Routledge
Taylor & Francis Group

Journal of Human Behavior in the Social Environment

ISSN: 1091-1359 (Print) 1540-3556 (Online) Journal homepage: https://www.tandfonline.com/loi/whum20

The impact of climate change and natural disasters on vulnerable populations: A systematic review of literature

Mia A. Benevolenza & LeaAnne DeRigne

To cite this article: Mia A. Benevolenza & LeaAnne DeRigne (2019) The impact of climate change and natural disasters on vulnerable populations: A systematic review of literature, Journal of Human Behavior in the Social Environment, 29:2, 266-281, DOI: 10.1080/10911359.2018.1527739

To link to this article: https://doi.org/10.1080/10911359.2018.1527739

JOURNAL OF HUMAN BEHAVIOR IN THE SOCIAL ENVIRONMENT
2019, VOL. 29, NO. 2, 266–281
https://doi.org/10.1080/10911359.2018.1527739

Routledge
Taylor & Francis Group

The impact of climate change and natural disasters on vulnerable populations: A systematic review of literature

Mia A. Benevolenza and LeaAnne DeRigne

School of Social Work, Florida Atlantic University, Boca Raton, Florida, USA

ABSTRACT

Climate change is acknowledged as being a crucial determinant of public health. The United States is experiencing an increase in the frequency and intensity of natural disasters as a result of climate change activity, influencing the ways federal, state, and local governments are addressing the growing issue. Individuals who are vulnerable to the effects of extreme weather, namely the poor, the elderly/disabled, children, prisoners, and substance abusers have experienced heightened levels of mental, emotional, and bodily stress due to natural disaster exposure. Researchers from a variety of disciplines, public health, social science, and environmental studies, in particular, are examining how natural disasters are impacting mental and physical health functioning while noting the demographic factors leaving certain groups more susceptible to harm. A systematic literature review was conducted on the past 12 years of research that examined natural disaster-related experiences and psychological and physiological health outcomes on populations who are more vulnerable to adverse weather impacts. It was found that the mental and physical health of marginalized populations during and after a natural disaster were elevated and/or exacerbated by circumstances pertaining to the weather event and the lack of disaster-response actions. It was also found that fostering social capital is a way to combat stressors in disadvantaged communities. It is imperative that clinicians and policy makers confront the issue of climate change and natural disasters, developing relief efforts and preventative measures to secure the well-being of underserved groups who may not have many resources at their disposal.

KEYWORDS

Climate change; natural disasters; health impact; vulnerable populations; at-risk groups

Policy relevancy statements

- Little empirical research has been conducted on how natural disasters in the United States have especially impacted the physical and mental well-being of underprivileged populations including the aged, the poor and the institutionalized. These individuals may be more susceptible to heightened levels of physical harm, trauma, anxiety, and depression as a result of major weather-related events.
- The results found in this review demonstrate that vulnerable groups (low-income, children, elderly, disabled), who often lack sufficient coping resources during times of natural disaster (such as money to evacuate or prepare) must be considered in separate and specialized emergency preparedness plans, trainings, and disaster-relief

CONTACT LeaAnne DeRigne lderigne@fau.edu Florida Atlantic University, 777 Glades Road, Boca Raton, FL 33431, USA

efforts. Policymakers must incorporate the health of vulnerable populations into comprehensive natural disaster planning efforts moving forward.
- Institutionalized individuals including prisoners, nursing home residents, those in residential substance abuse treatment facilities need to be regarded as a priority as these groups' evacuation needs differ from the general population. Prison officials and nursing home/residential care facilities across government levels (federal, state, local) must coordinate plans for and responses to natural disasters across facilities.

Climate change has been identified as "the defining issue" for public health in the 21st century, according to the World Health Organization (Sheehan, Fox, Kaye, & Resnick, 2017). A study conducted by the National Association of City and County Health Officials shows that eight out of ten health directors surveyed believe that climate change is occurring yet 76 percent of directors do not think they have the expertise to assess health impacts within their communities and 87 percent do not think they have adequate resources to address climate change impacts on local residents (Krueger, Biedrzycki, & Hoverter, 2015). Mental health experts warn that there exists a hidden psychological toll resulting from effects of extreme weather on society which will mount over time in the form of elevated rates of depression, anxiety, PTSD, substance abuse, domestic violence, divorce, murder, and suicide (Vestal, 2017). This public health epidemic is expected to strain the U.S. healthcare system as the intensity and frequency of hurricanes, floods, tornadoes, wildfires, earthquakes, and other natural disasters increase in the coming decades (Vestal, 2017). For low-income individuals, the elderly, children, prisoners, and addicts (all groups possibly without sufficient coping mechanisms, familial, social, and financial resource networks) symptoms resulting from natural disasters are much worse, but maybe the greatest risk of detrimental mental health reactions to extreme weather is when a whole community is so ravaged that people cannot return to a state of normalcy for months, years, or at any point in time (Vestal, 2017).

The issue of donor fatigue, happening as the pileup of catastrophic events on a national and international scale has been quite unprecedented, has only made the situation more challenging. World Vision International, a major provider of disaster relief across the globe, reports a marked decrease in cash donations, starting at just under four million for Hurricane Harvey in Texas, $900,000 for Hurricane Irma in the Caribbean and Florida, $150,000 for the earthquake in Mexico killing 340 people, and down to only about $100,000 for Hurricane Maria in Puerto Rico (Aizenman, 2017). Researchers and practitioners are beginning to examine solutions to alleviating the far-reaching effects from climate change on already vulnerable populations.

This article will analyze what researchers have discovered in the U.S. using data studies primarily from Hurricanes Katrina, Rita, and Sandy regarding the adverse mental, emotional, and physical health patterns catalyzed by extreme weather events on those more susceptible to distress. Hurricane Katrina, the most lethal hurricane to hit the Gulf Coast since the late 1920s, hit the Gulf Coast states of Louisiana and Mississippi on August 29, 2005, reaching Category 5 strength at its peak and causing over 1,800 fatalities; Hurricane Rita hit the same region one month later and caused significant damage (Montanya & Valera, 2016). In late October 2012 Hurricane Sandy hit the Northeastern United States and stalled over the states of New York and New Jersey for several days, producing record setting storm surges and flooding as one of the largest storms on a record with a diameter

twice the size of Hurricane Katrina and overall affected 60 million people in 24 states (Burger, Gochfeld, Pittfield, & Jeitner, 2017).

Climate change is a topic that can elicit intense controversy. Researchers have started to develop proposals and policy suggestions based on their work linking the importance of such a concept to the very matter of life and death for populations around the world, hoping that raising the alarm will garner serious consideration and action. Climate change refers to a "change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods" (Montanya & Valera, 2016). The United States is experiencing a greater quantity of natural disasters at more extreme magnitudes. Natural disasters are caused by natural processes of the Earth but can be exacerbated by climate change (Montanya & Valera, 2016). As climate change continues to elevate temperatures and oceans gets warmer, hurricanes will intensify. The year 2014 was the hottest year ever recorded and heat waves, respiratory illness, heat stroke, and heat-related deaths have thus become common (Montanya & Valera, 2016).

Vulnerable populations are groups who undergo hardships and may encounter prejudice, discrimination, and stigma due to their socio-economic status, race/ethnicity, gender, age, cognitive and/or physical ability, etc. These difficulties can be made worse by trauma in the form of natural disasters and their consequences. Residents who live in an "evacuation area who have family in nearby cities are more likely to evacuate than those who do not as are higher income families who have the means to evacuate while low-income, minority households, and households with disabled or elderly individuals are less likely to evacuate" (Brodie et al., 2006 p. 1404). Chronic disaster syndrome has emerged as a term to define the long-term effects of personal trauma, social arrangements which allow for disaster to become a prolonged part of life, and the overall ongoing social disruption brought about by extreme weather alongside socio-economic and political conditions that produce a host of complex problems (Adams, Hattum, & English, 2009).

The purpose of this review is to evaluate and summarize the research in peer-reviewed literature that pertains to climate change and natural disasters acting as destabilizing forces hampering the mental and physical health of vulnerable populations and to synthesize what is known about potential policy and clinical interventions to combat barriers to holistic health functioning. Although there is growing data on this topic, research is still lacking in terms of providing a comprehensive understanding as to how climate change impacts a multitude of groups and putting forth initiatives for progress.

Methods

Conceptual approach

This literature review was conducted in a systematic manner with use of the conceptual framework of natural disaster-related experiences and health outcomes in the context of three major hurricanes which occurred in the United States over the past 12 years. The framework proposes that mental and physical health are negatively impacted by extreme weather events in more disadvantaged populations, to include people of low socio-economic status, those aged 65 and older, children, those who are incarcerated, people who already have a serious mental health or physical illness, and drug/alcohol addicts. This review synthesizes the evidence on the

psychological and physical functioning of such groups and condenses the scholarly findings regarding how micro, mezzo, and macro policies and clinically-based efforts can help to reduce effects of trauma and discomfort.

Inclusion/exclusion criteria

Academic Search Premier was used as the search engine. Primary search terms used were "natural disasters", "climate change" and "vulnerable populations". "Hurricanes", "fires", "floods", "earthquakes", "extreme heat", and "drought" were used to expand upon "natural disasters" and "climate change". Likewise, "elderly", "poor", "low-income", "disadvantaged", "incarcerated", "indigenous", and "single mothers" were used to expand on "vulnerable populations". The search strategy required eligible citations to have some categorical term associated with "natural disasters" and "climate change" as well as with "vulnerable populations". The search strategy included finding articles, abstracts, titles, and key words that included the terms. Letters, editorials, book reviews, and meta-analyses were excluded. Search limits included publication dates between January 2005 through January 2017 and English language materials. In addition, only peer-reviewed articles that utilized U.S. studies (in order to avoid cultural differentiation between countries) in the past 12 years were included to focus on the most recent evidence.

A total of 42 articles were identified using this search method. Every article was scanned to determine its relevance for this review. Those that did not pertain to the topic were eliminated. Abstracts were read for the remaining articles and then full articles were read to reach a final inclusion decision. A set of criteria was established to determine whether an article was going to be included or excluded, with the goal of summarizing the knowledge base between disaster-related experiences and mental and physical health outcomes while exploring how demographic groups identified as being more vulnerable reacted to and were affected by the disasters outlined in the selected research studies. The following articles were excluded: those that were not empirical, that analyzed populations outside the United States, that were published prior to 2005, and that focused on impacts of extreme weather on relatively high-income and advantaged groups. To be included, studies must have provided a quantitative or qualitative analysis of primary or secondary data and had an outcome measure related to mental and/or physical health functioning. References lists from all articles included in the analysis were also reviewed for other relevant studies that might not have been found using Academic Search Premier.

A total of 13 articles met the criteria. The table below briefly summarizes the studies, including author, year of publication, design and analysis type, sample characteristics, and key findings (Table 1). The table allows readers to both compare and contrast the studies and to focus on the populations of most interest to them. Outcomes were distinct, as were the research designs. Findings were attained using cross-sectional and longitudinal designs, in-depth interviews, surveys, case studies, observation, and descriptive reviews. Variation in methods and lack of reliability given the small number of qualified studies selected is a limitation to this area of research, however, the dataset offers access to a wide range of individuals by demographic and health status following a natural disaster.

The findings on the impact of natural disasters on marginalized populations are summarized in two broad domains: impact on mental, emotional, and psychological health as interrelated components and impact on physical health relating to institutional

Table 1. Literature Review.

Study (Year)	Design/Analysis	Sample
Brodie et al. (2006)	Survey conducted September 10–12 in 2005 and interviews conducted in Red Cross shelters	N = 680 randomly selected respondents, = to or > 18 y
Burger et al. (2017)	In-depth, face-to-face interviews conducted 2014–2015 at seven Federally Qualified Health Centers	N = 335 Hispanic interviewees > 18 y
Cepeda et al. (2010)	In-depth, face-to-face interviews conducted 2006–2007 in voucher assisted apartment complexes	N = 350 drug-using African-American Katrina evacuees, 18 y to 65 y
Davies and Hemmeter (2009)	Administrative data using monthly extract of SSR for August 2005	N = 350,000 recipients of SSI living in hurricane-affected areas of TX, LA, AL, and MI during Katrina and Rita, = to or > 18 y
Fussell and Lowe (2014)	Longitudinal study of low-income parents enrolled in three community colleges on New Orleans between November and February 2005 during Katrina; phone interviews conducted for pre- and post-disaster assessments spanning 2005 – 2007	N = 392 low-income parents, mainly non-Hispanic Black single mothers, 18 y to 34 y
Giarratano et al. (2015)	Descriptive, cross-sectional study of prenatal women in greater New Orleans area	N = 402 prenatal women (24–40 weeks) recruited using convenience sampling, < 20 y, 20–24, 25–29, & > 30 y
Hamilton et al. (2012)	Exploratory design in two phases using in-depth interviews and systematic data collection along with ethnographies	N = 15 African-American women selected from original data set of 71 families who evacuated prior to Katrina to TX = to or > 18 y to 50 y
Montanya and Valera (2016)	Descriptive review based on ACLU report summarizing the constitutional and human rights violations against Orleans Parish prisoners throughout Katrina	N = 6,500 detainees from local, state, and federal facilities, including men, women, and youth, ages 10 y to 73 y
Paxson et al. (2012)	Longitudinal surveys conducted in New Orleans approx. one year before, 7–19 months after, and 43–74 months after Katrina	N = 532 low-income primarily African-American mothers, average age 26 y
Powell & Steiker (2015)	Qualitative interviews employing an instrumental case study approach exploring impact of intervention program on children in Tuscaloosa, AL in spring 2011	N = 30 students ages 8 y to 12 y, 14 facilitators, and 5 school social workers
Reininger et al. (2013)	Multistage random cluster survey in three coastal counties in TX noted for high levels of poverty, evaluated in multivariate analysis	N = 3,088 households consisting of White and/or Mexican-American individuals, = to or > 18 y
Schmeltz et al. (2013)	Field report describing the direct response efforts in Red Hook from board members and staff in the area nonprofit organizations as well as minutes from four community meetings, personal texts, and social media	N = 11,069 residents of Red Hook, many of whom did not evacuate for Sandy, 85% Black or Latino, all ages
Schuler et al (2017)	Longitudinal study utilizing substance abuse treatment discharge data from New Orleans from years 2006–2011 obtained from Treatment Episode Data Set; multiple logistic regression analysis was employed	N = 16,507 individuals admitted to substance abuse treatment programs, = to or > 18 y

barriers to safeguarding well-being in the event of extreme weather. Many of the researchers looked at issues that cross both of these domains; therefore, an article may be summarized more than once when the results are relevant to that area. This summary allows for review of literature on the variable pertaining to natural disaster consequences.

Impact on mental, emotional, and psychological health

Researchers examined the aftermath of natural disasters on the mental, emotional, and psychological health of vulnerable populations in eight different articles. In four of these

articles, researchers investigated the impact of Hurricane Katrina on low-income parents, largely single mothers, of African-American descent. Researchers in one study analyzed the effects specifically of housing instability on a sample of mainly low-income non-Hispanic Black single mothers following Hurricane Katrina and determined their profiles of displacement experiences (Fussell & Lowe, 2014). It was found that "relative to the returned profile, participants in the relocated profile had significantly higher general psychological distress and perceived stress; those in the unstably housed profile had significantly higher levels of perceived stress" (Fussell & Lowe, 2014, p. 142). Displacement was identified as that which is likely to affect mental health due to the disruption of social support systems, regular routines associated with homes, jobs, physical activity, and healthcare access, as well as crowdedness and isolation that can be felt by evacuees in shelters and later in arranged housing conditions who are more susceptible to additional stressors, and may face danger or possible discrimination (Fussell & Lowe, 2014). Paxson et al. (2012 p. 153) further expanded on this area of research, discovering that their sample of predominantly low-income African-American mothers "experienced significant levels of trauma and loss as a result of Hurricane Katrina". Eighty-one percent of respondents had damaged homes and 32 percent had a family member or friend who died from the storm (Paxson et al., 2012). Post-traumatic stress symptoms in participants declined over the time following the hurricane but remained high 43 to 54 months later, while psychological distress declined but did not return to pre-hurricane levels (Paxson et al., 2012). Despite a decline, about three and a half to four and a half years after the hurricane, researchers found that 30 percent of the sample had levels of psychological distress elevated enough to indicate probable mental illness (Paxson et al., 2012). Both studies demonstrate that maintaining financial and social support resources during natural disasters as many advantaged and higher-income populations are able to do, serve as buffers to detrimental mental health outcomes and risk factors. Low-income, minority, and undermined populations can thus encounter struggles and challenges in recuperating and dealing with trauma after storms.

Giarratano, Harville, de Mendoza, Savage, and Parent (2015) similarly examined the mental health of low-income women, in this case who were prenatal and accessed the New Orleans Healthy Start program during long-term recovery from Hurricane Katrina. The women accessing this program were considered more socially "at-risk" in being younger, low-income, single, African- American, and having a higher incidence of depression and PTSD than the comparison group of women sampled for the study accessing traditional prenatal care in New Orleans during the same period (Giarratano et al., 2015). As mentioned by Fussell and Lowe (2014) and Paxson et al. (2012), researchers noted that long-term psychological harm and PTSD is higher for individuals with the following conditions: those who have the most exposure to the disaster event, who have coexisting depression, are low-income, have a history of abuse, and experience other negative life events (Giarratano et al., 2015). For pregnant women in particular, exacerbated stress and minimal social supports have long been found to result in adverse birth outcomes like depression, preterm birth, low birthweight, and pre-eclampsia (Giarratano et al., 2015). Healthy Start subjects reported in greater numbers that they feared for their life (45 percent), that their lives were still disrupted following the storm, had much to tremendous house damage (68.3 percent), that they were pessimistic about New Orleans' future, and that race relations had intensified since the storm (Giarratano et al., 2015).

Hamilton et al. (2012) attempt to provide an uplifting lens into what can result from the immense difficulties endured by Hurricane Katrina survivors, who even before the storm were already among the poorest in the nation. Unevenly distributed resources, inadequate educational and social systems hosted at the most seriously affected parishes, and a general history of institutionalized oppression increased the vulnerability of African-American women in this study according to its researchers (Hamilton et al., 2012). Themes attained from in-depth interviews with participants revealed that deliberate neglect and abandonment, trauma, intersecting police oppression, and the feeling of being left behind contributed to the women and their families' unease, heightened stress, and despair, all of which were evident in the symptoms expressed by respondents in the study conducted by Paxson et al. (2012). Interestingly, women who took part in the interviews state that they attached powerful spiritual meanings to Katrina and actively relied on their faith and support from family and friends in order to move forward with their lives (Hamilton et al., 2012). The women created a resettlement narrative which enabled them to look to a common humanity, one which had felt a lot of pain but could be transformed by a shared courage and resilience (Hamilton et al., 2012). These qualitative interviews inform ways in which certain coping mechanisms have the power to adjust attitudes and behaviors as they are guided by one's mental and emotional health, with respondents in this study looking to spiritual enlightenment and bonds with others as forms of stress-relief.

Two researchers analyzed the impact of Hurricane Katrina on the mental and psychological health of drug addicts and those admitted to substance abuse treatment programs with a co-occurring psychiatric disorder (COD). Cepeda et al. (2010, p. 624) found that "among a sample of drug-using African-American Katrina evacuees, disaster-related experiences including negative life changes, disaster exposure, post-disaster stressors, and resource loss have unique, inverse relationships with mental health". "Resource loss had the strongest inverse relationship with mental health and disaster exposure had a negative interactive effect on psychological distress and anxiety" (Cepeda et al., 2010 p. 625). Participants indicated substance use six months before and/or after Katrina, and/or in drug treatment six months prior to Katrina; in addition to being drug users and simultaneous evacuees, the individuals in this sample consisted of a high proportion who were unmarried (93.6 percent), unemployed (77 percent), had little to no income, and had one or more children (72.6 percent) (Cepeda et al., 2010). Like the mental state of low-income mothers in the study by Paxson et al. (2012), 13 percent of respondents for Cepeda et al. (2010) noted symptoms that were consistent with a diagnosis of PTSD and high mean values on scales measuring psychological distress, anxiety, and somatic symptoms. Another study by Shuler, Suzuki, Podesta, Qualls-Hampton, and Wallington (2017) examined substance users but in a different context, looking to the prevalence of substance use, treatment characteristics, and demographics of discharges from substance abuse treatment in New Orleans, post-Hurricane Katrina. Following the storm and closure of a major psychiatric unit in the city, health care remained compromised for patients who evacuated and for those who remained in the region (Shuler et al., 2017). Unmet post-disaster mental health service needs were evident as the immediate loss of medical personnel left patients with insufficient or no alternative treatment (Shuler et al., 2017). Moreover, substantial financial cuts to mental health and substance abuse treatment at Louisiana State University Public Hospital is believed to have influenced the prioritization of discharge of psychiatric cases which in turn directly correlated with severity (Shuler et al., 2017).

Researchers found that about a third (35.2 percent) of all discharges in New Orleans from 2006 to 2011had a COD and discharges in this category were 29 percent less likely to complete treatment compared to those with no COD (Schuler et al., 2017). Significant trends in homelessness, criminality, and heroin use were also identified among discharges with a COD (Shuler et al., 2017). This study and the one conducted by Cepeda et al. (2010) highlight that mental health setbacks propelled by the direct and indirect repercussions from a natural disaster compounded by lack of coordinated response efforts can do noticeable harm to an already vulnerable population suffering from physical and psychological issues exacerbated by witnessing and experiencing a severe weather event.

Reininger et al. (2013) carried out their research through examination of social capital and its relationship to disaster preparedness among impoverished communities in three Texas counties, where resources were attained from the social cohesion drawn upon by individuals for their collective action and collective benefit. It was found that when there is trust during social interactions, communities are then better prepared for disasters, Disadvantaged groups can rely on their community when there is cohesion and congeniality that may overcome the effects of stress and anxiety (Reininger et al., 2013). Researchers also discovered that as "perceptions of fairness increased, self-reported preparedness increased", thereby affecting individuals' mental health by providing such positive communal interactions resulting in balanced exchange (Reininger et al., 2013, p. 55,).

Along with promoting social capital in the form of community unification and gatherings in order to combat natural disaster-related mental, emotional, and psychological effects on vulnerable groups, interventions for the processing of grief and loss were found to enhance health in children in a study devised by Powell and Steiker (2015). According to the researchers, "children are among the most vulnerable groups during and after a natural disaster as they experience a range of stressors such as fear of death and loss of a loved one, the loss of a home and community, displacement, emotional manifestations of anxiety, nervousness, anger, diagnosed PTSD, depression, an increase in bullying, and other externalized behaviors such as fighting in school" (Powell & Steiker, 2015, p. 176). As was indicated in the study by Giarratano et al. (2015) on prenatal women in terms of the future health of their babies, Powell and Steiker-Holleran (2015, p. 177) note that protective factors for children can lessen maladaptive trauma responses including prenatal and "social support, a sense of control, healthy coping responses, and social emotional skills." Researchers in the study were able to analyze how a broad-based post-disaster psychosocial intervention for children who were affected by a tornado which struck Tuscaloosa, Alabama in 2011 was successful specifically in helping children to better articulate their feelings, process grief, regulate emotions such as anger and depression, and gain knowledge about how to handle bullying behaviors in school (Powell & Steiker-Holleran, 2015). This model of clinical intervention practice on children can potentially be adapted to the low-income and substance-using populations who experience similar anxiety, depressive, and PTSD symptoms in the wake of a weather disaster and are in need of services to alleviate pain.

Impact on physical health as it relates to institutional barriers

Five articles discussed the impact of natural disasters in terms of the physical toll it took on vulnerable populations, with many individuals already having somatic health ailments and/or disabilities prior to the disaster which were then exacerbated by a lack of local,

state, or federal institutional regard for their care. Three studies examined the effects of Hurricanes Katrina and Rita on such groups and two studies centered on Hurricane Sandy.

Brodie et al. (2006) utilized survey centered on persons most adversely hit by Katrina (i.e. those who did not initially evacuate, who did not have access to housing on their own, and were living with family or friends or in shelters outside of Houston) to assess respondents' overall experiences with the storm. More than "90 percent of participants were African-American and approximately six in ten had household incomes below $20,000 in 2004" (Brodie et al., 2006, p.1404). "Forty-one percent of Houston shelter residents reported chronic health conditions such as heart disease, hypertension, diabetes, or asthma, and 33 percent with children said that they had been injured during the hurricane" (Brodie et al., 2006, p. 1406). Many lacked transportation and underestimated the storm so as a result they did not initially evacuate (more than a third stated they lacked a car or other means to evacuate). "Forty percent reported they spent at least a day on the street or in an overpass waiting to be rescued, more than half of respondents reported not having enough food or fresh water, and more than a third noted not being able to get their prescription medication" (Brodie et al., 2006, p. 1405). Without government monitoring and organized disaster and relief planning, dire situations arose, evidenced by the 61 percent of respondents who stated that their "experiences during Katrina and the aftermath made them feel the government did not care about people like them" (Brodie et al., 2006, p. 1404), a sentiment echoed by the low-income prenatal women studied by Giarratano et al. (2015) who reported pessimism about the future and absence of concern for the undermined, many of whom were African-American and poor.

The elderly and disabled were also among the hardest hit by Hurricane Katrina and one month later by Hurricane Rita (Davies & Hemmeter, 2009). According to the researchers, approximately 350,000 Social Security Income (SSI) lived in areas directly affected by Hurricanes Katrina and Rita, and were at a 40 percent greater odds of dying than SSI recipients from unaffected states (Davies & Hemmeter, 2009). In general, the elderly have higher rates of chronic illness, use of assistive devices, and are more likely to rely on others for care, all of which increase the potential for adverse effects of natural disasters during evacuation process (Davies & Hemmeter, 2009). Davis & Hemmeter (2009) also found that "non-elderly individuals with disabilities faced even larger barriers to evacuation and preparation for both storms including having no wheelchair chair lifts on some evacuation buses, separation from medical supplies necessary to maintain health, evacuation communication procedures which did not comply with federal law regarding vision and hearing impairments, and many Red Cross shelters not providing shelter to individuals with disabilities. In addition to physical difficulties faced by the disabled and elderly poor, rent prices in New Orleans increased in the year following the hurricane by 39 percent, limiting their housing options and causing added stress and lack of assurance as to the protection of individuals health and safety needs prior to and after a severe-weather related disaster, the mental side effects of which were shown with low-income mothers and the challenges of housing displacement (Fussell & Lowe, 2014).

Montanya and Valera (2016) analyzed the impact of Hurricane Katrina on prisoners, who are more at risk of transferring communicable diseases, living in unsanitary conditions, being exposed to hazardous materials, as well as being subject to violence from overwhelmed staff and inmate-on-inmate violence. In general, incarcerated individuals

have higher rates of chronic illness than the general population, with 40 percent of inmates reporting a chronic medical condition (Montanya & Valera, 2016).

During Hurricane Katrina and for many days following, thousands of men, women, and youth were left at Orleans Parish Prison, the New Orleans city jail; without emergency preparedness plans in place, chaos ensued as prison guards absented their posts and inmates were left without food, water, or proper ventilation (Montanya & Valera, 2016). It became evident that evacuation plans were not made for the prisoners and in effect the correctional officers, unsure of what to do, placed inmates on lockdown, with hunger, disease, and violence becoming rampant (Montanya & Valera, 2016). In addition to hurricane-related harmful effects, extreme temperatures are a concern for these individuals since many correctional facilities do not provide sufficient heating or air conditioning (Montanya & Valera, 2016). After receiving extensive criticism, complaints, and lawsuits in the aftermath of Katrina, the Federal Emergency Management Agency (FEMA) still did not offer guidance or clarification regarding emergency preparedness for correctional facilities (Montanya & Valera, 2016), demonstrating again that the underserved and underprivileged in society were largely cast aside and bereft of assistance when it was most needed for tending to severe physical health and medical conditions.

Studies conducted by Burger et al. (2017) and Schmeltz et al. (2013) document the poor health outcomes experienced primarily by low-income and minority individuals who reported struggles with accessing resources in communities affected by Hurricane Sandy.

Patients interviewed for the study by Burger et al. (2017) were largely uninsured and underinsured and went to medical clinics (which were damaged by storm surge, flooding, and evacuation from Sandy) tailored to these individuals. Access to medical care, medical need, medical interruptions, and experiences were determined from a Hispanic/Latino population in New Jersey with respect to demographics, personal impact rating, and community impact rating. Those who were told to evacuate and did not suffered more so than those who did, with 46 percent of those who ignored orders having "medical needs" before or immediately following Sandy (Burger et al., 2017). Hispanics were more likely to walk to health centers (28 percent) after the storm, suggesting lack of access to a car and thus having less opportunity to evacuate when Sandy hit (Burger et al., 2017), which was the case for many low-income African-American persons during Hurricane Katrina (Brodie et al., 2006). Minorities were found to be more reluctant to evacuate than majority residents in the same community, and given that evacuation requires transportation, shelter options, and entails additional costs as well as loss of wages (maybe even jobs), this is seen as a big burden for already economically challenged families (Burger et al., 2017). For this study, there was a high rate of foreign-born respondents (90 percent), with many reporting not having power, needing health centers, having trouble getting to the center, and having an interruption of medical services (Burger et al., 2017).

Like the Hispanic/Latino individuals located in the community researched by Burger et al. (2017), those who experienced Hurricane Sandy in a town in Brooklyn, New York in the study by Schmeltz et al. (2013) were left without electricity, heat, running water, garbage collection, local health clinic services, and had only limited access to routine medical care. Red Hook was the point of research for this study, a mainly low-income housing community consisting of 85 percent of Black or Latino residents who are more likely to encounter increased barriers to health care and exorbitant stressors (Schmeltz et al., 2013). Despite posted evacuation flyers in apartment complexes, many individuals preferred to stay in their residences; the only health

clinic in the neighborhood flooded and clinic staff, nurses, and doctors had to evacuate (Schmeltz et al., 2013). There was no heat for 17 days at a time when the city faced average temperatures in the mid-40s; for a community with a higher than average asthma rate and other underlying medical conditions, there was an added concern of contracting upper respiratory infections (Schmeltz et al., 2013). Environmental issues left untended for the duration of the storm and causing adverse health reactions for these residents were similar to those faced by inmates in the New Orleans prison during Katrina when they were neglected by prison staff and disregarded by the broader governmental institutions (Montanya & Valera, 2016). Fortunately, high social capital in Red Hook contributed to the community's resilience in the weeks after Sandy along with help from volunteers and community-based organizations who brought crucial resources to bear on problems that emerged in the wake of the storm (Schmeltz et al., 2013). This idea of social capital serving to benefit individuals living in vulnerable communities following a natural disaster was discussed by Reininger et al. (2013) in the sense of better understanding how both mental and physical health are tied to positive community relations and partnerships structured around care.

Discussion

The results summarized in this literature review have important implications for clinical practice and public health and environmental policy advocacy efforts. Literature reviews provide a synthesis of the evidence to inform both practitioners and those involved in policy reform movements about recent research results, the latter of which accumulated over the past 12 years starting with the groundbreaking work conducted after Katrina.

Policy implications

The results found in this review demonstrate that implementing and organizing emergency preparedness plans, trainings, disaster-relief efforts, and preventative measures are essential to promoting and stabilizing the mental and physical health and quality of life of vulnerable groups who often lack sufficient coping resources for facing extreme weather conditions. In terms of assisting low-income individuals faced with the event of a natural disaster, better communication plans need to be constructed for residents in urban areas, the latter of whom "need more detailed information on how to find safety or evacuate if they have no car, financial resources, place to stay, or if someone in their family is physically disabled" (Brodie et al., 2006 p. 1405). Officials orchestrating the carrying out of such plans need to be trained to ensure credibility and cultural competency, since individuals guided by information will base their trust and whether directions and advice are heeded on the officials who must afford a high level of care to traditionally underserved populations. Given the current health care system in the United States and dependence on hospitals as safety nets for the underinsured and uninsured, plans also need to be in place for the sick, injured, and chronically ill who may desperately seek out medical help from such institutions at heightened rates during severe weather situations. Cities must have enough designated health facilities and clinics with medical personnel ready and willing to attend to these people in need and have proper medication, food, water, and supplies on site for patients; providing Medicaid assistance by means of a federal response or through a state-by-state waiver program for those suffering

from health complications due to or increased by a natural disaster are potential legislative actions which should considered as another wide-ranging form of help (Brodie et al., 2006).

The USDA requires states to submit detailed plans outlining how they will administer emergency food assistance programs for people who lost food and income as a result of a natural disaster, with the federal government providing funds for assistance and the state in charge of administering the program (Swisher, 2017). Chaos surrounding distribution of food benefits to residents in South Florida following Hurricane Irma in September of 2017 illustrated the misalignment between the supposed federal guidelines and the state's response. Police abruptly shut down sites in two of the largest counties in South Florida because of health and safety concerns; the elderly and disabled were not accommodated and people were forced to stand on line for hours in the heat (Swisher, 2017). Those who are assigned to protect and secure the well-being of residents effectively jeopardized the mental and physical health of the most susceptible groups, which in and of itself is a concerning prospect for approaching the next natural disaster in a given state. Specific measures need to be taken so as to successfully manage coordination of programs by ensuring state authorities and officials are equipped prior to a natural disaster and know how to accommodate crowds, root out fraud, manage traffic, communicate with the public throughout the process, provide water, food, and access to restrooms, and allow for online applications if need be to save these groups from additional stress (Swisher, 2017). Funds need to be available for communities, especially smaller and lower-income ones, to clean up and rebuild after a severe weather event in order to mitigate prolonged distress.

For the aging population, the significance of disaster planning is further put into focus since older adults are more at a risk of mental and physical health damage manifested by high rates of depression, decreased mobility, changes in physiology, less adaptive capacity, and social isolation (Filiberto et al., 2010). An aging services network should be devised with expertise from the U.S. Administration on Aging, state units on aging, area agencies on aging, and local service providers who would be crucial resource guides in the planning process (Elmore & Brown, 2007). Impact on evacuation and relocation on older individuals' health must be considered and staff in shelters and disaster centers should have an understanding of the mental health conditions of older adults, with planning taking account the variety of settings where older adults reside (Elmore & Brown, 2007). Research has shown that older adults are more likely to accept outreach efforts if made by community helpers and trained workers who know the older adult community, speaking again to the importance of cultural competency and protecting these individuals from abuse, neglect and/or exploitation (Elmore & Brown, 2007). A new federal bill filed in October 2017 would require nursing homes to have generators that can power air conditioning for at least 96 hours and would require utility companies and emergency responders to treat nursing homes as top priorities after hurricanes, as they do now with hospitals (Sweeney, 2017). This bill coincides with similar measures being taken up by the Florida legislature and the state's local level after a generator requirement emergency order was put into effect in response to the death of 14 nursing home residents who died due to staff neglect and maltreatment after the facility lost power during Hurricane Irma.

Prisoners must also be regarded as a priority when it comes to approaching care, and as older prisoners are more susceptible to weather-related health consequences from extreme heat and lack of ventilation, standards should be put in place across correctional facilities.

The Bureau of Prisons monitors solely federal facilities, so it is difficult to coordinate emergency preparedness plans with other public health management officials at the local and state levels; reforms need to be devised to allow for investigative oversight and greater ease in planning, making organizations responsible for the health of inmates (Montanya & Valera, 2016). Two innovative measures which have been proposed are to include an air-conditioned section in the facility for those most vulnerable to extreme temperatures and to increase the reflectivity, or property of not absorbing light and radiation, on buildings. Sponsoring collaborations between prisons and environmentally sustainable construction companies to promote the implementation of effective changes is an attainable and workable goal for treating prisoners justly (Montanya & Valera, 2016).

The U.S. Centers for Disease Control and Prevention (CDC) Climate and Health Program is one of a few federal programs that builds capacity at the subnational level to assess and respond to the health impacts of climate change by supporting several state and local governments to be proactive in addressing residents' needs (Sheehan et al., 2017). Since 2010, the Climate-Ready States and Cities Initiative (CRSI), which is funded by the CDC, has awarded annual grants ranging from $100,000 to $250,000 on a competitive basis to public health departments in 16 states and two cities, with some states passing these funds through to cities, counties, and other localities (Sheehan et al., 2017). Over half of the CRSI grantees report developing social vulnerability or other indexes, mapping, and other quantitatively derived tools to assess vulnerability with help from a university technical partner; they cite the elderly, very young, those having a preexisting health condition, those having lower income, being a minority, working outdoors, living in vulnerable geographic locations, and lacking protective infrastructure such as air-conditioning as characteristics to describe groups more prone to harm from climate change effects (Sheehan et al., 2017). Grantee states and cities have also identified key climate hazards, associated health risks, addressed health department training, capacity building, and public outreach, and overall have informed next steps toward development of climate health adaptation plans (Sheehan et al., 2017). This program is an example of what the future of preventative efforts can look like at the federal, state, and local levels when climate change and its relationship to holistic health of marginalized groups is highlighted. If models of innovation such as CRSI and appropriate amounts of funding in anticipation of need and severe weather could be distributed across the country along with detailed plans for disaster preparation and relief, then positive change is possible.

Clinical implications

This review of the literature found that social factors impacting livelihoods of vulnerable individuals are associated with more or less capacity to adjust to changing environmental conditions and consequences brought about by natural disasters. Practitioners need to provide mental health services for relocated and unstably housed disaster survivors, forging connections with unstably housed survivors by linking disaster housing assistance programs with social service agencies working with survivors (Fussell & Lowe, 2014). Clinicians in communities receiving disaster survivors should have a greater understanding of the secondary stressors from resettlement and unstable housing so that they can explore areas of stress not fully recognized in disaster-affected patients, which in this review included those of low-income, children, the elderly, minority groups, and substance abusers (Fussell & Lowe, 2014). These professionals could facilitate individual and family disaster recovery through the

treating of anxiety stemming from temporary situations and by being guides for those who have suffered from fear and loss, separation, and isolation (Fussell & Lowe, 2014). Increasing psychoeducational skills and the processing of grief as they pertain to experiencing a natural disaster would be very beneficial for children, in particular, as they deal with disaster recovery (Powell & Steiker-Holleran, 2015). Being able to manage emotions such as anger is a protective measure against future mental health issues which could escalate following disruption from a severe weather event, and introducing generalized school-based interventions for the aggregate of youth who have witnessed effects from natural disasters would therefore be advantageous (Powell & Steiker-Holleran, 2015).

For childbearing women and low-income single mothers, developing a case management system of care supporting their restoration would be a step forward to minimizing the burdens faced by vulnerable women; the intangible benefits of emotional support and motivational interviewing by a trained personal provider may be especially beneficial in post-disaster recovery (Giarratano et al., 2015). Policies to build continual resilience to natural disasters call for more prevalent social programs and for community stakeholders to empower women. Policies put in place by leaders and professionals can become actualized as they instill confidence in women to approach their life transitions with more power and with decisions in areas of family planning (Giarratano et al., 2015).

Moreover, addressing social capital in underprivileged communities can serve as a buffer to adverse health outcomes and building preparedness activities around these natural social resources offers a leverage point for disaster management professionals (Reininger et al., 2013). Intervention models using neighborhood block leaders or community gatekeepers who connect families and neighbors could assist in disseminating preparedness information and direction to further resources. Future efforts should look to capitalize on bonds that exist between residents so that pain and suffering associated with disasters can be ameliorated through the social capital mechanism (Reininger et al., 2013).

Finally, practioners should focus on assisting individuals with the strain of uncertainty that comes with enduring natural disasters. Psychologists, psychiatrists, mental health counselors, public health professionals, social workers, and other licensed practioners would be tasked with tending to the mental and physical care of undermined individuals. Professionals need to make sure people learn to adapt to chronic uncertainty, that people emphasize hope and faith, and that they incorporate creativity and flexibility as well as the capacity to see climate change as a challenge and opportunity for reform (Mason, 2011).

Limitations

This literature review revealed that although there were a diverse set of research methods employed across the studies, there was limited reliability given that only 13 studies met criteria for the purposes of this review. Since only three studies utilized a longitudinal research design (Fussell & Lowe, 2014; Paxson et al., 2012; Sheehan et al., 2017), more studies that track health outcomes before and after a natural disaster are needed to strengthen existing research data. Additionally, two studies consisted of very small sample sizes (Hamilton et al., 2012; Powell & Steiker 2015). Future research on this topic should contain large sample sizes consisting of those who come from backgrounds classified as belonging to vulnerable demographics. There was also an absence of specific statistics in all studies as to how marginalized populations fared

compared to higher-income and relatively advantaged individuals in the case of, for example, evacuation and displacement experiences and recovery progression during and following a natural disaster. It is important to note that while there have been several natural disasters in the United States since Hurricane Sandy, empirical and peer-reviewed research studies have not yet been conducted on the extent to which people, focusing on more at-risk groups, have suffered and been impacted by these occurrences. The research would thus be stronger if work was done on studying the effects of the most recent disasters and creating standard questions for surveys and interviews that define how mental and physical health symptoms are manifested in vulnerable populations after a natural disaster, allowing for more generalizable results. Lastly, the research would be richer if other key players, especially health care providers and environmental policy experts, were included.

Conclusion

Climate change and the increase in the severity of natural disasters have compromised public health and are issues gaining national (and international) attention. A focus on vulnerable populations as they are at a heightened risk of adverse health outcomes including low-income individuals, the elderly and disabled, children, racial/ethnic minorities, and substance abusers is greatly needed. Changes and advancements in both policy and clinical practice surrounding preventative measures, disaster preparedness, and coordinated relief efforts could perhaps lead to improved quality of life for individuals, families, and communities who are already struggling financially and medically-speaking. Research that monitors the implementation of reforms combating the disruption, strain, and harm imposed by natural disasters will be needed to ensure successful outcomes.

References

Adams, V., Hattum, V. T., & English, D. (2009). Chronic disaster syndrome: Displacement, disaster capitalism, and the eviction of the poor from New Orleans. *American Ethnologist*, *36*, 615–636. doi:10.1111/j.1548-1425.2009.01199.x

Aizenman, N. (2017). *Goats and Soda*. Retrieved from http://www.npr.org/sections/goatsandsoda/2017/09/29/554291950/what-the-pileup-of-u-sdisasters-means-for-the-world

Brodie, M., Weltzein, E., Altman, D., Blendon, R. J., & Benson, J. M. (2006). Experiences of hurricane katrina evacuees in houston shelters: Implications for future planning. *American Journal of Public Health*, *96*, 1402–1408. doi:10.2105/AJPH.2005.084475

Burger, J., Gochfeld, M., Pittfield, T., & Jeitner, C. (2017). Responses of a vulnerable hispanic population in new jersey to hurricane *sandy*: Access to care, medical needs, concerns, and ecological ratings. *Journal of Toxicology and Environmental Health*, *80*, 315–325. doi:10.1080/15287394.2017.1297275

Cepeda, A., Saint Onge, M., Kaplan, C., & Valdez, A. (2010). The association between disaster-related experiences and mental health outcomes among drug using African American Hurricane katrina evacuees. *Community Mental Health Journal*, *46*, 612–620. doi:10.1007/s10597-009-9286-4

Davies, S., & Hemmeter, J. (2009). Supplemental Security Income recipients affected by Hurricanes Katrina and Rita: An analysis of two years administrative data. *Population & Environment, 31*, 87–120.

Elmore, L., & Brown, M. L. (2007). Emergency preparedness and response: Health and social policy implications for older adults. *Generations*, *4*, 66–74.

Filiberto, D., Wethington, E., Pillemer, K., Wells, M. N., Wysocki, M., & Parise, T. J. (2010). Older People and Climate Change: Vulnerability and Health Effects. *Journal of the American Society on Aging*, *4*, 19–25.

Fussell, E., & Lowe, R. S. (2014). The impact of housing displacement on the mental health of low-income parents after Hurricane Katrina. *Social Science & Medicine*, *113*, 137–144. doi:10.1016/j.socscimed.2014.05.025

Giarratano, G., Harville, W. E., de Mendoza, B. V., Savage, J., & Parent, M. C. (2015). Healthy start: Description of a safety net for perinatal support during disaster recovery. *Maternal Child Health Journal*, *19*, 819–827. doi:10.1007/s10995-014-1579-8

Hamilton, M., Everett, J., Hall, J., Harden, S., Lecloux, M., Mancini, S., & Warrington, R. (2012). Hope floats: African American Women's survival experiences after Katrina. *Journal of Human Behavior in the Social Environment*, *22*, 479–499. doi:10.1080/10911359.2012.664982

Krueger, J., Biedrzycki, P., & Hoverter, P. S. (2015). Human Health Impacts of Climate Change: Implications for the Practice and Law of Public Health. *Journal of Law, Medicine & Ethics*, *43*, 79–82. doi:10.1111/jlme.12223

Mason, R. (2011). Confronting uncertainty: Lessons from rural social work. *Australian Social Work*, *64*, 377–394. doi:10.1080/0312407X.2011.574144

Montanya, C. N., & Valera, P. (2016). Climate change and its impact on the incarcerated population: A descriptive review. *Social Work in Public Health, 31,* 348–357.

Paxson, C., Fussell, E., Rhodes, J., & Waters, M. (2012). Five years later: Recovery from post traumatic stress and psychological distress among low-income mothers affected by Hurricane Katrina. *Social Science and Medicine, 74,* 150–157.

Powell, T., & Steiker-Holleran, K. L. (2015). Supporting children after a disaster: A case study of a psychosocial school-based intervention. *Clinical Social Work Journal*, 45, 176–188.

Reininger, M. B., Rahbar, H., Lee, M., Chen, Z., Alam, R., Pope, J., & Adams, B. (2013). Social capital and disaster preparedness among low-income Mexican Americans in a disaster prone area. *Social Science & Medicine*, *83*, 50–60. doi:10.1016/j.socscimed.2013.01.037

Schmeltz, T., González, K. S., Fuentes, L., Kwan, A., Williams-Ortega, A., & Cowan, P. L. (2013). Lessons from Hurricane Sandy: A community response in Brooklyn, New York. *Journal of Urban Health*, *90*, 799–809. doi:10.1007/s11524-013-9832-9

Sheehan, C. M., Fox, A., Kaye, C., & Resnick, B. (2017). Integrating health into local climate response: Lessons from the U.S. CDC climate ready states and cities initiative. *Environmental Health Perspectives*, *125*, 1–6.

Shuler, M., Suzuki, S., Podesta, A., Qualls-Hampton, R., & Wallington, F. S. (2017). A post-hurricane katrina examination of substance abuse treatment discharges with co-occurring psychiatric and substance abuse disorders. *Journal of Dual Diagnosis*, *13*, 144–156. doi:10.1080/15504263.2016.1277816

Sweeney, D. (2017, October 15). Bill aims to keep nursing homes cool. *SunSentinel*, pp. 4B, 5B.

Swisher, S. (2017, October 23). Food aid fiasco taught Fla. lessons. *SunSentinel*, pp. 1A, 17A).

Vestal, C. (2017, October 16). Psychological trauma is invisible long-term toll of megastorms. *Miami Herald*, pp. 1A, 2A.