Climate Change and Mental Health

An evidence-based review of the emotional health risks associated with a changing climate.

ABSTRACT

Climate change is an enormous challenge for our communities, our country, and our world. Recently much attention has been paid to the physical impacts of climate change, including extreme heat events, droughts, extreme storms, and rising sea levels. However, much less attention has been paid to the psychological impacts. This article examines the likely psychological impacts of climate change, including anxiety, stress, and depression; increases in violence and aggression; and loss of community identity. Nurses can play a vital role in local and regional climate strategies by preparing their patients, health care facilities, and communities to effectively address the anticipated mental health impacts of climate change.

Keywords: climate change, disasters, extreme weather, mental health, preparedness, psychological distress, resilience

Human health has always been subject to the influence of climate, from everyday weather events to larger shifts in the earth's climate. This is especially true now, as we witness unprecedented changes in both the typical weather of a given region and the climate of the planet—changes that are affecting our air, food, and water supplies. In recent years, increases in atmospheric greenhouse gas concentrations have led to new precipitation patterns; rising sea levels; increases in the earth's temperature; and more intense, frequent, and longer-lasting extreme weather events. Just as these changes adversely affect our built and natural environment, so too do they impact human health.^{1,2}

In the United States, we are experiencing more frequent and intense heat waves, altered transmission patterns of vector-borne diseases (such as dengue, Lyme disease, and West Nile virus), an increasing prevalence of food and water-borne illnesses (such as *Salmonella* infection), and a greater amount of air pollution.³ Some health effects occur gradually, such as those resulting from higher average temperatures, and others, such as those due to vector-borne diseases, occur at unprecedented times of the year or in an expanding geographic area. Not all Americans are equally susceptible. Climate change can exacerbate existing health threats (such as asthma) in addition to creating new ones. A person's vulnerability is increased by simultaneous exposure to more than one threat, as well as by differences in sensitivity and capacity to respond to these threats. Underlying health, demographic, and socioeconomic factors also influence these health impacts. Children, pregnant women, older adults, those living in low-income communities, people of color, immigrants, people with disabilities, those with preexisting medical or mental health conditions, and people whose jobs make them particularly susceptible (such as those working outside) are all disproportionately vulnerable.³

In the last decade, there have been important advances in the scientific understanding of the human health risks associated with climate change. This research, however, has primarily focused on physical health, with much less attention given to the ways in which changes in the climate (with the exception of disasters) affect mental health and well-being. In this article, we examine the mental health effects associated with disasters as well as the more gradual implications of climate change, including temperature increases, food insecurity, displacement, and a changing physical environment, all of which have a significant impact on human psychology and well-being.



Residents connect amid the remains of their homes, consumed by flood and then fire, in White Sulphur Springs, West Virginia, June 2016. Photo © AP Photo / Steve Helber.

Increasing nurses' understanding of how the climate is changing and the potential impact on human health can guide their involvement in mitigating the progress of climate change and provide direction for interventions to protect public health. Nurses can make important contributions through preparedness efforts with patients and communities, particularly in regard to mental health consequences that can vary greatly, ranging from minimal symptoms of stress and distress to anxiety, depression, posttraumatic stress, and suicidal ideation.

CLIMATE-RELATED DISASTERS

Climate change is anticipated to bring about hydrologic disasters, such as floods, and meteorologic disasters, such as strong storms, hurricanes, and wildfires.⁴ An increasing number of disasters are projected to occur in the future as a result of climate change.⁴ Climaterelated disasters disrupt and significantly affect quality of life. Many people are forced to relocate and rebuild, and many experience loss of income and relationship stressors.⁵ Risk factors for developing mental illness in the aftermath of such disasters include the magnitude of the traumatic event, exposure to the injury or death of a loved one, female gender, younger age, lower socioeconomic status, less education, minority or ethnic status, psychiatric history, family instability, and inadequate social support.^{6,7} It has been estimated that 25% to 50% of those exposed to extreme weather events will experience negative mental health outcomes.⁸ Typically, psychological responses are heightened in the first year after the disaster occurs and improve over time.⁹

Common initial and immediate responses to experiencing a traumatic event, such as a climate-related disaster, include hypervigilance, avoidance, anger, flashbacks, guilt, anxiety, emotionality, difficulty concentrating, rumination, preoccupation, and social withdrawal.^{6,10} Researchers in England found that experiencing a flood can lead to psychological distress, particularly among people who were evacuated.¹¹ Alderman and colleagues discuss the association between psychological distress and flooding, and how the former has been found to worsen physical illness after a flood. $^{\scriptscriptstyle 12}$

According to Neria and Shultz, many symptoms resolve over time, and most people are able to recover fully after a disaster.⁷ A proportion of those who develop symptoms, however, go on to develop mental disorders.⁹

Acute stress disorder typically presents within four weeks of an extreme traumatic event or stressor.¹³ If symptoms persist longer than four weeks, a diagnosis of posttraumatic stress disorder (PTSD) is usually considered.¹³ Symptoms of acute stress disorder are very similar to those of PTSD, except for the duration and presence of dissociative symptoms.¹⁴ The dissociative symptoms of acute stress disorder include a sense of numbing or detachment, and an altered sense of reality, depersonalization, and dissociative amnesia.¹⁴ In the aftermath of Hurricane Katrina, researchers found that 62% of the evacuees they studied met the criteria for a diagnosis of acute stress disorder.¹⁵ 33% of participants met the criteria for a probable major depressive episode.¹⁸ In addition, Kessler and colleagues found a significant increase in suicidal ideation and suicide plans among victims of Hurricane Katrina, who were surveyed five to seven months afterward and again a year later.²⁰

Anxiety. It has been suggested that exposure to floods correlates with higher levels of anxiety among those affected.¹⁶ Symptoms of anxiety include excessive worrying, restlessness, irritability, fatigue, difficulty concentrating, muscle tension, and sleep disturbances that are difficult to control.¹³ Panic disorders and phobias may also occur in people affected by natural disasters.

GRADUAL CLIMATE EFFECTS

Disasters often receive more attention than the gradual effects of climate change, but the latter also cause significant harm to human health. These often slowprogressing and less visible effects pose an ongoing

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PTSD is the most frequently studied psychological outcome of climate-related disasters. Symptoms of PTSD, which must persist for longer than a month, include flashbacks, avoidance of stimuli associated with the traumatic stressor, hypervigilance, and sleep disturbance.¹³ PTSD prevalence ranges from 30% to 40% among those directly exposed to a natural disaster.9 In a systematic review examining the mental health impacts of floods, Fernandez and colleagues found a greater incidence of PTSD symptoms among victims of extreme flooding than in the general population.¹⁶ PTSD symptoms have also been reported among victims of wildfires.17 According to Marshall and colleagues, 24% of those who applied for disaster assistance after a wildfire in California showed symptoms of PTSD at three-month follow-up.¹⁸ In one study of hurricane-affected residents in the New Orleans metro area, 30.3% were estimated to have probable PTSD.19

Depression is the second most commonly studied mental health outcome among survivors of natural disasters.⁹ Symptoms of depression include feeling sad or empty, loss of interest, feelings of worthlessness, inappropriate guilt, changes in sleep, changes in appetite, and difficulty concentrating.¹³ A study of the mental health outcomes after wildfires found that mental health threat to people living in affected regions.

Heat. The 2010 Census revealed that more than 80% of the U.S. population live in urban areas, reflecting a trend that is expected to continue.²¹ Urban dwellers may experience greater exposure during a heat wave. Cities can have temperatures up to 10° warmer than rural areas, which have the cooling benefit of trees, vegetation, and open areas in which air can flow.

High temperatures have been associated with increased utilization of emergency mental health services for depression and suicidal ideation in Quebec, Canada.²² In addition, researchers in Israel found an association between admission rates to psychiatric hospitals for bipolar depression and exacerbation of acute psychosis during times of increased heat.^{23,24} An increase in suicide rates, particularly among men and the elderly, is also associated with increasing temperatures.²⁵

Among preexisting medical conditions, psychiatric illness was found to be most closely associated with death during a heat wave.²⁶ More than one-half of heat-related deaths resulting from a 2012 heat wave in Wisconsin occurred in people with at least one mental illness—and half of these people were taking a medication used to manage mental illness that sensitizes people to heat.²⁷ The area of the brain that regulates body temperature has dopamine, norepinephrine, serotonin, and α -adrenergic receptors; almost all psychotropic medications—except benzodiazepines, and particularly antipsychotics and antidepressants—affect these neurotransmitters in some way.²² Anticholinergic medications can inhibit sweating, which is another important mechanism the body uses to thermoregulate.²⁸ Those taking lithium are at increased risk for toxicity, because heat can lead to dehydration.²⁸ People with mental illness are also at elevated risk because they may have maladaptive coping mechanisms (such as drinking insufficient amounts of fluids or wearing darker, heavier clothing despite the heat) and inadequate housing and poor social support.^{29, 30}

Worker productivity can be compromised by extreme heat, especially among those who work outdoors or have jobs that require significant physical activity.³¹ Those that work in extreme heat conditions are at high risk for heat stroke and heat exhaustion, decreased motivation, compromised productivity, and accidents.³² These factors can lead to psychological distress or socioeconomic problems, which in turn can result in poor mental health outcomes.³¹⁻³³

Drought. Several studies from Australia and one from Brazil suggest a correlation between drought and negative mental health outcomes, such as psychological distress, anxiety, and depression.³⁴⁻³⁶ In New South Wales, Australia, researchers found an increase in the suicide rate of rural males 10 to 49 years of age during extreme drought conditions.³⁷ Drought can lead to negative mental health outcomes for several reasons, including its gradual effect, the perception that it's interminable, and its chronic nature.³⁴ In addition, the financial and social aspects of the daily lives of those working in agriculture can be interrupted during a drought.³⁷

Inadequate nutrition is an important health concern that should be considered in the context of climate change. Food insecurity can be defined as insufficient nutritional intake, skipped meals, and the inability to afford food.³⁸ It has been independently linked to increased psychological distress, mental illness, and compromised child development.³⁸ Both food insecurity and undernutrition have been linked to psychological distress and mental illness.^{39,40} As climate change continues, we can expect to see low crop yields, an increased incidence of food-borne disease, greater crop losses, and altered nutritional content of certain foods.²

Outdoor air pollutant concentrations are influenced by climate change in many ways. Climate influences temperature, humidity levels, the frequency and intensity of precipitation, and wind patterns, all of which can adversely affect air quality. In addition, climate-driven changes in meteorology can also result in changes in naturally occurring emissions that influence air quality (wildfires and wind-blown dust, for example).⁴¹ Researchers in Canada have found a statistical association between short-term exposure to air pollution and visits to the ED for symptoms of depression⁴² and suicide attempts.⁴³ One study from South Korea established a link between ambient particulate matter and suicide risk that was particularly strong among those who had cardiovascular disease.⁴⁴ Another study from South Korea found an association between ozone and the suicide rate.²⁵

Vector-borne diseases. Climate change is expected to contribute to an increase in vector-borne diseases.⁴⁵ West Nile Virus, a mosquito-borne illness, has been linked to depression and personality changes one year after diagnosis.⁴⁶ In fact, the illness has been linked to an increased rate of clinical depression eight years after initial infection.⁴⁷ In addition, chronic Lyme disease, a tick-borne illness, has been associated with neuropsychiatric symptoms, such as alterations in affect, behavior, cognition, and perception.⁴⁸

Solastalgia is a term coined a decade ago by philosopher Glenn Albrecht, who describes it as a psychoterratic syndrome.⁴⁹ It refers to the psychological distress resulting from degradation of one's home environment.⁴⁹ Solastalgia can occur as a result of events that impact climate change, including drought, wildfires, and natural disasters.^{49,50} When environmental degradation occurs in one's home, place and identity may be compromised, which can manifest as hopelessness, anger, sadness, and discomfort.⁵¹ Albrecht has described how chronic drought conditions in New South Wales, Australia, led to feelings of distress, loss, and bereavement, specifically among farmers, because of isolation and the loss of their livelihood.⁵²

COMMUNITY HEALTH

Both climate-related disasters and gradual climate effects can significantly affect communities. A recent report from the U.S. Global Change Research Program outlined several key areas of concern, including increased incidents of interpersonal aggression, violence, and crime as well as greater social instability and less community cohesion.¹ These climate-related effects can lead to breakdowns in economic stability, an inability to fully protect the public's health, and, in some situations, the collapse of cultural integrity and identity.^{53,54}

Aggression, violence, and crime. Significant changes in the climate can increase the incidence of conflict, including such interpersonal aggression as domestic violence, assault, and rape.⁵⁵ Researchers found that the rate of inflicted and noninflicted traumatic brain injuries among children ages two and younger was higher after Hurricane Floyd struck in 1999.⁵⁶

It's believed that as temperatures rise, acts of violence and aggression occur more frequently. Anderson noted a causal relationship between heat and violence, such that increases in the average temperature are likely to be accompanied by more incidents of violent aggression: for every increase of 2°F in average annual temperature, he predicted, an additional 24,000 assaults or murders will occur each year in the United States.⁵⁷ Ranson created models forecasting that between 2010 and 2099 increased average temperatures as a result of climate change will produce an estimated 22,000 additional murders, 1.2 million aggravated assaults, and 2.3 million simple assaults.⁵⁸

Violence may also occur because of the increased competition for natural resources, jobs, and land created by climate change. In addition, when funding is diverted from traditional community agencies that mitigate crimes, such as criminal justice systems or mental health agencies, to organizations that need to respond to natural disasters, the potential for higher crime rates exist.⁵⁹

drought that caused more than \$7 billion in agricultural losses.⁶⁸

Changes to ecosystems caused by climate change adversely affect the livelihood of those who depend on water and fertile land, such as fishermen and farmers. In addition, the practicing of this livelihood, particularly among indigenous groups that rely on these forms of subsistence living, is often an essential part of their culture and sense of well-being.⁶⁹

BUILDING RESILIENCE

Considering the anticipated acceleration of climate change, it's essential that nurses prepare and build resilience to potential mental health effects. Several factors place a person at greater risk for maladaptive outcomes following disasters, including the severity of

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Social instability and less community cohesion. Climate change has the potential to affect how people interact in communities and with each other. Shrinking natural resources and threats to territories have the potential to force migrations and create direct competition for limited resources. The destabilizing effects of climate change on national and international security are unknown but cause for concern. It is known that climate change can lead to political conflict when governments fail to adequately protect communities against natural disasters.^{55,60-63}

Migration. Climate changes may diminish the livability of communities because of the threat of sea levels rising, for instance, or a lack of access to clean drinking water. These threats to survival have led to the migration of entire communities and, in some cases, to conflicts.⁶⁴

Approximately 200 million people could be climate refugees as soon as the middle of this century.⁶⁵ Communities have already had to relocate because of climate change and extreme weather events: parts of New Orleans after Hurricane Katrina, for instance, and coastal Northern Alaskan communities, which have moved inland to avoid rising sea levels.⁶¹ These forced migrations can lead to a fracturing of social networks and support, causing grief and a sense of loss.⁶⁶

Economic impacts. As temperatures rise, agricultural yields are reduced.⁶⁷ An extreme example of this is the 2011 heat wave in Texas, which resulted in a

exposure, belonging to a vulnerable subpopulation, and reduced or negative social support.⁷⁰ Conversely, there are important determinants of resilience among those affected by disasters and other climate change events, including available psychological and social resources.⁷⁰

Determinants of maladaptive outcomes. Exposure to life-threatening events, like highly destructive hurricanes, has been linked to acute stress, PTSD, and higher rates of depression and suicide in affected communities.²⁹ The severity of exposure can significantly affect a person's ability to cope. Predictors of adverse outcomes include injury to self or a family member, threat to life, bereavement, panic during a disaster, extensive property loss, and displacement.⁷⁰

Specific subpopulations are at higher risk for distress and other adverse mental health consequences as a result of exposure to climate-related disasters. Those at greatest risk include the elderly, children, women (particularly during pregnancy and the postpartum period), and those living in poverty who have limited options for mitigation and adaptation.^{3, 29, 71-74} People living in areas most susceptible to specific climate change events and communities that rely on the natural environment for sustenance and livelihood are also at increased risk for adverse mental health outcomes.²⁹

Limited or negative social support can be a factor in adverse outcomes following a disaster. Researchers have noted, for example, that greater social fragmentation after a disaster can lead to an elevated risk of PTSD.⁷⁵ In addition, social support can gradually decrease in the aftermath of a weather-related disaster, when postdisaster stress and the need to regain a sense of normalcy lead some people to resume their previous way of life, thus reducing the amount of social support they offer to others. Negative social support involves the minimization of the impact of a disaster or false assurances about expectations regarding recovery. **Determinants of resilience.** Several factors have the potential to increase resilience to a weather-related disaster. Coping self-efficacy is an important predictor of psychological outcomes after a disaster. People who believe they can cope with whatever happens fare better.⁷⁶ In addition, among the strongest predictors of positive mental health outcomes after a disaster is the capacity for and generation of hope—a positive, future-oriented feeling that can coexist with intense grief and distress.⁷⁷

Framework for Resilient Health Care Settings

Climate change has led to more frequent, less predictable extreme weather events that pose unique challenges to health care facilities that must remain operational during and immediately after disasters. As Hurricane Katrina and Hurricane Sandy demonstrated, health care organizations need to reevaluate their infrastructure capabilities as part of their emergency-preparedness efforts.

The following is a framework for creating resilient health care settings. It's part of the U.S. Climate Resilience Toolkit, https://toolkit.climate.gov/topics/human-health/building-climate-resilience-health-sector, which is managed by the National Oceanic and Atmospheric Administration's Climate Program Office.

1. Climate Risks and Community Vulnerability Assessment

Maintain up-to-date data on climate hazards and community climate and health vulnerabilities, and use hazard vulnerability analyses to inform health services and infrastructure planning today and for the future. Understand the role of the hospital, long-term care, and ambulatory settings within the community during and after identified extreme weather events, and use this knowledge to inform resilience strategies.

2. Land Use, Building Design, and Regulatory Context

Understand and catalog the land use, building design, and regulatory context within which current health care facilities are situated. Are site improvements and existing building structures adequate to withstand extreme weather events now and in the future? What were the design assumptions for roads, storm water quantities, building envelopes and structures, roof drainage systems? Consider the larger local and community land use vulnerabilities that may impact health care facilities in the face of extreme weather—aging or inadequately sized infrastructure or removal of natural buffers.

3. Infrastructure Protection and Resilience Planning

Construct critical health care facilities with sustainable communications, energy, water, and waste infrastructure in appropriate locations to a standard of climate resilience to withstand events over the anticipated life of the structure. Infrastructure resilience measures reduced disruption, incapacitation, or loss of use of critical health care facilities. For less critical facilities: design for safe closure prior to an event with the ability to resume services within 48 to 96 hours following a major event.

4. Essential Clinical Care Service Delivery Planning

Ensure that essential clinical care services remain operational during and immediately following extreme weather events. Often, hospitals must both shelter inpatients in place as well as handle patient care surges related to the weather event. Emergency departments, urgent care centers, laboratory, and imaging services must remain operational. Nursing homes and residential care facilities house medically fragile, vulnerable populations. Research facilities house irreplaceable samples and data. In addition, health care settings may serve important nontraditional disaster response roles in their communities, providing sources of clean water, food, and shelter for a larger affected population.

5. Environmental Protection and Ecosystem Adaptations

Protect and support ecosystems and natural buffers to mitigate extreme weather hazards that may threaten your building or campus. Green infrastructure practices, heat island mitigation, and enhanced storm water management are key contributory strategies. Understand that ecosystems, wildlife corridors, and natural hydrology patterns extend beyond individual property boundaries; engage the broader community in applying best design practices for adapting to extreme weather risks in order to mitigate future damages to property and people.

Source: U.S. Federal Government, 2014: U.S. Climate Resilience Toolkit. http://toolkit.climate.gov.

Yet, success in facing psychological adversity depends on more than personal resources and reserves. People are a part of a larger community, and they are in a significantly better position to withstand trauma if that community is well functioning and socially connected.78 After a mass trauma event, for instance, social support can limit psychological distress and promote well-being. Social networks can improve a person's ability to obtain the information necessary for disaster recovery, and they can provide occasions for problem-solving, emotional and social support, normalization of reactions and experiences, and the sharing of resources for coping.^{70,75} In a study of prolonged drought, Stain and colleagues found strong community bonds, social connectedness, and hopefulness as mitigators of the adverse psychological effects of extreme environmental conditions.36

Public health planners can strengthen community and social networks by encouraging schools, churches, and community groups to develop ways to work together when faced with physical or psychological adversity.⁷⁸ Climate preparedness planning is more likely to be successful if plans are developed with community involvement.⁷⁹

RESPONDING EFFECTIVELY

Typical recommendations for disaster preparedness include suggestions to gather food, water, medication, and batteries.⁸⁰ However, items that provide psychological comfort and strength are also important. These may include blankets and toys for small children, religious items (including family bibles), books, games, and even paper and pens to write down important information.

Reliable, effective warning systems can make a critical difference. Unfortunately, trustworthiness and efficacy can be variable. Technologic limitations in weather forecasting, for instance, may result in warnings being discounted because of previous false alarms.⁸¹ Communities should test warning systems to ensure that all residents understand the meaning of the warning and what actions to take. They also need to develop ways to ensure that all residents are aware of the warning.

Any plan to prepare and build resilience among individuals and communities must specifically address vulnerable populations. As noted previously, people and communities differ in their exposures, their inherent sensitivity, and their adaptive capacity to respond to and cope with health threats related to climate change. Moreover, people experience different sensitivities to the impacts of climate change at different ages and life stages. Social determinants of health, such as those related to health disparities and socioeconomic factors, may amplify climate-related health effects. In addition, the vulnerability of both individuals and communities to climate-related hazards is closely tied to place. Geographic data and tools can enable communities to more effectively map risk factors and social vulnerabilities, identifying and protecting specific locations and groups.⁸²

Finally, the health care delivery system plays a critical role in community resilience in the face of climate change. The increasing intensity and frequency of some extreme weather events are creating complex hazards that challenge accepted baseline assumptions about infrastructure capabilities, redundancies, and disaster preparedness and response. The essential health care services provided must remain available to communities during and in the wake of extreme weather events that can bring utility outages and disruption in transportation.

When Hurricane Sandy hit in late October 2012, hospitals that did not have on-site power generation were extremely vulnerable to electrical grid failure. Utilities and mechanical equipment were flooded in facilities that had core electrical backup systems below the ground floor, disrupting services and forcing closures. Entire hospitals needed to be evacuated, and restoring these facilities took months, at massive costs. Hurricane Sandy resulted in a significant loss of total bed capacity in New York City, including at major facilities such as Bellevue Hospital Center, NYU Langone Medical Center, and Coney Island Hospital. These three hospitals alone typically treat 1.5 million patients annually.83 After Sandy made landfall, the combined total loss of bed capacity at NYU Langone and Bellevue was 1,700 patient beds.83 Although the community depends on these two facilities for approximately 1,000 daily ED visits, they could no longer provide these services after the storm; in addition, at Bellevue all 100 prisoner beds and 320 psychiatric beds were unavailable.83 Some areas of NYU Langone were able to reopen within two months of the storm, but Bellevue didn't reopen until February 2013, and Coney Island Hospital didn't reopen until March of that year. These closures severely tested the limits of the regional health care system for weeks and months beyond the event itself.

Building health care resilience must go beyond the provision of essential clinical care service delivery planning (see Framework for Resilient Health Care Settings).84 It must also include climate risks and community vulnerability assessment; consideration of land use, building design, and regulatory context; infrastructure protection and resilience planning; and environmental protection and ecosystem adaptations. Hurricane Katrina, Hurricane Sandy, and other extreme weather events that have recently affected health care delivery across the United States have demonstrated that resilient health care organizations must anticipate extreme weather risks. To do this, they must transcend the limitations of regional public policy, local development vulnerabilities, and community infrastructure challenges as they site, construct, and retrofit health care facilities.⁸⁴

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