate variability and change.

Research shows that individuals who experience an intense, life-threatening event, first hand, will experience a significantly higher level of concern for mitigation than those who did not have such direct exposure (Vasileiadou and Botzen 2014). Therefore, in order to raise the level of concern about likely impacts of extreme weather, an appeal for support will be most effective if made with the personal circumstances and emotions of the people who suffered most directly. This could be done through public information campaigns about real-life cases, more field visits by government functionaries and corporate officials, and creating possibilities for the general public to participate in the relief and rehabilitation efforts.

Television, radio and newspapers could be tools for spreading weather related information and drought adaptation strategies to the larger community. Alongside government sponsored drought relief measures, community based plans and effective implementation and management can be undertaken to compensate for any failures of relief measures (Udmale 2014).

7.4 Knowledge Sharing

Knowledge generated through research and qualitative analyses must be shared with various stakeholders and community members so that everyone knows the potential risks from disasters and, together, can plan ahead of potential disaster. Knowledge sharing may take newer forms in the Internet era. It may be in the form of online discussions, live reporting by community members, video conferencing, use of community radio, creating local level knowledge and resource and village information centers, using mobile technology for creating applications for creating disaster awareness and preparedness. Along with traditional methods of information sharing and knowledge, public discussions, debates and lectures involving respected experts may help in community awareness.

In essence, people have more day-to-day, pressing business on which to focus, beyond the “what if” of a potential extreme weather event occurring. A need for awareness campaigns exists, at the community-level, on a regular basis, to help share knowledge and information with different sectors of the general public. This should occur in appropriate languages, and on the radio as well as in print, to reach people who are illiterate or without access to print or digital media. Innovative methods at communication such as awareness songs, movies in local dialects on disaster risk reduction, paintings, debate competitions on flash floods in local schools, and story-telling have been variously used by communities and societies in different parts of the world. Local festivals and fairs have been used to create awareness about risks and enhance preparedness, thus trying to build a culture of prevention and resilience (United Nations Development Programme (UNDP) 2008, 2012a).

7.5 Land Use Planning

In the past, houses were built on raised grounds and natural land slopes that were utilized to divert flood-water. Simple early-warning systems were used. Today, the traditional systems have been ignored and the lands that once were the natural slopes for flood-water flow are now used to support increasing urban settlements—houses, hotels and businesses—in growing economic development (Mishra 2014). To achieve this, people at the community-level should be trained to easily identify and recognize hazard prone land regarding the places and the heights to which floodwaters may reach (United Nations Development Programme (UNDP) 2012a). Land use planning and management concepts need to be popularized within communities and local government levels so that disaster prone and risky sites may be identified and prohibited from being built upon.

7.6 *Regional Cooperation*

Communities vulnerable to extreme weather events need to monitor their environment and their social structures. They must share and disseminate data among themselves in order to issue timely warnings to those most likely to be affected. International platforms provided by regional associations like the SAARC (South Asian Association for Regional Cooperation) and its disaster management center may help in developing a region-specific, coordinated strategy for addressing disaster risks that could involve all stakeholders and sectors. Actions must be synchronized between the administration, the technical institutions, civil society organizations, humanitarian and development agencies and other players (United Nations Development Programme (UNDP) 2012). Knowledge created by technical and research organizations, can be used to prepare comprehensive strategies that can guide, say, the NGOs working in the field.

7.7 *Best Practices for Mental Health Care*

The WHO (2003) gave certain guidelines for meeting post-disaster mental health challenges. According to their report, national preparedness plans should incorporate a well-organized mechanism of satisfactory social and mental health response in the wake of disasters. It should include training people who are already aware of the local realities so that overall disaster relief is practical and quick. A very significant guideline is that health care staff should receive supervised, clinical, on-the-job training, by mental health experts. The aim of all these activities, according to the WHO, should be long-term community mental health services and other social interventions.

Two phases of mental health care are apparent. One is the **acute emergency phase** and the other is the **reconsolidation phase**. The acute phase will involve managing urgent psychiatric complaints and organizing outreach and non-intrusive emotional support (Few 2004). In the reconsolidation phase, longer-term social and psychological interventions could be undertaken, such as teaching mental health skills to primary health care workers and following up on psychiatric cases. The WHO (2003) suggests that such activities need not be exclusive, they could be interwoven with already existing coping mechanisms and traditional practices.

Psychologists should be guided by the findings of disaster psychology and target their treatments to achieve the long-term psychosocial adjustment of the people affected. Psychologists can employ individual and group therapies to deal with the indirect mental health consequences of extreme weather disasters (Karlsson 2011).

Relief and rehabilitation post-disaster would include actions such as creating awareness of post-traumatic stress disorder symptoms, and alleviating these by educating and helping people to develop adequate coping mechanisms (Gupta and Kapoor 2012). Mental health data and information must be part of an emergency

health care response that can include psychological First Aid, triage, assessment, referral and intervention needs (New South Wales 2000). The mental health-care initiatives can also involve local volunteers, community-based organizations, and professional health personnel during disaster emergencies (Few et al. 2005).

It is equally important to address the psychosocial context post disaster, when the mental health issues are more likely occur (Wind et al. 2013). Wind et al. (2011) suggest that “individual oriented stress reducing interventions,” which go to the individual appraisal of losses experienced, social support and coping, could be more effective in reducing mental health outcomes (anxiety, depression and Post Traumatic Stress Disorder—PTSD). These interventions address the social context of the community and promote trust, mutual support and reciprocity. This ‘social cohesion’ is important in determining the susceptibility to PTSD symptoms and should be taken into account while developing public health strategies (Health Protection Agency 2011).

In Indian culture, it is believed that people can cope with disasters through social cooperation. Nevertheless, disasters do lead to psychological impacts on entire affected populations, especially children. Psychiatrists in India recommend that parents involve themselves more with children who have been affected by weather related disasters, and build a positive environment in order to help children overcome trauma (Muzaffar 2014).

Jabry (2002) suggested that psychological interventions for children in the event of a disaster could include talking about their experience, seeking their perspectives on rehabilitation and on tasks related to future preparedness and restoring their daily routines, including their educational routines, in order to achieve emotional and psychological recovery. In New South Wales (NSW), Australia, a Farmers Mental Health Network was created, with service providers, academicians, government, private agencies, and the NSW Farmers Association. The Network helped to develop a model that covers key issues and the topical areas in which action promoting mental health would be needed (Fragar et al. 2008).

Shukla (2013) recommends that government, the general public, and expert psychologists pay close attention to the findings and predictions of extreme weather and evolving climate regimes. Skills and the capacities to use them must be built so as to meet the mental health challenge of extreme weather events. There is general consensus among psychologists that daily changes in behavior could lead to positive changes in the long run. Behavioral changes should be cultivated in order to tackle the mental health challenge posed by extreme weather events and climate change. Psychologists are still exploring which behavioral changes may be most beneficial and, hence, which to promote (Corner 2009).

There is a need to prepare health plans to provide specific help to victims. Very few countries have national disaster plans that outline steps to identify psychosocial aspects of hazard events or to help deal with them (PAHO 1999). The importance of mental health care in disaster situations is gradually being recognized (Few et al. 2004). For example, the Indonesian government trained over 150 community leaders and health workers to provide mental health interventions in the Aceh

province (WHO 2005a, b). Documents related to mental health emphasize the important role of training and experience (NSW 2000; WHO 2003).

For flood related disasters it is known that well trained disaster workers are effective in counseling and psychological skills. These workers also form connections with other groups and individuals who are part of the relief work. They are aware of policies and procedures that may help the victims (Chatterjee 2005). But, training must equip disaster workers with the knowledge and skills necessary for offering specific help for specific problems. It has also been documented that heavy work pressure, fatigue, and exposure to the dead are serious stressors that increase the risk of disaster workers themselves having mental health issues. Observations in developing countries suggest substantial risk to mental health depending upon the scale of the devastation caused by the disaster (Medicenes sans Frontieres 2004). One also must be more vigilant post disaster, with planned interventions that may last for several years thereafter (Weems 2007b).

Research into the possible human behavioral changes that could alter patterns of consumption of environmental resources is recommended. Efforts need to be made to increase public awareness of the risks inherent in indiscriminate use of earth's resources (Shukla 2013).

Most studies of droughts and floods have been conducted in countries such as the United States and Australia. More studies across different geographies are required to estimate impacts of drought correctly on the mental health of affected populations within a variety of environments.

Greater effort is required from psychologists and behavioral scientists to become future-oriented, and prepared to deal with post-disaster mental health challenges. Psychologists could start to organize themselves into "ready to respond" teams to deal with mental health problems faced during a disaster. Psychologists and other social services would be advised to find ways to help stakeholders cope with anxiety and worry about projections of extreme weather disasters under scenarios of climate change. Each community and its associated local, regional and national government agencies must take the initiative and create the means (including institutions if necessary) to provide psychological support services along with the socioeconomic resources needed to deal effectively with disaster-related adverse mental health impacts (Shukla 2013).

If nations of the world work together to share resources, skills and models for predicting and preparing for extreme weather, the mental health and other risks associated with extreme weather events would be greatly reduced. As of now, competing demands for resources thwart true preparation and policy preparedness for extreme weather events. If climate evolves to create more severe and more frequent weather extremes, the need for preparation and policies will only increase. Currently, the main course of action for communities is to be prepared by taking stock of local resources and preparing policies for action in the face any future extreme weather event. Communities must gear up and get trained to deal with both, the physical and mental health challenges they may yet face.

References

- Abrahams MJ, Price J, Whitlock FA, Williams G (1976) The Brisbane floods, January 1974: their impact on health. *Med J Aust.* 18–25 Dec 1976 2(25–26):936–939
- Alderman K, Turner LR, Tong S (2012) Floods and human health: a systematic review. *Environ Int.* 2012 Oct 15 47:37–47. doi:10.1016/j.envint.2012.06.003. Epub 2012 Jun 27. <http://www.ncbi.nlm.nih.gov/pubmed/22750033>
- Alston M, Kent J (2008) The big dry: the link between rural masculinities and poor health outcomes for farming families. *J Sociol* 44(2) Jun 2008 133–147
- Ashraf M, Routray JK (2013) Perception and understanding of drought and coping strategies of farming households in north-west Balochistan. *Int J Disaster Risk Reduct* 5(2013):49–60
- Ashrit R (2010) Investigating the Leh ‘Cloudburst’. National Centre for Medium Range Weather Forecasting. Ministry of Earth Science, India. http://www.ncmrwf.gov.in/Cloudburst_Investigation_Report.pdf
- Australian Psychological Society (APS) (2007) Tip sheet: climate change—what you can do. Australian Psychological Society, Melbourne, Australia
- Bennet G (1970) Bristol floods 1968: controlled survey of effects on health of local community disaster. *Br Med J* 3:454–458
- Brown ME (2008a) Famine early warning systems and remote sensing data. Springer, Heidelberg
- Brown O (2008b) Migration and climate change. International Organisation for Migration, Geneva, Switzerland
- Bryan E, Ringler C, Okoba B, Roncoli C, Silvestri S, Herrero M (2010) Coping with climate variability and adapting to climate change in kenya: household and community strategies and determinants. World Bank Report 3a of the project “Adaptation of Smallholder Agriculture to Climate Change in Kenya”, IFPRI–KARI–U of Georgia–ILRI, International Food Policy Research Institute, Washington DC, p. 63
- Bureau of Meteorology (BOM) (2008) Model of a cyclone, BOM at URL: http://www.bom.gov.au/lam/Students_Teachers/cycmod.shtml#
- Carnie T, Berry H, Blinkhorn S, Hart C (2011) In their own words: young people’s mental health in drought-affected rural and remote NSW. *Aust J Rural Health* 19(5) Oct 2011:244–248
- Center for Disease Control and Prevention (2010) Mental health and stress-related disorders-impacts on risk. http://www.cdc.gov/climatechange/effects/mental_health.htm
- Chatterjee P (2005) Mental health care for India’s tsunami survivors. *Lancet* 365:833–834
- Cleary P (2011) Local heroes hold the front line, theAustralian. <http://www.theaustralian.com.au/news/features/local-heroes-hold-the-front-line/story-e6frg6z6-1225999759864>
- Confalonieri U, Menne B, Akhtar R, Ebi KL, Hauengue M, Kovats RS, Revich B, Woodward A (2007) Human health. In: Parry ML, Canziani OF, Palutikof JP, van der Linden PJ, Hanson CE (eds) *Climate change 2007: impacts, adaptation and vulnerability. Contribution of working group II to the fourth assessment report of the intergovernmental panel on climate change.* Cambridge University Press, Cambridge, United Kingdom
- Corner A (2009) Psychology is the missing link in the climate change debate, *Guardian*, 2009. <http://www.guardian.co.uk/environment/cif-green/2009/oct/26/psychology-of-climate-change>
- Davies M, Oswald K, Mitchell T (2009) Climate change adaptation, disaster risk reduction and social protection, promoting pro-poor growth: social protection, OECD
- Dean J, Stain H (2010) Mental health impact for adolescents living with prolonged drought. *Austr J Rural Health* 18. In: Greenhill J, King D, Lane A, MacDougall (2009) Understanding resilience in South Australian farm families. *CRural Society*, vol 19, no 4 Dec 2009: 318–325, no 1 Feb 2010: 32–37
- Doherty TJ, Clayton SD (2011) The psychological impacts of global climate change. *Am Psychol* 66(4):265–276
- Earth Observatory (2015) India faces deadly heat wave, June 5, 2015. <http://earthobservatory.nasa.gov/IOTD/view.php?id=85986&src=eo-a-iotd>

- Easterling DR, Karl TR, Gallo KP, Robinson DA, Trenberth KE, Dai A (2000) Observed climate variability and change of relevance to the biosphere. *J Geophys Res* 105:20101–20114
- Edwards B, Gray M, Hunter B (2015) The impact of drought on mental health in rural and regional Australia. *Socia Indicators Res* 121(1):177–194
- Fact Finding Committee on Mumbai Floods (2006) Final report, March 2006, Government of Maharashtra, India. “Final Report” (PDF). Retrieved 29 Sept 2015
- Food and Agriculture Organization (FAO) (2013) AQUASTAT database 2013. Available: <http://www.fao.org/nr/water/aquastat/main/index.stm>
- Fragar L, Kelly B, Peters M, Henderson A, Tonna A (2008) Partnerships to promote mental health of NSW farmers: the New South Wales Farmers Blueprint for Mental Health. *Austr J Rural Health* 16(3):170–175, Jun 2008
- Fritze JC, Blashki GA, Burke S, Wiseman J (2008) “Hope, despair and transformation: climate change and the promotion of mental health and wellbeing. *Int J Mental Health Syst* 2, article 1
- Geoscience Australia (GA) (2008) What is a cyclone at URL: <http://www.ga.gov.au/hazards/cyclone.jsp>
- Grant M (2014) New report: action needed now to fix climate change preparedness deficit, conservation, insurance leaders urge reinvestment in natural defenses. <http://www.nwf.org/news-and-magazines/media-center/news-by-topic/global-warming/2014/10-20-14>
- Green D (2006) How might climate change affect island culture in the torres straight? CSIRO marine and atmospheric research paper 011, commonwealth scientific and industrial research organisation (CSIRO). Canberra, Australia
- Greenough G, McGeehin M, Bernard S, Trtanj J, Riad J, Engelberg D (2001) The potential impacts of climate variability and change on health impacts of extreme weather events in the United States. *Environ Health Perspect* 109(2):191–198
- Guha J (2012) Farmer suicides in Maharashtra, India: facts, factors and possible fixes. Honors scholar theses. Paper 235
- Guha SD (1991) Rapid assessment of health needs in mass emergencies: review of current concepts and methods. *World Health Stat Q* 44(3):171–181. <http://www.ncbi.nlm.nih.gov/pubmed/1949885>
- Gupta AK, Tyagi P, Sehgal VK (2011) Drought disaster challenges and mitigation in india: strategic appraisal. *Curr Sci* 100(12), 25 June 2011
- Gupta P, Khanna A, Majumdar S (2012) *Indian J Community Med.* Jul–Sep 2012, 37(3):185–190. doi:10.4103/0970-0218.99928, PMID: PMC3483513
- Hannah R (2014) Tropical cyclone hudhud: responding in India. *Environmental health perspectives* 109(2):191–198. <https://www.directrelief.org/2014/10/tropical-cyclone-hudhud-responding-in-india/>
- Health Protection Agency (HPA) (2011) The effects of flooding on mental health, extreme events and health protection, centre for radiation, chemical and environmental hazards, health protection agency, ExtremeEvents@hpa.org.uk, Agency <http://webarchive.nationalarchives.gov.uk/20140714084352/>, http://www.hpa.org.uk/webc/HPAwebFile/HPAweb_C/1317131767423. Accessed 2 June 2015
- Heilprin J (2014) ‘Extreme’ weather events of 2013 points to human-induced climate change: UN. <http://www.ctvnews.ca/sci-tech/extreme-weather-events-of-2013-points-to-human-induced-climate-change-un-1.1742875>
- Hossain N (2015) Analysis of human vulnerability to cyclones and storm surges based on influencing physical and socioeconomic factors: evidences from coastal Bangladesh. *Int J Disaster Risk Reduction* 13, (September 2015), published online first. Accessed June 2015. <http://www.sciencedirect.com/science/article/pii/S2212420915300054>
- Indo Asian News Service (2013) Uttarakhand floods: victims suffering from Post-Traumatic Stress Disorder. <http://www.thehealthsite.com/news/uttarakhand-floods-victims-suffering-from-post-trauma-stress-disorder/>. Accessed 25 June 2015
- Intergovernmental Panel on Climate Change (IPCC) (2014) WGII AR5 summary for policymakers, WGII AR5 phase I report launch 1 31 March 2014, climate change 2014: impacts, adaptation, and vulnerability

- International Federation of Red Cross and Red Crescent Societies (IFRC) (1999) World disasters report. International Federation of Red Cross and Red Crescent Societies, Geneva, Switzerland
- Islamic relief (2014) Food, water and psychosocial support for flood survivors, Islamic relief. <http://reliefweb.int/report/india/food-water-and-psychosocial-support-flood-survivors>. Published on 20 Nov 2014
- Jabry A (ed) (2002) Children in disasters: after the cameras have gone. Plan UK, London. <http://www.plan-uk.org/pdfs/Children.pdf>
- Karlsson L (2011) Climate change adaptation white paper series, vermont climate change health effects adaptation. Vermont Department of Health, USA, May 2011. <http://www.anr.state.vt.us/anr/climatechange/Pubs/VTCCAdaptHealthEffects%20.pdf>
- Karpisheh L, Mirdamadi M, Hosseini JM, Chizari M (2010) Iranian farmers attitudes and management strategies dealing with drought: a case study in fars province. *World Appl Sci* 10(10):1122–1128
- Keshavarz M, Karami E, Vanclay F (2013) The social experience of drought in rural Iran. *Land Use Policy* 30:120–129
- Kessler RC, Galea S, Gruber MJ, Sampson NA, Ursano RJ, Wessely S (2008) Trends in mental illness and suicidality after Hurricane Katrina. *Mol Psychiatry* 13(4):374–384
- Kiem AS, Austin EK (2013) Drought and the future of rural communities: opportunities and challenges for climate change adaptation in regional Victoria, Australia. *Glob Environ Change* 23(5):1307–1316
- Knutson TR, McBride JL, Chan J, Emanuel K, Holland G, Landsea C, Held I, Kossin JP, Srivastava AK, Sugi M (2010) Tropical cyclones and climate change. *Nat Geosci* 3:157–163
- Kovats RS, Menne B, McMichael AJ, Corvalan C, Bertollini R (2000) Climate change and human health: impact and adaptation. WHO, Geneva, Switzerland
- Kuo CJ, Tang HS, Tsay CJ, Lin SK, Hu WH, Chen CC (2003) Prevalence of psychiatric disorders among bereaved survivors of a disastrous earthquake in Taiwan. *Psychiatr Serv* 54(2):249–251
- Lehmann E (2014) Images of damage from extreme weather may lower political support for climate action. <http://www.eenews.net/stories/1059994756/print>. Psychological impacts of Weather related media reports
- Maharashtra Floods (2005) Government of Maharashtra. Department of Relief and Rehabilitation. <http://mdmu.maharashtra.gov.in/pdf/Flood/statusreport.pdf>
- Mahr K, Bukhari F (2014) A week on from flood, 150,000 still stranded in Kashmir. <http://in.reuters.com/article/2014/09/14/flood-kashmir-rescue-news-idINKBN0H90FG20140914>
- Majra JP, Gur A (2009) Climate change and health: Why should India be concerned? *Indian J Occup Environ Med* 13(1):11–16
- Mall RK, Singh R, Gupta A, Srinivasan G, Rathore LS (2006) Impact of climate change on indian agriculture: a review climatic change 78(2–4):445
- Maynard T (2014) Extreme weather is a reality—the insurance industry must adapt, partnerships, sustainable repair in communities, and innovative services will help insurers respond to climate change. <http://www.theguardian.com/sustainable-business/extreme-weather-insurance-industry-climate-change>. Accessed 31 Jan 2014
- McCarthy M (2011) New study shows stark correlation between the fluctuations of El Niño and the incidence of civil conflicts. <http://www.independent.co.uk/environment/climate-change/revealed-climate-quirk-that-doubles-risk-of-war-2343243.html>
- McMichael AJ (2003) Climate change and human health: risks and responses. World Health Organization, Switzerland
- McMichael AJ (2007) Climate change, prolonged drought conditions and health: implications for rural Australia. The 9th national rural health conference, 7–10 Mar 2007. National Rural Health Alliance, Deakin West, ACT, 7 p, *Med J Austr* 2:936–939
- Medicines Sans Frontieres (MSF) (2004) Website: R&D systems is failing to meet Health needs in developing countries. Briefing note as presented to the ministerial smite on health research. Mexico city, 16–20 Nov 2004
- Mishra AK, Singh VP (2010) A review of drought concept. *J Hydrol* 391(2010):202–216

- Misra T (2014) Why the Kashmir floods have been so deadly. <http://www.citylab.com/housing/2014/09/why-the-kashmir-floods-have-been-so-deadly/380051/>. 11 Sep 2014
- Mulligan M (2013) <http://theconversation.com/aid-responses-to-typhoon-haiyan-lessons-from-the-indian-ocean-tsunami-20100>. 3.53 pm AEDT, Aid responses to Typhoon Haiyan—lessons from the Indian Ocean tsunami. 13 Nov 2013
- Muzaffar I (2014) Flood trauma can affect health of Kashmir children' Images of flood can have psychological repercussions on them. <http://www.greaterkashmir.com/news/2014/Oct/1/-flood-trauma-can-affect-health-of-kashmir-children-24.asp>
- Myers N (2005) Environmental refugees: an emergent security issue, 13th edn. Economic Forum, Prague, Czech Republic
- National Academy of Agricultural Sciences (NAAS) (2011) Drought preparedness and mitigation. Policy paper no. 50. National Academy of Agricultural Sciences, New Delhi. p 22
- National Centers for Environmental Information (2013) National centers for environmental information, state of the climate: global analysis for November 2013, published online December 2013. Retrieved on 23 June 2015 from <http://www.ncdc.noaa.gov/sotc/global/201311>
- National Oceanic and Atmospheric Administration (NOAA) (2002) Drought: monitoring economic, environmental, and social impacts. <https://www.ncdc.noaa.gov/news/drought-monitoring-economic-environmental-and-social-impacts>
- National Remote Sensing Centre, Indian Space Research Organisation (2014) Floods in Jammu and Kashmir. http://www.nrsc.gov.in/Jammu_Kashmir_Floods_Inundation.html
- Noji EK (2000) The public health consequences of disasters. Pre hospital and disaster medicine, Oct–Nov, 2000 15(4), pp 147–157
- O'Brien LV, Berry HL, Coleman C, Hanigan IC (2014) Drought as a mental health exposure. *Environ Res* 13:181–187
- Osofsky JD, Osofsky HJ, Harris WW (2007) Katrina's children: social policy considerations for children in disasters. *Social Policy Rep* 21(1):3–20
- Pan American Health Organization (PAHO) (1999a) The devastating path of Hurricane Mitch in central America. Disasters: preparedness and mitigation in the Americas (Supplement 1):S1–S4
- Pandit S (2014) J&K floods: 13 bodies found in Srinagar house, death toll crosses 200. <http://timesofindia.indiatimes.com/india/JK-floods-13-bodies-found-in-Srinagar-house-death-toll-crosses-200/articleshow/42804602.cms>
- Patel A (2015) Treating India's suicidal farmers. <http://blogs.wsj.com/indiarealtime/2015/04/24/treating-indias-suicidal-farmers/>
- Patz JA, McGeehin MA, Bernard SM (2000) The potential health impacts of climate variability and change for the United States: executive summary of the report of the health sector of the U.S. National Assessment. *Environ Health Perspect* 108(4):367–376
- Paul BK (1998) Coping mechanisms practiced by drought victims (1994/95) in North Bengal. Bangladesh, *Appl Geogr* 18(4):355–373
- Peek-Asa C, Ramirez M, Young T, Cao Y (2012) Flood-related work disruption and poor health outcomes among university students. *Prehosp Disaster Med* 27(6):503–508. <http://www.ncbi.nlm.nih.gov/pubmed/23031409>
- Rao V (1999) Poverty and public celebrations in rural India. The World Bank, Washington DC
- Samenow J (2013) Major disaster averted: 5 reasons why cyclone Phailin not as bad as feared in India. <http://www.washingtonpost.com/blogs/capital-weather-gang/wp/2013/10/14/major-disaster-averted-5-reasons-why-cyclone-phailin-not-as-bad-as-feared-in-india/>
- Sartore G, Kelly B, Stain HJ, Albrecht G, Higginbotham N (2008) Control, uncertainty, and expectations for the future: a qualitative study of the impact of drought on a rural Australian community. *Rural and Remote Health* 8:950. Available: <http://www.rrh.org.au>. Science 289: 2068
- Sharma S (2014) Disasters: An Indian experience, national academy of medical sciences & institute of human behavior analysis of the published literature indicates that the main health effects are drowning

- Shukla J (2013) Extreme weather events and mental health: tackling the psychosocial challenge. ISRN Public Health 13
- Stain HJ, Kelly B, Carr VJ, Lewin TJ, Fitzgerald M, Fragar L (2011) The psychological impact of chronic environmental adversity: responding to prolonged drought. *Social Sci Med* 73(11):1593–1599
- Stanke C, Kerac M, Prudhomme C, Medlock J, Murray V (2013) Health effects of drought: a systematic review of the evidence. *PLOS Curr Disasters*, (1st edn). doi:10.1371/currents.dis.7a2cee9e980f91ad7697b570bcc4b004
- Times of India (2014) <http://timesofindia.indiatimes.com/city/lucknow/Bodies-of-missing-members-leave-families-devastated-in-villages/articleshow/40626127.cms>
- Turnbull M, Sterrett CL, Hilleboe A (2013) *Toward resilience: a guide to disaster risk reduction and climate change adaptation*. Practical Action Publishing Ltd., UK. <http://reliefweb.int/sites/reliefweb.int/files/resources/ECB-toward-resilience-Disaster-risk-reduction-Climate-Change-Adaptation-guide-english.pdf>
- Udmale P, Ichikawa Y, Manandhar S, Ishidaira H, Kiem AS (2014) Farmers' perception of drought impacts, local adaptation and administrative mitigation measures in Maharashtra State, India. *Int J Disaster Risk Reduction, Part A* 10:250–269. Available at <http://www.sciencedirect.com/science/journal/22124209>
- UNDP (2008) Community based disaster risk management. Available at available at www.tezu.ernet.in/cdm/cdm_linkfile/link/study_material/CBDM_practice.pdf
- UNDP (2014) UNDP calls for governments, businesses and communities to boost collaboration for a new climate and development era, 09 Dec 2014. Available at <http://www.undp.org/content/undp/en/home/presscenter/pressreleases/2014/12/09/>
- Union of Concerned Scientists (2010) Climate change and mental health, extreme weather takes a toll. Available at http://www.ucsusa.org/global_warming/science_and_impacts/impacts/climate-change-and-mental-health.html
- United Firefighters Union—Queensland (2013) Government inaction could jeopardise lives during extreme weather events. April 12, Media release http://www.Ufuq.Com.Au/Files/8113/6607/0584/Firefighters_And_Climate_Change.Pdf
- United Nations Development Programme (UNDP) (2012a) Risk reduction through community-based approaches. Bureau for crisis prevention and recovery. United Nations Development Programme, South and South West Asia Office, New Delhi. Retrieved from <http://www.sasparm.ps/en/Uploads/file/GLOF%20Risk%20Reduction%20through%20Community-based%20Approaches.pdf>
- United Nations Development Programme (UNDP) (2012b) Environment and energy (India): communities adapt to extreme weather conditions. <http://www.us.undp.org/content/washington/en/home/ourwork/environmentandenergy/successstories/india-communities-adapt-to-extreme-weather-conditions.html>
- Vasileiadou E, Botzen WJW (2014) Communicating adaptation with emotions: the role of intense experiences in raising concern about extreme weather. *Ecol Soc* 19(2):36. doi:10.5751/ES-06474-190236
- Weems CF, Watts SE, Marsee MA, Taylor LK, Costa NM, Cannon MF, Carrion VG, Pina AA (2007a) The psychosocial impact of Hurricane Katrina: contextual differences in psychological symptoms, social support, and discrimination. *Behav Res Ther* 45(10):2295–2306
- Weems CF, Pina AA, Costa NM, Watts SE, Taylor LK, Cannon MF (2007b) Predisaster trait anxiety and negative affect predict posttraumatic stress in youths after hurricane Katrina. *J Consult Clin Psychol* 75(1):154–159
- Wilhite DA (2002) ISDR ad-hoc discussion group on drought. Interagency task force on disaster reduction. Geneva, pp 1–5
- Wilhite DA, Hayes MJ, Knutson C (2000) Planning for drought: moving from crisis to risk management. *J Am Water Resour Assoc* 36:697–710
- Wind TR, Fordham M, Komprou IH (2011) Social capital and post-disaster mental health. *Glob Health Action* 4. doi:10.3402/gha.v4i0.6351. Epub 15 Jun 2011. <http://www.ncbi.nlm.nih.gov/pubmed/21695072>

- Wind TR, Joshi PC, Kleber RJ, Komproue IH (2013) The impact of recurrent disasters on mental health: a study on seasonal floods in northern India, *Prehosp Disaster Med.* 2013 Jun; 28(3):279-85. doi:10.1017/S1049023X13000290. Epub 24 Apr 2013. <http://www.ncbi.nlm.nih.gov/pubmed/23611652>
- World Bank Report (2003) World bank report on financing rapid onset natural disaster losses in India: a risk management approach. The World Bank, Washington, DC 2003
- World Health Organisation (2002) World report on violence and health. WHO, Geneva, Switzerland
- World Health Organization. Summary (2003) Climate change and human health: risks and responses. WHO, Geneva
- World Health Organization (2005a). Report of an inter-regional workshop, Mukteshwar, India. Health impacts from climate variability and change in the Hindu Kush-Himalayan Region. WHO Regional Office for South-East Asia, New Delhi
- World Health Organization (2005b). Tsunami & health, situation report # 41, 11 March. Available at <http://reliefweb.int/sites/reliefweb.int/files/resources/DAF2F9F4DFCDD8F3C1256FC4003624AF-who-southasia-11mar.pdf>
- www.chemonics.com/OurWork/OurProjects/Pages/Famine-Early-Warning-Systems-Network.aspx. Using early warning systems to prevent and alleviate famine. Accessed 23 Aug 2015
- www.ncbi.nlm.nih.gov/pmc/articles/PMC28161/?report=printable#CIT14 <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2822161/?report=printable#CIT14>
- www.telesurtv.net/english/news/Mumbai-Flooding-Climate-Change-Brings-Extreme-Weather-to-India-20150619-0029.html". Accessed 27-08-2015
- www.undp.org/content/undp/en/home/ourwork/ourstories/communities-adapt-to-extreme-weather-conditions-in-india.html 2014