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SASWATI UPADHYAY Date: 04/30/2021

Effects of Extreme Weather Events on Mental Health of Perinatal Population: Narrative Review

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M.D.
Dr. DY Patil Vidyapeeth,
2015

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Abstract

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By Saswati Upadhyay

Purpose: As the climate crisis intensifies, Extreme Weather Events (EWEs) are increasing in frequency and severity and include drought, flooding, hurricanes, tornados, extreme temperatures, and wildfires. EWEs are associated with significant, negative consequences that can affect the economy, cause population displacement, resulting in injury or death, and impact mental health. , Research indicates that women are more likely to suffer from climate-related mental illness than men. This gender-related predisposition, combined with the known challenges of the perinatal period, make pregnant and postpartum women an especially vulnerable population regarding EWE exposure.

Aims and Objectives: Our aim was to evaluate the impact of EWEs on perinatal mental health through a literature search of articles published in the previous decade. The objective was to investigate the nature of the relationship between EWEs and perinatal mental health disorders (and related symptomology) along with protective factors such as interventions and programs designed to support families that have been adversely affected.

Methods: The databases utilized in this search were PubMed, EMBASE, Web of Science, and PsychInfo; articles published between January 2010 to September 2020 were eligible for inclusion. Various combinations of search terms for mental health, extreme weather events, and mothers were utilized. After screening and eliminating those articles that did not qualify for exclusion criteria set by reviewers, 25 articles were included.

Results: After obtaining the final set of papers, the principal investigators read the articles and grouped them by primary themes. Six themes were identified: 1) EWEs and associated psychological symptoms, 2) Impacts of EWE trauma on offspring, 3) Assessment tools for EWE survivors, 4) Interventions, and coping mechanisms accessible during and after EWEs, 5) Protective factors during an EWE, and 6) Posttraumatic growth after an EWE. The results were collated and synthesized.

Conclusions: Identifying and supporting pregnant women and new mothers who have experienced Extreme Weather Events is of major public health concern. Lower socioeconomic status, a lack of social support, a history of mental health issues, and living in areas prone to EWEs are just a few of the risk factors for diminished mental health outcomes for disaster survivors.

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Section 1: INTRODUCTION

Becoming a mother is one of the most challenging transitions in a woman's life due the associated and multiple role demands, including mother, daughter, wife/partner, employee, member of society, and neighbor [1,2]. That pregnant women undergo a cognitive restructuring that promotes maternal identity development [3] is a notion that is supported by the literature. In addition to the myriad responsibilities of caring for an infant while managing various other domains, hormonal changes are characteristic of the perinatal period [4] and represent a unique set of challenges. Progesterone, estrogen, cortisol, oxytocin, dopamine, and testosterone can fluctuate significantly during the perinatal period [5,6]; these changes can cause rapid shifts in mood including feelings of anxiety and vulnerability [7]. These hormone related changes are apparent during the first trimester of pregnancy and settle down once the body has adjusted [8]. But for a few women, the hormonal changes remain throughout pregnancy and postpartum [9,10]. A study by Bloch et al. 2000 established that women who have an abnormal reaction to fluctuations in reproductive steroid levels (estrogen and progesterone) during their pregnancy are more susceptible to antenatal and postpartum depressive disorders [11]. This is significant, as perinatal mood and anxiety disorders (PMADs) have the potential to impact the mother's quality of life and child development [12].

Studies have demonstrated a high prevalence of Perinatal Mood and Anxiety Disorders (PMADs) worldwide [13]. In fact, findings indicate that approximately 15-25% of perinatal women suffer from depressive symptoms worldwide [14]; this rate is often higher in low-income populations [12]. Specifically, absence of social support, lower social-economic status (SES), being a racial minority, and having difficult childbirth [15] represent complicating factors and predispose women to the development of Perinatal Mood and

Anxiety Disorders (PMADs), which are the most common complication of childbirth [16]. Postpartum Depression (PPD) has been expansively studied in the literature and is associated with an increased possibility of psychosocial and developmental difficulties in children [17,18]. PMADs also have implications for the development of the fetus, delivery, and mother-child bonding [19].

In short, hormonal fluctuations, recovery from childbirth, and evolving role demands combine to present a unique set of challenges for both primiparous and multiparous women. The perinatal period a timeframe in which women are particularly vulnerable to PMADs, especially depression and anxiety, which are highly prevalent conditions and can complicate recovery from childbirth [20]. The notion that additional stressors or traumatic experiences can compound this already complicated transition is both intuitive and corroborated by the literature [21-23] .

On their website, the National Institutes of Mental Health states, "A traumatic event is described as a shocking, scary or dangerous experience that can affect someone emotionally and physically" [24]. Traumatic past life events such as rape, sexual abuse, intimate partner violence, childhood trauma, and environmental risk factors [25] can influence the birth experience, recovery from it, and the ability to adapt to new responsibilities [26]. Additionally, increasing numbers of families are being impacted by extreme weather events (EWEs) likely due to a changing climate. As our planet continues to warm, EWEs are increasing in frequency and severity and include drought, flooding, hurricanes, tornados, extreme temperatures, and wildfires [27]. The World Health Organization estimates a rise in death close to 250,000 more per year between 2030 to 2050 due to climate change [28]. EWEs are also associated with significant, negative consequences that can affect the economy, cause population displacement, result in injury or death, and

impact mental health. There is significant literature describing the mental health consequences of EWEs and natural disasters [29-31]. Anxiety, depression, posttraumatic stress (PTS), sleep disruption, substance abuse, suicide, and suicidal ideations are all potential ramifications of incurred loss as the result of an EWE [31-36].

Further, research published on the changing climate and mental health indicates that women are more likely to suffer from climate-related mental illness than men [37]. Women have less access to fundamental human rights and are more likely to live in poverty and face systemic violence that intensifies during disasters [38]. This gender-related predisposition, combined with the known challenges of the perinatal period, makes pregnant and postpartum women especially vulnerable to the effects of EWE exposure. To the authors' knowledge, the mental health ramifications of having experienced an EWE during the perinatal period have not been synthesized across multiple types of disasters.

Therefore, our research team conducted a literature review aimed at elucidating the perinatal mental health effects observed across a broad range of EWEs types, including hurricanes, tornados, tsunamis, floods, wildfires, and drought. We intend to synthesize our findings regarding the psychological effects of EWEs on the perinatal population, its impact on their offspring, and scope of protective factors related to EWE exposure during the perinatal period. Interventions and programs designed to help perinatal women through the process will be discussed to the degree they present in the literature. In this narrative review, major themes in perinatal mental health (due to EWEs) are identified and discussed.

Section 2: METHODS

The Preferred Reporting Items for Systematic Reviews and Metanalyses (PRISMA) method was applied for consistency and transparency in our search strategy (Figure 1). The databases

utilized in this search were PubMed, EMBASE, Web of Science, and PsychInfo; articles published between January 2010 to September 2020 were eligible for inclusion.

Various combinations of search terms for mental health, extreme weather events, and mothers were examined. The final search terms included for mental health were "mental health" or "mental health behavior" or "mental health disorder" or "behavior" or "depression" or "depressive order" or "anxiety" or "anxiety disorder" or "posttraumatic stress" or "posttraumatic stress disorder" or "stress" or "mood" or "mood disorder." These terms were combined with terms for EWEs, which were "extreme weather" or "disaster" or "natural disaster" or "hurricane" or "tornado" or "tsunami" or "flood" or "drought" or "extreme heat" or "extreme cold weather" or "wildfire." Both sets of terms were then combined with "mother" or "maternal."

A set of 880 articles was initially retrieved and screened for duplicates. A total of 281 duplicates were removed, leaving 599 articles for screening by title and abstract. The exclusion criteria for the screening were:

- Human-made disasters (defined as "terrorism," "war," or "nuclear war", “oil spill”, or “landslides”)
- Papers that did not meet the quality control standards set by reviewers
- Articles focused on earthquakes as there is no consensus on whether it constitutes an extreme weather event. [39]
- Non-English language papers
- Studies focused on animals

After screening and eliminating those articles that did not qualify for exclusion criteria by title and abstract, 119 full-text studies were assessed for eligibility. After full-text screening

to ensure that the study population matched our target population (pregnant or postpartum women who were exposed to EWEs) 25 studies remained (Figure 1).

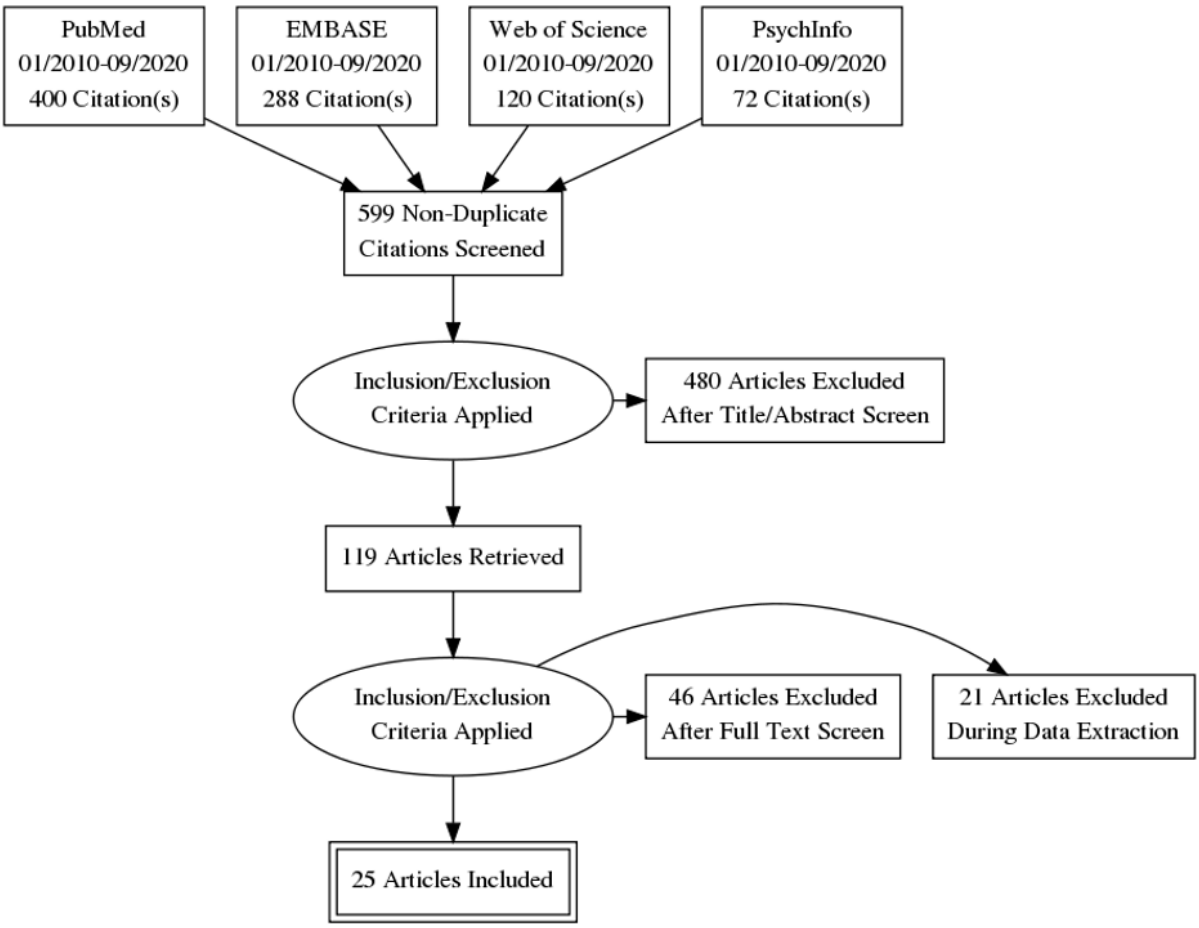

Figure 1

Section 3: GROUPING BY THEME

After obtaining the final set of papers, the principal investigators read the articles and grouped them by primary theme. Through this process, the following six themes were identified:

- EWEs and associated psychological symptoms
- Impacts of EWE trauma on offspring
- Assessment tools for EWE survivors
- Interventions and coping mechanisms accessible during and after EWEs
- Protective factors during an EWE
- Posttraumatic growth after an EWE

Our findings are presented/described by these six themes.

Section 4: RESULTS

EWEs AND ASSOCIATED PSYCHOLOGICAL SYMPTOMS:

Posttraumatic stress disorder (PTSD) and depression are the most common mental health conditions that perinatal women suffer after exposure to EWEs [40,41]. A study by Giarrtano et al. confirmed that pregnant and postpartum women who had experienced Hurricane Katrina had a higher depression and PTSD rate of 40% and 15% respectively, than the general prenatal population at 10-15% and 5-10% [42]. Another study by Pomer et al after a cyclone in Vanuatu established that although pregnant and non-pregnant women were equally susceptible to distress 3 to 4 months after the cyclone, pregnant women experienced 65.9% more distress [43].

High levels of exposure to an EWE increase an individual's vulnerability to mental health impacts [44,45]. Examples of high-level exposures to disasters include walking through floodwaters, inhalation of wildfire smoke, fear for one's life, injury, and property loss/damage.[42,46]. Pregnant women exposed to severe hardships during EWEs not only

have higher levels of depressive symptoms compared to the general population, but also lower levels of well-being several years after childbirth., In addition, their peri-traumatic distress (i.e., transient reactions to trauma exposure such as intrusive thoughts and hyperarousal) has been identified as a significant mediator of the link between disaster exposure and depression [47].

The risk for PTSD and depression is elevated for women of lower socioeconomic status (SES) relative to higher SES women [42]. Social factors such as race, low income, and being unmarried are risk factors that place women at greater risk of adverse psychological impacts [42,48].

IMPACTS OF EWE TRAUMA ON OFFSPRING

Adverse birth outcomes and (child) developmental delays are associated with maternal mental health difficulties [19,49]. Prenatal exposure to maternal stress, depression, and anxiety has been linked to changes in the development of the infant's hypothalamic-pituitary-adrenal (HPA) axis [50,51]. Furthermore, postnatal exposure psychopathology is known to influence the development of the critical emotional brain systems necessary foremotion processing later in life; this system becomes functional at around the first year of life [52,53]. Maternal mental health issues related to having experienced an EWE are known to increase the risk for adverse effects in the offspring through fetal programming, and some of those events are pre-term labor, low birth weight, and child developmental issues [54-56].

Project Ice Storm conducted by Dancause et 2011 was focused on how disaster-related prenatal maternal stress (PNMS) was associated with maternal behavioral changes which, in turn, influenced birth outcomes. They compared objective and subjective stress

effects; objective stress was defined as the severity of storm-related events experienced by pregnant women, and subjective stress assessed pregnant women's psychological reaction to the storm. The results from the study showed that high levels of subjective PNMS in early pregnancy predicted smaller head circumferences [57]. In contrast, high levels of objective PNMS predicted slightly larger head circumferences. There also appeared to be an interaction between objective and subjective PNMS [57]. Predicted birth lengths were shortest among newborns of women exposed to high levels of objective PNMS and those who reacted only minimally or had a highly reactive subjective response to low-level objective PNMS. The findings were suggestive that any in-utero exposure to the ice storms had a negative effect on the birth outcome irrespective of the mothers' social status [57].

A similar study performed by Dancause et al. 2015 after the Iowa floods indicated that stressful exposure to a natural disaster before and during pregnancy predicted greater total adiposity at age 2.5 and a more significant increase in BMI from age 2.5 to 4 years in their offspring [58] . Timing of flood exposure in pregnancy, objective hardship, and subjective distress increased variance explained by up to 10%. These two studies highlighted the impacts of disaster-related prenatal stress on birth outcomes and childhood development.

Another concrete example of impacts on offspring is the study conducted by Tees et al. 2010, where maternal stress related to Hurricane Katrina analyzed infant temperament using the Early Infancy Temperament Questionnaire (EITQ;) [59]. Women with high scores on the PTSD Checklist- Civilian version screening tool [60], Hurricane exposure questionnaire, Symptoms Checklist-90-Revised (anxiety, somatization, obsessive-compulsive tendencies, and the Edinburgh Postnatal Depression (PPD) scales reported having infants with more difficult temperaments [61].

POST-DISASTER SURVIVORS ASSESSMENT TOOLS EWE

Disaster response, especially in the mental health space, requires targeted investment and refinement to address unmet needs [62]. Provision of mental health services to vulnerable populations – such as women and children – is a recognized priority for some agencies [63].

Quite a few tools and assessments exist with the purpose of measuring post-disaster mental health ailments[64]. Certain examples present in the literature include, disaster-specific questionnaires and tools, such as Community Assessment for Public Health Emergency Response (CASPER) designed by the Centers for Disease Control and Prevention [65], were modified, and adapted to identify struggling, EWE-exposed individuals' post-disaster and support them during pregnancy and the postpartum to help with their unmet needs [66]. A document by the Indicator Development Working Group (IDWG) for the CDC with 25 indicators and measures with questions was developed to guide post-disaster assessment and surveillance for pregnant, postpartum women, and infants [67]. The document helps identify salient conditions and exposures (e.g., stress, poor mental health outcomes, degree of disaster exposure) and outcomes (e.g., maternal and birth outcomes such as low birth weight, intrauterine growth restriction) to be monitored via post-disaster data collection. Furthermore, the document would help to promote consistent measures across post-disaster zones in the US [67]. Other assessment scales, such as the Perceived Stress Scale (PSS) and Assessment of Stress of the Prenatal Psychosocial Profile (PPP), are reliable and were developed to classify stress and support (partner and social) among perinatal women post-disaster [68].

INTERVENTIONS AND COPING MECHANISMS ACCESSIBLE DURING AND AFTER EWES

An intervention was tested right after Hurricane Harvey and Fort McMurray wildfires struck to assess its relevance in the setting as previous studies have asserted increased, or

accumulated stress caused by natural disasters can surge an individual's allostatic load [69] ; the Olson et al. 2019 study first used questionnaires in Fort McMurray wildfires and hurricane Harvey settings to assess stress levels related to natural disasters amongst pregnant women and their children. After participant assessment via the questionnaires, an expressive writing intervention was implemented with the purpose of decreasing stress and increasing resilience [70,71] among the study population. Pennebaker's expressive writing intervention showed that short bursts (i.e., 15-20 mins) of writing promoted emotional disclosure [70,72] and cognitive processing [73). Expressive writing is known to help with resilience and optimism to overcome traumatic events [73].

Several programs have centered on building coping skills and resilience in perinatal EWE-exposed women [54,74,86]. Giarratano et al. 2019 [75] suggested applying the Psychological First Aid (PFA) principle that is an evidence-informed intervention which can be beneficial in a disaster-struck population. The PFA emphasizes on the Look, Listen and Link approach that indicates to learn about a traumatic event, look for safety, listen to affected people who may require support, and then link them to the resources needed [76]. Brymer et al asserts that the nurses could be mobilized to build resilience; as they have a unique opportunity to apply these PFA principles to ensure meaningful patient engagement and minimize mental health risks through supportive interventions due to their proximity to the disaster-struck areas and focused work with the perinatal population [75,77].

Savage et al. 2010 [78] studied complementary alternative therapy (CAT) use among childbearing women post-Hurricane Katrina. CAT services are utilized when mental health services are unavailable after a natural disaster. Alternative therapies commonly used during the postpartum and pregnancy include prayer, meditation, music, massage, and aromatherapy [79,80]. The qualitative analysis of the Savage et al validated the women's experiences of

distress and instability due to losses of their homes, friends, and the expected birth/new baby. In this situation, their ability to provide self-care, a key component of maternal functioning [15], through CATs and their access to traditional modalities enhanced their ability to face and overcome these losses and uncertain situations. The quantitative results of the study corresponded with the qualitative results, indicating that prayers, music, or exercise were effective techniques in terms of improving mood during pregnancy[78] . The investigators who conducted the Oni et al. 2015 study found a significant, positive association between level of hurricane exposure and frequency of induction of labor (p=0.03) and perceived stress (p=<0.01). Women who perceived higher stress levels were also at greater risk for Pregnancy-Induced Hypertension (PIH), Gestational Diabetes Mellitus (GDM), and cesarean births [81]. Certain coping styles appeared protective against pregnancy complications in the post-disaster period. The use of planning to deal with the disaster aftermath, acceptance, humor, instrumental support, and venting coping styles was associated with significantly reduced pregnancy complications, while women who used the denial coping style were more likely to develop GDM [81].

Some examples of coping strategies seen in the various other studies were emotion-focused coping methods such as positive reframing (positive reappraisal), humor, social support, and acceptance. Humor and social support were helpful for pregnant women after the Queensland floods in 2011 [74]. The emotion-focused strategy helped reduce subjective distress under low and moderative levels of uncontrollable objective hardship [74].

PROTECTIVE FACTORS DURING EWES

Humans are wired to learn from their experiences, be resilient, and cope with changing circumstances [82,83]; this is especially true of the child population [31]. The literature implicates pre-disaster social support as a protective factor for perinatal women. In fact,

women with more of it (social support) exhibit greater resilience [54,86]. Adequate support appears to have decreased stress in survivors of Hurricane Katrina and Rita [84]. This protective effect of social support is consistent across EWE types [85,86]. A study by Brock et al. 2014 [86] conducted after the Iowa floods indicated that receiving frequent support of any kind was beneficial for perinatal mental health. Issues related to intimate partner relationships–prolonged separations, tensions, and partners' infidelity, alcohol and drug abuse, and incarceration were consistent contributors to pre- and post-disaster poor mental health for the mothers. Furthermore, lack of partner support was seen as a risk factor and resulted in longer-term recovery from post-disaster mental health implications [87].

Level of EWE exposure and resilience are also related[31,39]. For example, those who experienced injury or loss during Hurricane Katrina exhibited diminished resilience relative to those whose exposure was less severe [54].

POSTTRAUMATIC GROWTH AFTER EWEs:

Posttraumatic growth was seen as another major theme in the literature [54,88]. Experiencing damage during an EWE event has been linked to several types of perceived benefits and posttraumatic growth [89,90]; hence it was associated with better resilience. Some examples of perceived benefits that the participants in the study mentioned were having gotten closer to family/friends, material benefits of getting a new house, feeling closer to the community, and being better aware of the hurricanes [54].

Section 5: DISCUSSION

The aim of this paper was to consolidate and synthesize scientific, peer-reviewed information on perinatal mental health impacts due to Extreme Weather Events (EWEs) in the past decade (i.e., 2010 to 2020). Most of the papers that emerged from the search were

focused on hurricanes, floods, and ice storms. Conversely, there was little to no data on the impacts of droughts, wildfires, and/or extreme temperature events regarding perinatal mental health. The Canada Ice storm of 1998, Hurricane Katrina of 2005, the Iowa Floods of 2008, and the Queensland Flood of 2011 were the focus of most the studies reviewed for this paper [40-42,47]. As it is well-established, pregnant, and postpartum women already bear the burden of fluctuating hormones, physical trauma of childbirth, and increased responsibility causing a strain on their mental health [23]. In addition, the stress levels from an EWE directly and indirectly impact their psychological well-being, developing fetus, and posttraumatic growth [23,91]. While the search produced articles on the negative psychological impacts of EWEs on perinatal mental health, the focus of the literature was on PTSD and depression; there is almost no consensus of other mental health problems such as anxiety and somatic disorders in the post-disaster period due to lack of research assessment and focus on these topics. Each of these studies utilized multiple questionnaires to detect various mental health problems, but the timing of assessing the mental health problems post-disaster also plays an essential role in diagnosing and capturing the symptoms [92,93].

Mental health problems such as depression and PTSD precipitated by EWEs in the perinatal population have been associated with complications in pregnancy (pre-term labor, PIH, GDM), and cognitive developmental issues in their offspring [54-56,61]. Coping and resilience interventions have proven effective in mitigating the effects of the mental health impacts in some study populations but need to be implemented more broadly for optimal impact [54,69,74,86,94].

It has also been demonstrated that exposure to pre-disaster PTEs (potentially traumatic effects) indirectly exacerbates the mental health impacts of EWEs in mothers [95-97]. EWEs can also be destabilizing and traumatic, especially if parent and child are separated at the time of the event[31]. As a mother, the safety of one's child is primary. Maternal uncertainty

regarding her child's safety during disasters is a significant post-disaster factor with the potential for causing posttraumatic stress (PTS) and psychological distress [84]. Young mothers are known to put their children's needs ahead of their own and suppress their negative emotions to protect children from further harm, in turn aggravating their own mental health problems [84,98]. Added to these difficulties, health inequity was also commonly observed in the results. Mothers who were single, belonged to a lower socioeconomic status, and were women of color suffered the most due to these frequent EWEs [54,74].

In such scenarios, there is substantial evidence that religiosity is predictive of favorable post-disaster psychological functioning, as it corresponds to more social resources and a stronger sense of optimism [94]. Religious communities nurture a sense of community, which is protective for mental health and wellness [99]. They can both fill the void in prevention and intervention efforts, especially among vulnerable populations. Religion supports coping through praying and attending services and helps build resilience by securing resources to rebuild communities[74].

Coping and resilience strategies incorporated by disaster management organizations acted as protective factors and helped to promote posttraumatic growth for most affected low socioeconomic mothers [54,74,86].The disaster relief packages that included relocation, building houses, and a better community for post-disaster support and new economic opportunities were seen as a positive impact and helped with resiliency[100,101]. The opportunity is motivational as it allows them to see their goals as attainable [74,86]. Other positive outcomes of posttraumatic growth observed were enhanced appreciation for life, closer relationships to family members, greater personal strength, and increased spirituality [88].

Section 6: STRENGTHS AND LIMITATIONS OF THE STUDY

To the authors' knowledge, this is the first study that summarizes and synthesizes information on perinatal mental health across disaster types. As Hurricane Katrina (2005), the Iowa Floods (2008), and the Queensland Flood (QF) (2011), were the more noteworthy disaster events causing a considerable amount of damage in the earlier half of the decade, the focus of a significant number of articles reviewed was on them. Since, the effects of climate change on human health is an emerging area of concern, we expect more research across a greater variety of EWE types. The disadvantage of reviewing a relatively new topical area was that the effects of certain disasters (on perinatal mental health) are not documented at all. For example, the effects of extreme cold, droughts, and other types of storms are understudied regarding their impacts on perinatal mental health.

Section 7: CONCLUSIONS

The climate crisis has been described as the greatest challenge we, as a society, have ever faced [102, 103]. Therefore, understanding the impacts of climate change on physical and mental health is paramount to our survival and requires further scientific investigation and investment. Women are often the primary caregivers in their families and their role is key to maintaining overall family wellness [15,104]. Therefore, identifying and supporting pregnant women and new mothers who have experienced Extreme Weather Events is of major public health concern. Lower socioeconomic status, a lack of social support, a history of mental health issues and living in areas prone to EWEs are just a few of the risk factors for diminished mental health outcomes for disaster survivors [31].

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