



# Mental Health Impacts of Climate Change on Women: a Scoping Review

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## Abstract

Climate change is the largest threat to human health of the twenty-first century. Women are disproportionately affected by climate change. While the physical health impacts of climate change are an active area of research, works related to the mental health impacts are less developed. Furthermore, the mental health impacts of climate change on women are a particular area of interest due to women's disproportionately negative experiences with climate change and climate change-related events. Therefore, the purpose of this scoping review is to understand what is known from the existing literature regarding the mental health impacts of climate change on women. The methods for this review follow the Arksey and O'Malley framework for a scoping review. By searching databases for publications that discuss women, mental health, and climate change, and screening for relevant work, 20 studies that met inclusion criteria were included in the review. Themes derived from the reviewed studies include negative mental health outcomes, gender-based violence, burdens of care and responsibility, attachment to land and traditions, and the importance of intersectionality. From these findings, there is a clear need for climate policies on adaptation and mitigation to reflect women's unique needs to ensure their health and safety.

**Keywords** Climate change · Gender · Women · Mental health · Scoping study

Climate change is the largest threat to human health of the twenty-first century, with the power to undermine years of public health progress [1–6]. The physical health impacts of climate change include increased risk of heat stroke, intensified and prolonged pollen season that can exacerbate asthma, increased spread of vector borne diseases such as Lyme disease and dengue fever, and worsened cardiorespiratory functioning due to worsening air pollution [2, 5, 6]. Food and water security are increasingly at risk due to drought, flooding, and ice melting, which can impact human nutrition [6–8]. Global temperatures are expected to reach 1.5 °C by 2040, which will significantly intensify existing climate change impacts, such as an increase in the intensity and frequency of the following: hot days and nights, precipitation, floods, droughts, and strong tropical cyclones [9].

All of these impacts have and will continue to have impacts on global human health [9]. While the physical effects as well as the science behind climate change are and have been continuously studied, the mental health impacts of climate change have been overlooked [10].

Women are disproportionately affected by the varying impacts of climate change [11–16]. Due to pre-existing inequities facing women, such as poverty, gender-based violence (GBV), unequal access to resources and education, constraints on movement and freedom, and disproportionate caring responsibilities, women are particularly vulnerable to climate change [11, 17]. From Australia [18], Uganda [15], South East Asia [12, 19, 20], to Canada [21], evidence suggests women face disproportionate climate-related threats to their socio-economic position, livelihood, food security, and health [22]. Furthermore, women have limited engagement in climate-related decision-making processes, preventing them from fully participating in climate policy, governance, and various aspects of climate governance and leadership [11, 16, 21, 22]. If women are not fully engaged in climate-related decision-making, we cannot expect that their needs will be met as climate impacts on human life begin to grow.

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A number of researchers have recognized this gap in the literature and have begun to study the psychosocial effects of climate change as a new, emerging field [10, 23, 24]. Studies have found that extreme weather events such as floods, wildfires, storms, and heat waves, as well as more chronic changes in weather pattern, such as sea level rise, melting permafrost and ice, and drought, can all negatively impact mental health [10, 25]. Other impacts, such as feelings of fatalism, eco-anxiety (intense fear for the future), and solastalgia (a homesickness while at home), have been related to the knowledge and awareness of climate change [23]. It is important to highlight that much of the research on climate change and mental health is conducted after an extreme weather event. Although no single extreme weather event can be conclusively directly related to or caused by climate change, it is certain the we are experiencing and will continue to experience an increase in frequency and severity of extreme weather events [26]. It is for this reason that extreme weather events are discussed so prominently in these works and are related to the changing climate.

Women are disproportionately impacted by climate change given their often-overwhelming responsibility to care for others, vulnerability to violence, and pre-existing mental health challenges [11, 27]. For example, during extreme weather events, women can be constrained by their unremitting responsibility for the care of others, are more likely to die, and experience severe increases in violence [11]. Similarly, in the case of more chronic climate change-related weather patterns, such as drought and water scarcity, women are forced to travel further and to more remote locations for access to resources than what was historically necessary, increasing their risk of being assaulted and/or abducted [27]. Globally, women experience a high prevalence of mental health challenges, particularly depression and anxiety [28]. These experiences of depression and anxiety could be due to specific risk factors that women face, such as gender-based violence, socio-economic disadvantage, subordinate social status, and the responsibility to care for others [28]. Climate change amplifies these pre-existing gender inequities and may intersect with other forms of marginalization [10].

Kaijser and Kronsell [29] suggest intersectionality should be part of discussions around climate change. Intersectionality stems from Black feminists [30–35] who identified the overlapping nature of forms of oppression, such as racism, sexism, homophobia, and classism. Most current studies focus on one determinant of health, such as gender, and

in doing so oversimplify and fail to recognize inequity as intertwined with other structures of oppression [29]. Gender can intersect with various forms of marginalization, which can affect the severity of climate impacts [29]. For example, all women are subject to disproportionate climate change impacts, yet people of color, immigrants, people living in poverty, people with pre-existing health conditions, and Indigenous peoples are at high risk [10]. Although this paper focuses on gender, the concept of intersectionality is relevant, as it takes into consideration the varying experiences and backgrounds that contribute to a woman’s experience.

While women can face disproportionate climate impacts, little research has been explored as to how climate change impacts women’s mental health specifically. This review will define women as anyone who identifies as such. Mental health will be defined broadly, as a concept that includes states of affirmative health as well as the more commonly discussed states of mental illness [10]. Furthermore, mental health will be defined holistically, as it is often defined in Indigenous ways of knowing, including spiritual well-being and connectedness to one’s environment and nature [36]. The purpose of this scoping review is to determine what is known about the impact of the changing climate on women’s mental health (Tables 1 and 2).

## Materials and Methods

This study followed the Arksey and O’Malley [37] 5-stage framework for scoping reviews, where the available scope of literature on a particular topic is assessed. Stage one begins with identifying a research question. The research question for this study was as follows: *What is known from the existing literature about the impact of climate change on women’s mental health?* Stage two seeks to identify relevant studies, where the process includes searching electronic databases, reference lists, hand-searching of key journals, and existing networks (see Fig. 1). Stage three comprises selecting the appropriate studies and eliminating studies not central to the research question (see Fig. 1). In the fourth stage, Arksey and O’Malley [37] suggest charting the data from all the selected studies, which is a process for recording information about each study such as study design, purpose, methodology, population, and results (see Table 3). The fifth stage is collating, summarizing, and reporting the results, which

**Table 1** Key search terms

| Climate change  | Mental health   | Women                              |
|---|---|------------------------------------|
| “climat* change” OR “global warming” OR “greenhouse effect” OR “greenhouse gases” | (mental* OR psych* OR emotional*) N3 (health* OR well*) | Woman OR women OR girl* OR female* |

**Table 2** Inclusion and exclusion criteria

| Inclusion   | Exclusion   |
|---|---|
| Publications between the dates of 2007 and 2020, as the 2007 edition of Lancet Countdown on Climate Change and Health declared that climate change is the largest threat to public health of the twenty-first century   | Publications before 2007  |
| Publications in English   | Publications in languages other than English  |
| Publications that include the experiences/data of women, young women, girls, gender non-binary femme-identified people, and Two-Spirit people   | Publications that focus solely on the experiences and health of men or that combine men and women in an overall population                                |
| Publications that include the three main concepts: climate change (weather events, changes in weather pattern, or knowledge of climate change), mental health, and gender (women, young women, girls, gender non-binary femme-identified people, and Two-Spirit people) | Publications that focus strictly on physical health, matters unrelated to the anthropogenic changes in climate, or do not mention gender in study results |
| Location of study can be global   |   |

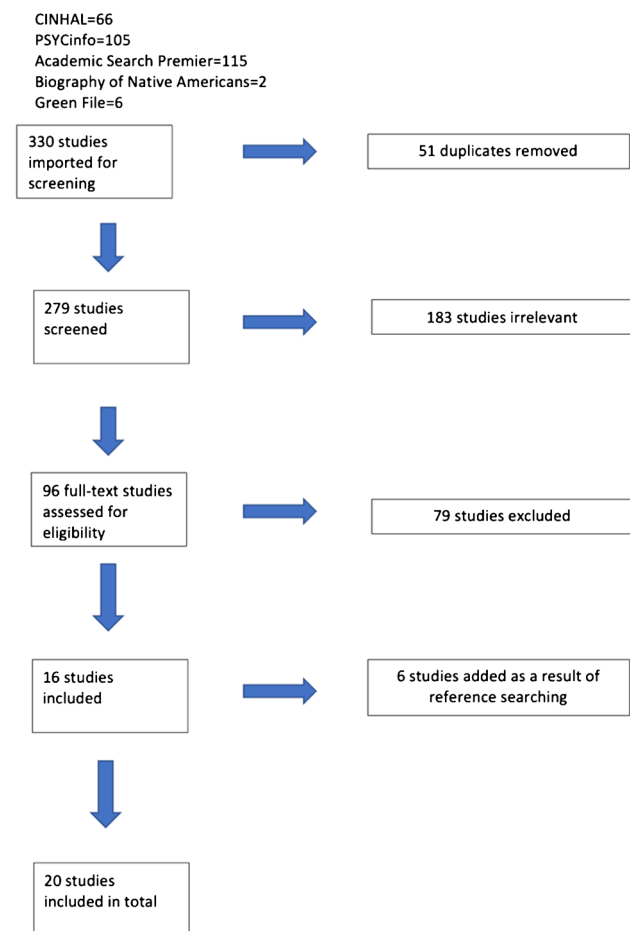
includes giving basic numerical analysis of extent, nature, and geographic distribution of studies in the review, as well as organizing the literature thematically [37]. Scoping reviews are useful for discovering the breadth of knowledge on emerging, understudied, and complex

topics, making climate impacts on women’s mental health an appropriate topic for review [37].

### Search Strategy

The search strategy used in this review was developed in consultation with a Health Sciences librarian from Dalhousie University. Potential publications to consider for this review were found by searching the databases CINAHL, PsycINFO Academic Search Premier, Biography of Native Americans, Green File, and Medline. Key topics used included climate change, mental health, and gender. Key search terms provided in Table 1 were used for searches in each database. Appropriate subject headings were then used in each database. For example, the subject heading “climate change” was exploded into numerous search terms such as (ZU “climate change”) or ((ZU “global warming”)) or ((ZU “greenhouse effect”) or (ZU “greenhouse gas laws”) or (ZU “greenhouse gas mitigation”) or (ZU “greenhouse gas mitigation laws”) or (ZU “greenhouse gases research”) or (ZU “greenhouses & the environment”) or (ZU “greenhouses in art”)) or ((ZU “climate change & arctic sustainable development: scientific, social, cultural & educational challenges (book)”) to capture studies that may have used different terminologies. The same was done for “mental health” and “women.”

Most studies in the field of climate change and mental health are centered on the impacts of an extreme weather event. Although it is difficult to attribute one single event entirely to climate change, climate scientists have been increasingly able to calculate the degree to which events are caused by climate change by using modeling technology [38]. Such modeling attribution studies have not been conducted on the particular extreme weather events included in this review; however, studies on extreme weather events have been included on the basis that climate change has and will continue to increase the frequency and severity of extreme weather events [13, 26]. The study of singular

**Fig. 1** Search process

**Table 3** Chart

| Authors (years); country   | Study purpose   | Population   | Design/methodology  | Key points   |
|--|---|--|---|--|
| Ajibade et al. (2013); Nigeria                                   | To explore the impacts of the 2011 flood event on women's lives, livelihoods, and health  | Low-, middle-, and high-income women in Lagos, Nigeria                                 | Mixed methods: interviews, focus groups, and survey               | <ul style="list-style-type: none"> <li>• Women reported being anxious about the health and safety of their children — flood management and childcare are women's problems, so when the skies get gray, women's minds cannot rest</li> <li>• The home is everything to participants (beyond shelter) — when the rainstorm attacks the home, it has a profound impact on women's well-being</li> <li>• Women reported experiencing high stress and a decline in their sense of peace</li> </ul>  |
| Alston (2013); Includes literature from Australia and Bangladesh | To argue that climate action requires strategies that are gender sensitive and that further research on climate change, adaptations, and actions should include a gender analysis | N/A  | Review of the literature  | <ul style="list-style-type: none"> <li>• Post-disaster sites can lead to post-traumatic stress disorders, and an increase in GBV is universal</li> <li>• Women report feeling overwhelmed by the loss of their homes, livelihoods, and possessions</li> <li>• Women take on the burden of caring work post-disaster, providing emotional support to family members without attending to their own needs</li> </ul>   |
| Anastario et al. (2009); USA                                     | To assess changes in the rates of GBV after Hurricane Katrina among internally displaced people   | Women living in a travel trailer park in Mississippi who experienced Hurricane Katrina | Quantitative: cross-sectional randomized surveys in 2006 and 2007 | <ul style="list-style-type: none"> <li>• Gender-based violence remained greater than twice the baseline rate up to 2 years following the displacement</li> <li>• The most rapid increase in all types of violence occurred in the first year following the disaster and continued to escalate in the 2 years following displacement</li> <li>• The prevalence of intimate partner violence increased the most</li> <li>• Recent and lifetime rates of GBV were significantly associated with an increased risk for MDD, depressive symptoms, and suicidal ideation. Suicide attempts were only associated with lifetime GBV</li> </ul> |

Table 3 (continued)

| Authors (years); country                                  | Study purpose   | Population  | Design/methodology  | Key points   |
|---|---|---|---|--|
| Beaumier & Ford (2010); Igloodlik, Nunavut                | To explore the determinants of food security among Inuit women  | Inuit women living in Igloodlik   | Qualitative: interviews and focus groups  | <ul style="list-style-type: none"> <li>• More than half of participants reported feeling anxious about running out of food during the past year</li> <li>• To cope, women skip meals and/or cut the size of their meal to let other family members eat, rely on sharing networks, and sell their personal items/assets</li> <li>• Climate change has resulted in fewer full-time hunters and thus increasing difficulty in obtaining food</li> <li>• Women worry about GBV and violence in the regional center during the last flood, with one participant mentioning the increase in the cost of living due to climate change making it more difficult for women to leave domestic violence situations</li> <li>• Women were worried about the psychological damage caused by domestic violence that diminishes women's self-esteem and confidence</li> <li>• Women are often in charge of purchasing household goods and can be put to blame when there is climate-related price inflation</li> <li>• Women expressed sadness in response to the changing climate due to the following: <ul style="list-style-type: none"> <li>• Concern for the local ecology</li> <li>• Concern for the future generation</li> <li>• Deep attachment to the land</li> <li>• Change in landscape's impacts on family traditions</li> </ul> </li> <li>• Long-term exposure to high temperature, age, and female gender were found to be risk factors for developing MDD</li> <li>• In the younger group (20–64 years), women were more susceptible than men to heat-related MDD</li> </ul> |
| Boetto & McKinnon (2013); Australia                       | To explore the gendered nature of health impacts related to climate change in rural Australia             | Women who either worked for women's services or have activist roles within the community pertaining to women's services | Qualitative: interviews   |  |
| Bray et al. (2018); Fiji, Cyprus, New Zealand, and the UK | To explore how gender can lead to different emotional responses to climate change across 4 island nations | Women and men living in the 4 island nations  | Qualitative: interviews   |  |
| Chen et al. (2018); Taiwan                                | To investigate the association with long-term exposure to high temperature and MDD                        | All citizens of Taiwan that used national health insurance between the years of 2003 and 2013                           | Quantitative: series of statistical tests performed on data to explore heat exposure and incidence of MDD |  |

**Table 3** (continued)

| Authors (years); country                           | Study purpose   | Population                                      | Design/methodology                            | Key points   |
|--|---|---|---|--|
| Cunsolo Willox et al. (2012); Rigolet, Nunatsiavut | To examine the connections among climate change, sense of place, and health in an Inuit context   | Members of the community of Rigolet, aged 29–43 | Mixed methods: interviews and questionnaires  | <ul style="list-style-type: none"> <li>• All respondents reported a strong love for and attachment to the land, as well as a sense of place</li> <li>• Women scored higher than men on the emotional response to climate change in all categories (frustration, sadness, fear, anger, helplessness, distress) except for anxiety</li> </ul>  |
| Dean & Stain (2010); Australia                     | To follow up with adolescents from a previous study location (rural) and determine if their resilience remained after ongoing drought 3 years later | Rural Australian adolescents                    | Mixed methods: focus groups and questionnaire | <ul style="list-style-type: none"> <li>• Gender had a significant interaction effect for emotion, peer problems, and prosocial behavior</li> <li>• Girls reported significantly higher levels of prosocial behavior and emotional difficulties than boys</li> <li>• Adolescent girls had more total difficulties than the normative population, with older girls more significantly affected</li> <li>• The emotion subscale scores for this study were significantly higher than both the previous study (2007) and Australian norms</li> </ul>   |
| Demetriades & Esplen (2008); N/A                   | To unpack the links between gender, poverty, and climate mitigation and adaptation  | N/A   | Review of the literature                      | <ul style="list-style-type: none"> <li>• Complex intersections between gender, race, sexuality, age, and geography need to be considered in current climate analyses, as “women” are not a homogenous group</li> <li>• Women and girls may face mental health consequences of climate change because of gender discrimination in the allocation of household resources, including nutrition and medicines</li> <li>• Women and girls in many societies can also face social and material barriers to healthcare services due to limited funds, cultural and/or religious restriction on solo mobility</li> <li>• Women and girls can become likely to face domestic and sexual violence after a disaster, with adolescent girls reporting especially high levels of sexual harassment and lack of privacy</li> </ul> |

Table 3 (continued)

| Authors (years); country                  | Study purpose   | Population  | Design/methodology  | Key points   |
|---|---|---|---|--|
| Dodd et al. (2017)                        | To explore the lived experiences of four communities in the Northwest Territories in relation to the 2014 wildfire season | Community members from Yellowknife, N'Dilo, Detah, and Kakisa   | Community-based partnership qualitative research: interviews<br>Part of a larger project: "Summer of Smoke: A Mixed-Methods Examination of the Health Effects of Record Wildfire Season in Canada's North West Territories" | <ul style="list-style-type: none"> <li>• Women participants found the wildfires frightening and anxiety-inducing</li> <li>• Women felt that not being able to go outside negatively impacted the sense of community</li> <li>• Women reported detachment to the land, leading to emotional and spiritual impacts, which was particularly underscored in First Nation interviews</li> </ul>   |
| Durkalec (2013); Nain, Nunatsiavut        | To examine the relationship between health and sea ice for Inuit and Kablunãgajuit (mixed ancestry)                       | Inuit and Kablunãgajuit men and women, where some participants were expert ice travellers   | Community-based participatory: interviews and focus groups  | <ul style="list-style-type: none"> <li>• Women reported being scared, nervous, and disappointed because of changing conditions</li> <li>• More women than men reported mental/emotional health benefits from going off on sea ice</li> <li>• Less female than male participants reported travelling during the whole ice season (new ice and late spring ice) and were less likely to travel alone than men</li> <li>• A female expert traveller reported that one cannot trust the ice anymore</li> </ul>   |
| Durkalec et al. (2015); Nain, Nunatsiavut | To examine the role of environment for Inuit health in the changing climate   | Sea ice travellers and users that have lived in Nain for at least 20 years and are beneficiaries of the Labrador Inuit Land Claim Agreement | Qualitative: interviews and focus groups, which were separated by gender to increase participant comfort  | <ul style="list-style-type: none"> <li>• The female focus group reported feeling disappointed, unhappy, and lacking motivation due to the restricted ice travel brought about by changing ice conditions</li> <li>• Women also mentioned impacts to their cultural well-being, noting how sea ice is their way of living, and different places connect them to traditions and history</li> <li>• Women participants reported feeling worried about cocoa prices dropping due to drought and flooding, and thus being unable to afford their children's school fees, sparking concern for educational opportunities</li> <li>• Women were also concerned with household food security during flooding and droughts</li> </ul> |
| Eissler (2019)                            | To explore household dynamics of small-scale cacao producers and understand gender divisions of labor in Indonesia        | Small-scale Indonesian cacao farmers in Lampung and South Sulawesi  | Mixed methods: two qualitative case studies of different Indonesian provinces using interviews, as well as surveys and data from the Swisscontact's CocoaTrace database   | <ul style="list-style-type: none"> <li>• Women participants reported feeling worried about cocoa prices dropping due to drought and flooding, and thus being unable to afford their children's school fees, sparking concern for educational opportunities</li> <li>• Women were also concerned with household food security during flooding and droughts</li> </ul>   |

**Table 3** (continued)

| Authors (years); country      | Study purpose  | Population  | Design/methodology  | Key points  |
|-------------------------------|--|---|---|---|
| Hayes (2019); Canada          | To explore the psychosocial impacts of climate change and adaptation opportunities in High River, Alberta in relation to the 2013 Southern Alberta floods                                    | Community members that experienced the 2013 flood and self-identified as one or more of the following: “female, youth, elderly, non-white, someone with low SES, someone with pre-existing health concerns,” as well as “key informant” health care providers | Qualitative: desktop climate change and health vulnerability adaptation assessment including < 100 data sources, interviews, and focus groups | <ul style="list-style-type: none"> <li>• Women and people experiencing other marginalities (that can intersect) such as seniors, children, non-white ethnicity, immigrants, people with pre-existing health conditions, and people with low SES are at risk for mental health concerns after an extreme weather event</li> <li>• Women accessed more mental health services for depression and anxiety after the flood</li> <li>• There was an increase in prescriptions for anti-anxiety medication for women following the 2013 flood</li> <li>• There was an increase in sexual assaults following the 2013 flood</li> <li>• Women who migrated for financial reasons may have done so to support their family, potentially due to their husbands struggling with climate-related drought and loss of cattle</li> <li>• Both women who migrated for financial reasons and education home, stressors, social isolation, and loneliness</li> <li>• Women from studies in this review struggled with choosing what water sources to provide to their family, as contaminated water could be unsafe, leading to stress and poor mental health</li> <li>• Women’s spiritual health was compromised when water sources put family members at risk or become ill from contaminated water</li> </ul> |
| Jowell et al. (2017) Tanzania | To explore women’s experience migrating from rural traditional Maasai territory to urban cities and Tanzania   | Maasai women who have migrated from rural to urban centers for education or monetary reasons  | Qualitative: interviews   |   |
| Kevany and Huisingsh (2013)   | To explore the climate change-related water challenges, such as rising sea levels, water salination, and rainfall inconsistencies, and reveal innovations that draw water and women together | N/A   | Literature review   |   |



Table 3 (continued)

| Authors (years); country        | Study purpose  | Population   | Design/methodology   | Key points   |
|---------------------------------|--|--|--|--|
| Mamun et al. (2019); Bangladesh | To investigate the prevalence of depression among Bangladeshi women after surviving Cyclone Mora                     | Women residing in the village of Dalbhanga above the age of 18 | Quantitative: interviews used the Bangla PHQ-9 survey to screen women for depression | <ul style="list-style-type: none"> <li>• Younger women fulfilled the criteria for depression more than older women</li> <li>• Being physically injured from the cyclone and having to miss work were identified as risk factors for depression</li> <li>• The depression rate among women was 65%, which is a higher prevalence than other populations after sustaining a natural disaster</li> <li>• Roughly 30% of women did not receive a disaster alert notification</li> <li>• Being female is a risk factor for adverse psychosocial outcomes after a natural disaster because of the following:               <ul style="list-style-type: none"> <li>- Women have limited access to services during and after the disaster</li> <li>- Women have sometimes unattainable expectations to fulfill family roles and responsibilities post-disaster, potentially causing guilt and depression</li> <li>- Women may suffer mental strain due to sexual harassment while waiting in lines for food and supplies</li> <li>- Women may become widows after a disaster, rendering them poor for the rest of their lives, which is a significant risk factor for mental illness</li> </ul> </li> <li>• Both cognitive risk judgements (of probability) of serious negative consequences of climate change and affective risk judgements (worry) were predicted by knowledge of climate change</li> <li>• Women were more worried than men but equal to men with respect to cognitive risk judgements</li> </ul> |
| Nahar et al. (2014); Bangladesh | To propose a model that sustainably improves post-disaster mental health services for vulnerable Bangladeshis        | N/A  | Debate paper   |  |
| Sundblad et al. (2007); Sweden  | To understand the demographic factors (such as gender) that are associated with risk judgements about climate change | Randomly sampled Swedish residents                             | Quantitative: questionnaire  |  |

extreme weather events can provide knowledge on how best to adapt, in this case, from a psychosocial lens, to a future where extreme weather events are more intense and frequent. To narrow the search, keep the focus closely related to climate change, and to ensure this was not a review of only extreme weather events, studies included had to have mentioned climate change in their work, even briefly, as potentially related to their central study focus. Thus, the three main search terms below remain strictly related to the central focus of this review yet will likely capture many instances of study on extreme weather events.

## Selection of Relevant Studies

This review included studies published between January 1, 2007, and January 29, 2021 (when the search was conducted) that discussed women's mental health in relation to climate change. This time frame was set according to the 2007 publication of *Lancet Countdown on Climate Change and Health* that determined climate change to be the largest threat to public health [1]. Using the Arksey and O'Malley framework [37], studies were first screened by title and abstract. At this stage, each study was screened by two reviewers using Covidence software and the inclusion and exclusion criteria are presented in Table 2. At the full-text revision stage, articles were screened by two reviewers, and a third reviewer assisted in resolving conflicts.

Data from each of the final selection of articles was extracted and charted using Microsoft Excel by the first author and reviewed by the last author. The Arksey and O'Malley [37] descriptive-analytical approach to extraction was used to guide charting (shown in Table 3). Themes were developed iteratively by the first author using guidance from the Braun and Clark [39] method for thematic analysis, which were later reviewed by the last author [37]. All authors came together to discuss themes, which were then refined by the lead author.

## Results

### Search Outcome

Through the database search, a total of 330 publications were identified. Of these, 51 duplicates were removed, resulting in 279 studies screened. Screening titles and abstracts resulted in the exclusion of 183 studies, meaning 96 articles were assessed at full text for eligibility. Sixteen articles were included following full-text review. Four additional articles were identified through reference-list searching, where the reference list of all 16 publications was searched for relevant work that fits inclusion and exclusion criteria. This process

resulted in 20 relevant publications being included in this review. The search process and outcome are visible in Fig. 1.

Although this review included literature from the past 13 years, the majority of included studies [15] were from the past 7 years. There was a wide range of study locations, with several taking place in Australia and/or New Zealand [4], Bangladesh [3], and Inuit Nunangat [4], most likely due to the significant climate change impacts in these regions. Eight of the included studies were qualitative, of which three used a participatory or community-based methodology. Four studies were quantitative, four used mixed-methods, and four were reviews of the literature, of which one was a commentary-style publication. Extracted study characteristics are summarized in Table 3.

Of the included studies, only two focused on all three of this review's key concepts (climate change, gender, and mental health) fully and equally [40, 41]. Most included studies [10] focused on climate change and mental health, with a lesser focus on gender [25, 42]. Other studies focused on climate change and gender, but mental health was not a primary component or outcome [6, 43, 44]. A few studies focused specifically on gender and mental health but were less focused on climate change [3, 45]. Depending on their focus, all studies either recommend that mental health be considered in climate discussions and adaptations or that responses and policies need to consider gender and/or the voices of women in decision-making.

### Themes

Of the 20 included articles, five themes were developed through thematic analysis: gender-based violence, burden of care and responsibility, and connection to the land, culture, and tradition and the importance of intersectionality.

### Negative Mental Health Outcomes

Authors of the selected studies often described how participants experienced negative emotions, such as worry, stress, and sadness. Publications ranged from using general language, such as "emotional difficulties" [46], or "mental health concerns" [47], to specific fears and anxieties. For example, two studies noted the anxiety women felt about the ice melting in Inuit land north of Canada, where some women reported feeling scared and nervous to use ice for hunting and travelling [48], leading to anxiety about food security [43]. Across the globe, Ajibade and colleagues [8] found that women in Nigeria reported feeling anxious regarding the health and safety of their children after flooding, due to the heightened risk of falling into a stream or contracting infectious water-borne diseases. Women in Australia reported worrying for the well-being of other women due to financial hardships caused by climate change [44].

Finally, findings from a Swedish study suggest that women, overall, worry more than men about climate change [49].

A negative emotion highlighted as important by several studies was sadness. One study found that sadness was an emotion experienced by women as a result of climate change across four island nations [40]. Furthermore, Inuit women participants from a study in Nain reported that if they could not access the sea ice, now melting due to climate change, they would be sad and unwell [50]. The same study reported that women also felt disappointed, unmotivated, and unhappy due to climate change related to restricted ice travel. These responses to climate change and ice are similar across other studies conducted in Inuit Nunangat. For example, Inuit women in the town of Rigolet, Nunatsiavut, displayed negative emotions through a survey, where they rated having high levels of frustration, sadness, fear, anger, helplessness, and distress in response to the changing climate [25]. These negative emotions, although serious, were not specifically linked to any clinically diagnosed mental disorders; however, other studies explored mental illness directly [25, 40, 50].

Five studies noted that climate change could increase the risk of psychological disorders among women, either through changes in weather patterns or extreme weather events. According to a study conducted in Taiwan [51], an increase in global temperature could increase the risk of women aged 20–64 for developing major depressive disorder (MDD). In terms of extreme weather events, Hayes [42] noted that not only was there an increase in prescriptions for anti-anxiety medications for women following the 2013 Alberta, Canada flood, but more women were also seen accessing mental health services for depression and anxiety post-flood. Similarly, Alston [11] notes that post-disaster sites can lead to post-traumatic stress disorders for women, and Mamun [41] found that 65% of women post-disaster in Bangladesh experienced depression. Post-disaster sites can also be physically dangerous places for women; Anastario et al. [45] reported there was a significant increase in gender-based violence (GBV) following Hurricane Katrina in the USA, which was found to increase women's risk of developing MDD and suicidal ideation.

### Gender-Based Violence

A review by Alston [11] notes that there is an increase in GBV following extreme weather events, from Bangladesh to Australia. This has been revealed in a number of articles included in this study; for example, after the 2013 flood in Alberta, Canada, High River experienced increased rates of sexual assault [42]. In a study in Australia, women participants noted they were worried about the next flood due to the increase in domestic violence incidents from the last flood [44]. Demetriade and Esplen [47] suggested that women and

girls face domestic and sexual violence after a disaster, with adolescent girls reporting especially high rates of sexual violence and lack of privacy. Similarly, women in Bangladesh reported sexual harassment while waiting in lines for food and supplies after extreme weather events [52]. Finally, a study conducted by Anastario et al. [45] investigated the rates of GBV after Hurricane Katrina in the USA among an internally displaced community in Mississippi. Through a survey, it was found that GBV, and particularly intimate partner GBV, increased significantly in the year following the hurricane [45]. The increase in GBV was significantly associated with mental health challenges [45].

Women living rurally and women with low socio-economic status are further at risk for GBV [8, 44]. For example, women in rural Australia reported facing more GBV than the urban average, and how climate change worsened this issue by increasing the cost of living; thus, it is more difficult for women to leave domestic violence situations [44]. Similarly, women with low socio-economic status in Laos, Nigeria, already face high rates of domestic violence and other gender inequities that make day-to-day life challenging [8]. Women in Australia reported worrying about the psychological and emotional damage caused by domestic violence, where women's self-esteem and confidence can be diminished [44]. Furthermore, the increase cost of living increases precipitated by climate change can get blamed on rural women because they are often responsible for purchasing household goods [44].

### Burden of Care and Responsibility

Six studies [8, 11, 20, 43, 47, 53] discussed how women's caregiving responsibilities are amplified by climate change and can have adverse impacts on mental health. For example, one study reported that, because it is often the responsibility of women to clean, cook, and ensure family well-being, their work is significantly heightened after a major flood, resulting in a decreased sense of peace [8]. Similarly, Alston [11] noted that women take on the burden of care work in post-disaster sites, where they often provide emotional support to their family members without attending to their own needs.

Women in Igloodik, Nunavut, reported putting their families first when climate change results in resource scarcity, as they reported skipping meals, reducing the size of their meals, and selling personal items and assets to ensure their family eats [43]. Similarly, Eissler [20] found that drought and flooding in Indonesia lead women to worry about household food security, in addition to their children's educational fees and future employment opportunities. Nahar and colleagues [52] suggest that women in Bangladesh sometimes have unattainable expectations to fulfill family roles and responsibility post-disaster, which could cause feelings of guilt. Kevany and Huisingh [53] report similar unattainable

expectations for women in times of climate change–related water insecurity, wherein women face mental and spiritual challenges. Both Kevany and Huisingsh [53] and Demetriades and Esplen (2008) suggest that women’s caring obligations prevent them from being able to contribute to community-level decision-making on climate change, resulting in their specific needs being overlooked.

### Connection to the Land, Culture, and Traditions

Six included studies [8, 25, 40, 48, 50, 54] indicated that climate change is challenging for women in particular due to their deep connection to the land, culture, and traditions. To the participants in a Nigerian study, the home environment is important to women and provides a sense of comfort; in other words, it is not just shelter, but a maternity center, safe haven, and livelihood [8]. Thus, when climate-driven disasters destroy the very homes that facilitate tradition and security, there can be significant impacts on the well-being of women.

The same positive emotions evoked in the homes of women in Nigeria are evoked by the sea ice in women in Nain, with participants reporting mental, spiritual, emotional, cultural, and social health benefits from going off on the sea ice [48, 50]. Authors report how the sea ice is women’s way of living, and that different places connect them to traditions and histories [50]. Another study discusses women’s strong love for and attachment with the land, and how it gives them a sense of place [25]. These relationships with the land can be strained as climate change warms the ice and renders weather patterns unpredictable [25, 48, 50]. Dodd and colleagues [54] note how women reported being unable to partake in traditional summer activities due to record-breaking wildfires, indicating a pain that came with a separation from the land. Finally, women in Fiji, New Zealand, the UK, and Cyprus all reported a deep attachment to their landscapes [40]. The authors reported that changing landscapes evoke sadness in the women because their family traditions of farming and hunting are becoming harder and less accessible due to climate change, with the potential to lose traditions all together [40].

### Importance of Intersectionality

Many studies note the intersections of gender, age, race, and socio-economic status as important to discuss both in recommendations and in theory. For example, while Ajibade et al. [8] suggest gender equality is needed in the labor market and the household, it is also noted that being middle or upper class protects women against the worst effects of gender biases and disaster impacts. Thus, it is recommended that the intersection of gender relations and roles, class, place, employment, status, and social entitlement such

as healthcare be addressed in order to protect all women [8]. Jowell and colleagues [55] noted the differences of the impacts of climate-driven immigration on Maasai women in Tanzania, where educated women struggled significantly less than other migrant women, suggesting a need for more targeted interventions. Similarly, Nahar et al. [52] suggest that special attention and care be paid to women with low socio-economic status in Bangladesh before, during, and after extreme weather. For example, women with low socio-economic statuses might need to be warned of upcoming weather disasters differently than those with access to cell phones and televisions and may need other specific supports during and after extreme weather [52].

Demetriades and Esplen (2008) discourage the use of the word “women” as if it is a homogenous group. Authors argue that intersections of race, sexuality, age, and geography must be taken into account when discussing the challenges of climate change [47]. The importance of geography is illustrated by du Bray et al. (2018) where it was noted that women living in New Zealand and the UK had different reasons for being sad than women living in Fiji and Cyprus (all island nations have different adaptive capacities), indicating the importance of intersections between gender and climatic vulnerability when discussing emotional responses to climate change. Women living in rural Australia have different vulnerabilities and challenges concerning climate change than urban Australian women [44]. Similarly, Kevany and Huisingsh [53] discuss the additional challenges that poor and rural women face during climatic changes, such as being forced to travel long distances to retrieve water which may involve sleep deprivation, stress, and fear of unreliable water sources. Overall, women of varying ages, races, socio-economic statuses, and places across the globe are impacted differently by the changing climate.

## Discussion

This scoping review reveals a growing body of research on the impacts of climate change on women’s mental health. Studies were diverse in design and findings, but similar enough to allow for theme development. Themes are distinct but deeply interrelated in instances, especially the theme of intersectionality, where race, geography, and age can impact negative mental health outcomes, GBV, responsibility of care, and culture and traditions. The themes detail women’s experiences and their mental health within a changing climate. Women experience a wide range of emotions due to climate change, with some experiencing specific psychological disorders such as anxiety, MMD, and PTSD. While it cannot be determined that climate change is the only cause of these disorders, studies indicate the importance of climate change as a negative influence on mental health. Negative

emotions and mental health disorders were then discussed in relation to the increase in GBV that women can experience post-disaster, where different studies discuss the psychological and emotional damage caused by domestic violence.

Women's responsibility to care for others is increased during an extreme weather event or in times of climate-related food scarcity. Studies discussed in this theme listed different tasks that women are responsible for and how they fulfill the needs of others before fulfilling their own in times of disaster. While women seem to have heightened responsibility, they also have further attachment to land, place, and traditions, thus increasing emotional difficulties when such ties are under threat due to climate change. Finally, the majority of studies discuss clearly the ways in which women's experiences of climate change differ according to age, race, income, and geography. This finding is in keeping with literature that deems conversations of gender and climate change alone too simplistic, as there are so many other factors at play that shape experiences of climate change [29].

Another theme well aligned with other literature was the impacts of extreme weather and changing weather patterns, where much of the current literature indicates that floods, wildfires, storms, and heat waves, as well as more chronic changes in weather pattern, such as sea level rise, melting permafrost and ice, and drought, can all negatively impact mental health [10, 24]. Furthermore, themes of gender-based violence and women's responsibility for care are consistent with the broader literature. For instance, Meyiwa et al. [27] discuss the impacts of gender-based violence and the unequal division of labor between men and women, which the World Health Organization [28] suggests could contribute to women's worldwide experience of disproportionate mental health challenges. Conversely, women's connection to land, culture, and tradition was a theme less discussed among the broader literature. While newer studies have begun to discuss the importance of nature for women and girls [56], this theme has not been previously reported on in relation to climate change and thus adds to the literature.

This review revealed gaps in the literature, where a lack of focus on women, age, and awareness of climate change was present in many studies. For example, just seven publications focused on women participants alone, without comparison to men. In other publications, either women were directly compared to men or gender was only briefly mentioned in the analysis. Of the seven studies that focused solely on women, three had a strong focus on mental health, whereas others only briefly mentioned factors relating to mental health. Furthermore, although age was identified as an important factor to consider when discussing gender and climate change, only one study focused on the experiences of youth, where the rest concentrated on adults or older adults. Finally, all but two publications from the 20 selected for review were completed in relation or response to an extreme weather event or

change, such as flooding, ice melting, storms, or wildfires. There was a lack of publications dedicated to analyzing the emotional distress related to the knowledge and awareness of the climate crisis, which has been identified by several authors as an important area of study [10, 23, 57].

## Recommendations for Future Research

To address the identified gaps in literature, future research should specifically explore women's experiences with climate change, as this review indicates that women face particular challenges regarding mental well-being and the changing climate. Studies should refrain from simply comparing women to men, as this was reported in the review frequently, yet there was limited literature with a complete focus on women's mental health. Furthermore, it is suggested that future research conduct studies with youth, as this review has indicated age as a possible factor that impacts the experience of climate change and where young women may be significantly impacted. Research should also consider exploring the gendered impact of knowledge and awareness of the overarching problems humans worldwide face due to climate change, as there is currently little study of this topic with a gendered lens. An interesting area for future research is to explore the ways in which women are connected to land, culture, and traditions, and how this connection may be impacted by the changing climate. Further exploration of, and strengthening of, women's relationships with the land can improve women's health and planetary health through reciprocal health-promoting relationships between women and the natural world. Finally, as further research emerges on women, mental health, and climate change, future research may be able to compare and contrast women's experiences across the globe and throughout different environments, climates, and cultures.

## Strengths and Limitations

This review identified studies examining women's mental health in the changing climate. To date, studies have primarily focused on gender and climate change, or mental health and climate change. To our knowledge, this is the first review that has explored both emerging fields together to uncover what is known about women's mental health during the climate crisis. Another strength of this review is that we were able to identify gaps in the current literature that can inform aspects of future research. The use of the Arksey and O'Malley [37] framework strengthened the process of identifying, extracting, and analyzing publications for this review. Finally, this work was conducted by a team of researchers with expertise in gender research.

Scoping reviews do not assess quality of literature; therefore, the authors of this review cannot speak to the quality of

publications included in this review. Furthermore, due to the limited number of publications surrounding this topic and the fact that climate change is a global phenomenon, studies from all over Earth were included, making it challenging and beyond the scope of this study to compare and contrast women's experiences globally. Due to the global nature of the literature, it is highly possible that only including publications written in English in this review limited the scope of research displayed.

## Implications

Findings from such investigations could develop a stronger evidence base on health inequities and the climate crisis and push forward equity-based solutions on climate adaptation and mitigation. The broad negative mental health outcomes discussed in theme one are relevant not only for researchers to build upon, but also for mental health professionals to consider when providing treatment to women, particularly those who have survived extreme weather, or are experiencing a change in weather patterns. The information on mental health and gender-based violence should be recognized by policymakers, especially in the field of emergency preparedness and response, as it is clear that women face an increased risk for violence after extreme weather, as well as during changes in weather patterns. These data should be integrated into public safety strategies to protect women. Policymakers should also understand the burden of care and responsibility that women experience, and how it is amplified by climate change. Policymakers have the chance to recognize women's work by advocating for free childcare or payment for the unpaid work of mothers and daughters. Service providers for mental health initiatives in programs may also take into consideration the connection between women, land, and culture, as a strengthening of these connections may promote human health, especially for Indigenous peoples, as well as bolster environmental stewardship. Finally, all researchers, policymakers, mental health professionals, and service providers should consider intersectionality in their work, as findings from this review suggest that intersections of the structural determinants of health are important in the context of climate change.

## Conclusions

This review provides a scope of the current knowledge on the mental health of women in a changing climate. Women from the 20 selected studies experienced negative mental health outcomes, such as anxiety and depression, as well as gender-based violence as a result of climate changes. Furthermore, studies illustrated how women's traditional role as a caretaker can further impact them during and after

climate change-related events, as well as how the loss of traditions and changing landscapes particularly impacts women. Finally, most studies stated that although women face inequity in climate change, experiences can differ based on broader determinants of health such as age, race, income, and geography. Gaps from the literature include a lack of focus on women, age, and awareness of climate change. Further research should focus on women, youth, and the mental health impacts of knowledge and awareness of climate change to fill the current gaps in the literature. Additional exploration of these topics could be important for women's health, planetary health, policymakers, and health professionals.

## Declarations

**Conflict of interest** The authors declare no competing interests.

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