



Gender at the crossroads of mental health and climate change: A scoping review



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ABSTRACT

The global intensification of environmental change and its resulting impacts on mental health are becoming increasingly evident, with gender mediating these outcomes. The primary goal of this scoping review is to highlight gender-specific mental health exposures and experiences in the face of climatic stressors. We further examine the role of climate responses in perpetuating climate-induced mental health impacts on men and women in existing literature. We synthesized studies published since 2010 using six electronic bibliographic databases. We identified 3640 studies, which were imported into Covidence, and only 43 studies were utilized to perform our analysis. The studies were spatially categorized based on the Sustainable Development Goals (SDG) regions. Most of the studies were conducted in Australia and New Zealand ($n = 9$) and Central and Southern Asia ($n = 9$). Only seven studies explicitly indicated their guiding theoretical approaches or frameworks. Twenty-six studies focused on both men and women, fifteen on women only, and one on adolescents and children. No studies exclusively focused on men or included gender non-conforming, transgender, and non-binary individuals. A limited number of studies (13) applied longitudinal or time series approaches. Three main themes emerged: the gendered direct and indirect (violence, economic, food and water insecurities) mental health impacts (suicidality, suicide, stress), determinants of climate-induced mental health impacts (e.g., structural and social determinants), and adaptation interventions (e.g., coping strategies at and beyond the individual level and agency). Gendered factors identified include men and women's work, physical and reproductive health, socio-cultural expectations or constraints and gender-blind initiatives. Findings suggest a need for context and gender-specific interventions to mitigate the impacts of climate change, particularly on mental health outcomes.

1. Introduction

The global intensification of climate-related environmental changes is becoming increasingly evident (Intergovernmental Panel on Climate Change (IPCC), 2023). Similarly, the resultant spatial distribution of health and wellbeing impacts among populations is becoming more taxing and uneven, with gender mediating these outcomes (Simmonds et al., 2022; IPCC et al., 2023). Power negotiations in sociocultural environments and the establishment of gender norms for women and men often underpin these gendered impacts (Awiti, 2022). Women are disproportionately exposed to and affected by climatic events and their associated health outcomes due to socio-economic inequalities and cultural norms. For instance, prolonged drought periods and erratic rainfall patterns impact water security, further burdening women and girls who are responsible for collecting water for their households in

many communities in sub-Saharan Africa (SSA) (Abu et al., 2019). They face the risk of physical health challenges, including muscular issues from walking long distances and carrying water on their heads, shoulders, or backs (Geere et al., 2018). Similarly, women and girls are exposed to various levels of violence, particularly sexual violence, which impacts their sense of security (Abu et al., 2019).

Pope et al. (2022) establish in their scoping review that dowry and bride price incentives (i.e., money or livestock) are increasingly becoming an adaptation strategy to address livelihood insecurity induced by climate change and extreme weather events. A potential consequence is an increase in girl-child marriages in SSA, South Asia, and Southeast Asia, where dowry practices are ingrained in local cultures and livelihoods are heavily tied to the physical environment. Additionally, these girls encounter various forms of gender-based violence (GBV) and bear responsibilities that exceed their

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psychological capacities (Miruka, 2023). For instance, Ahmed et al. (2013), in their study in Asia, found that early marriages, early pregnancies, and associated responsibilities are risk factors for depression among girls. Similarly, men and boys, who are traditionally expected to be the breadwinners of their families, are constrained in adequately fulfilling their gendered roles in areas where agricultural output is declining. Khan et al. (2023) asserted that men and boys in Bangladesh and South Africa who experience livelihood insecurity due to climate-induced low agricultural and fishing outputs are concerned about their social status. Moreover, the impacts of climate change on men, especially in patriarchal contexts, have the potential to reverberate back and impact girls through child marriages. For instance, in Bangladesh and India, the view of dowry as a form of capital acquisition by families of young men places a significant burden on families of girls, who are responsible for paying dowry, which increases with the age of the girl (Alston et al., 2014; Srivastava et al., 2021). In these events, climate-induced economic insecurities may lead to families marrying off girls younger to avoid the hefty cost of dowry payment. Similarly, in events where families of men pay dowry, poor farming families in northern Ghana perceive the girlchild as a liability yet a resource and source of social protection after marriage through dowry payment (Asare and Forkuor, 2024).

These situations may worsen further as the IPCC predictions depict a grim scenario, with most climate models indicating rising temperatures and unpredictable rainfall that would surpass the global average (IPCC, 2018; 2023; Riede et al., 2016). The severity of climatic events, such as droughts, floods, and storm surges, presents significant challenges to health, food, and water security for resource-poor communities. For example, climate change is expected to decrease the yields of major staple crops, with corn yields projected to drop by 7 % by 2050 in Ghana (United States Department of Agriculture, 2023). These observable environmental changes and their effects substantially contribute to the emotional and mental health burdens faced by populations worldwide and are gaining recognition across various fields. Some researchers describe this phenomenon as *eco-anxiety* or *climate anxiety*, which Clayton et al. (2017) define as the “*chronic fear of environmental doom*.”

Like the physical impacts of climate change, women and men experience mental stressors differently. Despite recent progress in climate change, mental health, and gender issues, more needs to be done. In their review of climate and health studies, Berrang-Ford et al. (2022) found that only 5 %, representing 730 out of 15963, focused on mental health. They also indicated that a significant portion of the literature on mental health is dominated by articles from High-Income Countries (HIC), particularly in North America. Interestingly, Low- and Middle-Income Countries (LMICs) continue to bear the brunt of climate change impacts, including agricultural shifts, livelihood insecurity, displacements, and social disorder, yet are less resilient to environmental changes. Despite these impacts, response measures, policies, and interventions addressing extreme weather can influence mental health outcomes. The review by Berrang-Ford et al. (2022) found that the term mental health was prominently featured in research on adaptation topics, particularly disaster risk reduction and community resilience. Therefore, communities need to implement adaptation and mitigation measures that consider the impact on mental health. While climate responses involve adjusting to current or anticipated climate-related consequences, there remains an urgent need for long-term solutions to address the current adverse impacts (Bellon et al., 2019).

Researchers and activists in the environmental and gender spaces advocate for climate change responses, including mitigation and adaptation measures that provide equitable opportunities and rights in climate decision-making at local, national, and global levels. For example, Awiti (2022) emphasized the necessity for meaningful gender-transformative resilience and adaptation interventions. Similarly, the 2015 Paris Agreement calls for a gender-specific adaptation plan (Onencan and Van de Walle, 2018). These goals can be achieved using disaggregated data and evidence. Researchers are beginning to

synthesize available knowledge on climate change, mental health, and gender. Berrang-Ford et al. (2022) explored climate change and health broadly, with a limited focus on mental health, by analyzing titles and abstracts. Gianconi et al. (2020) and Charlson et al. (2021) provided insightful reviews on environmental exposures and the risks of climate change to mental health, although they lacked emphasis on gendered dynamics. Stone et al. (2022) conducted a scoping review examining the impacts of climate change on women, while Awiti (2022) reviewed studies on climate change and gender, with a focus on Africa. The current scoping review builds on this prior work to offer a more comprehensive perspective on the gendered impacts of climate change on mental health, as well as examine the role of climate responses—namely adaptation and mitigation policies—in perpetuating the differential effects of climate change on men and women. This review aims to identify research and policy gaps in addressing the climate crisis, extreme weather events, mental health, and gender. This scoping review addresses the following objectives.

- I. To synthesize existing knowledge of climate-induced gendered mental health conditions and impacts globally
- II. To investigate the role of climate responses in perpetuating different gendered mental health conditions and their global impacts in the existing literature.
- III. Identify research and policy gaps related to the climate crisis, mental health, and gender.

2. Methodology

We comprehensively reviewed existing peer-reviewed literature to assess the links between climate change, gender, and mental health conditions. An extensive review was conducted in accordance with the steps outlined by Arksey and O’Malley (2005). Scoping research involves a broader search of the existing literature, prioritizing reproducibility, transparency, and trustworthiness. In this study, the search method involved selecting keywords related to gender, climate change, and mental health. As guided by the UNFCCC, climate change encompasses significant changes in weather patterns and an increase in extreme weather events. Similarly, the term mental health conditions include mental disorders, psychosocial disabilities, and other mental states associated with significant distress, impairment in functioning, or risk of self-harm (WHO, 2022). The authors generated the search terms, and the search was conducted with the assistance of research assistants and a librarian.

2.1. Identifying relevant studies

We systematically searched several electronic bibliographic databases: PubMed, Embase, MEDLINE (Embase), CINAHL, EBSCOhost, and Web of Science. Table 1 below displays a combination of keywords used to search these various databases with MeSH terms. The articles obtained from the searches were imported into Covidence, an online tool designed to enhance the efficiency of different stages of the scoping review process. The software facilitates the screening of references, including titles, abstracts, and full-text screenings. It also enables the creation and population of data extraction forms and the completion of risk tables. Covidence automatically eliminated any duplicate articles and titles in languages other than the desired language. We constructed the criteria for inclusion and exclusion. To be eligible for inclusion, the manuscripts must be peer-reviewed publications, primary studies published in English by 2010 and aligned with our objectives. Studies could employ quantitative, qualitative, or mixed methodologies. Grey literature, narratives, commentaries, reports, essays, editorial opinions, and studies published in languages other than English were excluded from our analysis. Furthermore, systematic reviews were also excluded; however, we ensured that the reference lists of all qualifying systematic reviews were thoroughly examined to identify additional relevant

Table 1
Search terms.

Database	Climate change		Mental health conditions		Gender
Science Direct	"Climate Change" OR "Global Warming" OR "Greenhouse Effect" OR "Climatic Processes" OR "Hot Temperature" OR "Hot Climate" OR "Hot Weather"	AND	"Mental Disorders" OR "Mental Illness" OR "Mental Distress" OR "Psychiatric Disorder" OR "Mental Health Condition" OR "Psychological disorder" OR "Cognitive Disorder" OR "Mental Health"	AND	"Gender" OR "Male and Female" OR "Woman" "Women" OR "Man" OR "Men" OR "Gender Experiences" OR "Gender Roles" OR "Gender Identity" "Gender expression"
CINAHL via EBSCOhost	"Climate Change" OR "Global Warming" OR "Greenhouse Effect" OR "Climatic Processes" OR "Hot Temperature" OR "Hot Climate" OR "Hot Weather"	AND	"Mental Disorders" OR "Mental Illness" OR "Mental Distress" OR "Psychiatric Disorder" OR "Mental Health Condition" OR "Psychological disorder" OR "Cognitive Disorder" OR "Mental Health"	AND	"Gender" OR "Male and Female" OR "Woman" "Women" OR "Man" OR "Men" OR "Gender Experiences" OR "Gender Roles" OR "Gender Identity" "Gender expression"
PubMed	"Climate Change" OR "Global Warming" OR "Greenhouse Effect" OR "Climatic Processes" OR "Hot Temperature" OR "Hot Climate" OR "Hot Weather"	AND	"Mental Disorders" OR "Mental Illness" OR "Mental Distress" OR "Psychiatric Disorder" OR "Mental Health Condition" OR "Psychological disorder" OR "Cognitive Disorder" OR "Mental Health"	AND	"Gender" OR "Male and Female" OR "Woman" "Women" OR "Man" OR "Men" OR "Gender Experiences" OR "Gender Roles" OR "Gender Identity" "Gender expression"
Web of Science	"Climate Change" OR "Global Warming" OR "Greenhouse Effect" OR "Climatic Processes" OR "Hot Temperature" OR "Hot Climate" OR "Hot Weather"	AND	"Mental Disorders" OR "Mental Illness" OR "Mental Distress" OR "Psychiatric Disorder" OR "Mental Health Condition" OR "Psychological disorder" OR "Cognitive Disorder" OR "Mental Health"	AND	"Gender" OR "Male and Female" OR "Woman" "Women" OR "Man" OR "Men" OR "Gender Experiences" OR "Gender Roles" OR "Gender Identity" "Gender expression"
Medline	"Climate Change" OR "Global Warming" OR "Greenhouse Effect" OR "Climatic Processes" OR "Hot Temperature" OR "Hot Climate" OR "Hot Weather"	AND	"Mental Disorders" OR "Mental Illness" OR "Mental Distress" OR "Psychiatric Disorder" OR "Mental Health Condition" OR "Psychological disorder" OR "Cognitive Disorder" OR "Mental Health"	AND	"Gender" OR "Male and Female" OR "Woman" "Women" OR "Man" OR "Men" OR "Gender Experiences" OR "Gender Roles" OR "Gender Identity" "Gender expression"
Embase	"Climate Change" OR "Global Warming" OR "Greenhouse Effect" OR "Climatic Processes" OR "Hot Temperature" OR "Hot Climate" OR "Hot Weather"	AND	"Mental Disorders" OR "Mental Illness" OR "Mental Distress" OR "Psychiatric Disorder" OR "Mental Health Condition" OR "Psychological disorder" OR "Cognitive Disorder" OR "Mental Health"	AND	"Gender" OR "Male and Female" OR "Woman" "Women" OR "Man" OR "Men" OR "Gender Experiences" OR "Gender Roles" OR "Gender Identity" "Gender expression"

studies.

2.2. Study selection

Using the eligibility criteria outlined above, the two authors evaluated the studies for selection. The initial selection involved assessing titles and abstracts, while the subsequent selection required a thorough examination of the full-text articles. Any conflicts between the reviewers during the screening stages were resolved by the two authors. When necessary, research assistants sought the authors' perspectives on general screening challenges.

2.3. Charting the data (data extraction)

After selecting articles, a Microsoft Excel spreadsheet was used to manage and analyze the data. The authors jointly developed a Microsoft Excel spreadsheet for charting. The spreadsheet was used to record the following data: author(s), year of publication, study setting, characteristics of the participants (such as children or adults), type of study purpose, study design (quantitative, qualitative, or mixed methods), measurement methods, outcomes measured, and critical study findings. The table underwent updates through an iterative process, during which data extraction was carried out and additional variables were deemed pertinent. One author (TZA) conducted the data extraction process,

Table 2
Characteristics of studies based on SDG region.

SDG Regions	Area	Qualitative	Quantitative	Mixed Methods	Longitudinal	Cross-sectional	Women	Both women & men	Children	Direct Mental Conditions	In Direct Mental Health Conditions
Australia and New Zealand	9	3	5	1	5	4	4	4	1	6	3
Central and Southern Asia	9	3	4	2	1	8	5	4	0	0	9
Europe and North America	6	2	4	0	1	5	1	4	1	5	1
Latin America and the Caribbean	2	0	2	0	1	1	1	1	0	1	1
Oceania multiple contexts	1 2	1 1	0 1	0 0	0 1	1 1	1 0	0 2	0 0	0 1	1 1
Eastern and South-Eastern Asia	7	0	7	0	4	3	1	6	0	7	0
sub-Saharan Africa	6	5	0	1	0	6	2	4	0	0	6
North Africa and Western Asia	1	0	1	0	0	1	0	1	0	0	1

while another author (MA) verified the accuracy of the extracted data. The extracted data is presented in the study characteristics (Table 2).

2.4. Collating, summarizing, and reporting the results

A comprehensive analysis of the studies included in this research was conducted to present a coherent narrative highlighting the link between climate change, mental health, and gender. Given the wide range of outcomes, a thematic synthesis was performed to categorize the results. The emerging themes are detailed in the results and discussion sections, as shown in Table 3.

3. Results

The PRISMA diagram shown in Fig. 1 summarizes the process from screening to data extraction. We identified and imported 3640 studies from all the databases into Covidence. Covidence identified and removed 1178 duplicates, while four duplicates were eliminated manually. Of the 2458 studies screened, 2092 were deemed irrelevant and excluded from the process. We included 43 studies in the extraction

Table 3
Summary of themes.

Themes	Discussed Topics
Theoretical Framework	
Theories Employed	Intersectionality (3); Sustainable Livelihood Framework (1); Cohen 2001 Conceptual Framework of Denial (Self-Protective Strategies) (1); The Foucauldian Inspired Conceptualization of Discursive (Im)mobility Decision-making (1); Thurston et al. Framework on Resilience (1); A combination of multiple theories, i.e., vulnerability studies, feminist political ecology, and PEH (1)
Categories of Climate-Induced Mental Health Impacts	
Gendered Direct Mental Health Impacts	
Climate Indicators, Extreme Weather Events, Gender Roles (men's work vs. women's work) and Physical reproductive traits (pregnancy and miscarriages, menopause) and mental health conditions;	
Gendered Indirect Climate-Induced Mental Health Impact	
Induced violence	Gender-Based Violence (GBV), Intimate Partner Violence (IPV); Family violence; Community conflicts
Economic insecurity	Loss of lives, property, and livelihoods; Burden of recovery, Burden of workplace adjustment; Sociocultural barriers disproportionately affecting women
Food and water insecurity	Emotions towards food and water security; Burden and implications of women's work (domestic work)
Determinants of Climate-Induced Mental Health Conditions	
Knowledge	Knowledge and behaviors; Environmental awareness and induced mental health conditions; Intergenerational knowledge transfer, identity and wellbeing
Structural determinants	Emotions towards inadequate reactive political action; Inadequate robust government actions and gender mainstreaming
Sociodemographic indicators and intersectionality	Identity and mental health conditions; Women's intersectional identity and agency; Household heads and climate-induced mental health conditions
Climate Response and Induced Mental Health Conditions	
Individual Level Coping Strategies	Emotions towards individual capacity to adapt; Individual behavior and livelihood change; Gender and climate adaptation disparities
Interventions beyond the individual	Community efforts and collective adaptation strategies (women groups' agency and social capital; Emotions towards local governments and aid institutions (mal)adaptation
Decision-making and Empowerment	Decision making and sustained wellbeing; Emotions towards social barriers on women's active participation

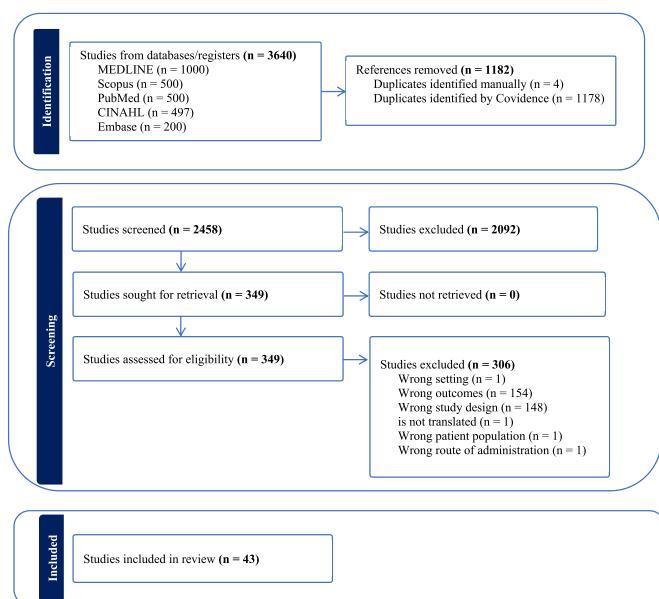


Fig. 1. PRISMA diagram.

phase after applying the inclusion and exclusion criteria.

3.1. Characteristics of included studies

We present the spatial distribution of all forty-three (43) studies using the SDG regions. Nine (9) studies (including Hanigan et al., 2018; Austin et al., 2020; Alston et al., 2022; Powers et al., 2012; Patrick et al., 2023) were conducted in Australia and New Zealand. Similarly, nine (9) studies were conducted in Central and Southern Asia (including Goli et al., 2023; Zhu et al., 2023; Nosheen et al., 2023; Prati et al., 2022; Ayeb-Karlsson, 2020). Seven studies were conducted in Eastern and Southeast Asia, including Lin et al. (2017), Chen et al. (2019), Zhang et al. (2023), Tawatsupa et al. (2010), and Zhou et al. (2023). Six studies were conducted in Sub-Saharan Africa, including Cooper et al. (2019), Lindvall et al. (2020), Jewkes et al. (2023), and Adams and Nyantakyi-Frimpong (2021). Six studies were conducted in Europe and North America, including those by Leonhardt et al. (2022), Wullenkord and Reese (2021), Urbild et al. (2023), Rahman et al. (2023a,b), and Beaumier and Ford (2010). Only two studies have been conducted in Latin America and the Caribbean (Díaz and Saldarriaga, 2023; Ramírez-López et al., 2023). We identified only one study, each conducted in North Africa and Western Asia (Joseph et al., 2023) and Oceania (Singh et al., 2022). Two of the studies, Du Bray et al. (2019) and Ngu et al. (2021) were conducted in multiple contexts. The 43 studies employed a wide range of methods. Fifteen studies, including Nosheen et al. (2023), du Bray et al. (2019), Goli et al. (2023), and Adams and Nyantakyi-Frimpong (2021), employed qualitative methods. Twenty-four (24) studies, including Díaz and Saldarriaga (2023), Lin et al. (2017), Ramírez-López et al. (2023), and Rahman et al. (2023a,b), employed quantitative approaches. Four (4) studies (including Alston et al., 2022; Matin and Taylor, 2015; Prati et al., 2022; Myers et al., 2025) utilized mixed methods (both qualitative and quantitative). Additionally, we found that only thirteen (13) out of the 43 studies included in the data extraction process applied longitudinal and/or time series approaches (Gepp et al., 2022; Rich et al., 2012). Interestingly, only two (2) studies focused on building projections and scenarios (Hanigan and Chaston, 2022; Zhu et al., 2023). Thirty (30) studies engaged in cross-sectional approaches. The target population for the 43 studies varied. A majority (26) of the studies focused on both men and women (Middleton et al., 2020; Joseph et al., 2023; Tawatsupa et al., 2010; Patrick et al., 2023; Urbild et al., 2023). Fifteen (15) studies

focused exclusively on women (Díaz and Saldarriaga, 2023; Johnson et al., 2022; Powers et al., 2012; Mamun et al., 2019; Akinsemolu and Olukoya, 2020). Notably, participants in four (4) of the 15 studies addressing women's mental health and climate included both men and women. One (1) study by Leonhardt et al. (2022) focused on adolescents, mental health, and climate. Another study by Xu et al. (2018) concentrated on children.

Analyzing the regional breakdown (see Table 2 below), all studies ($n = 7$) from Eastern and South-Eastern Asia were quantitative. Notably, most qualitative studies ($n = 5$) originated from the SSA region, with only one study from this area employing mixed methods. Studies from Australia and New Zealand ($n = 5$), followed by those from Eastern and South-Eastern Asia ($n = 4$), utilized longitudinal or time-series approaches. Central and South Asia ($n = 8$) and SSA ($n = 6$) had the highest number of studies employing cross-sectional approaches. Most studies focusing on women were from Central and South Asia ($n = 5$) and Australia and New Zealand ($n = 4$). The majority of studies addressing both men and women were from Eastern and South-Eastern Asia ($n = 6$), with four studies each from Australia and New Zealand, Central and Southern Asia, Europe and North America, and SSA. Most studies covering indirect gendered mental health conditions originated from Central and South Asia ($n = 9$) and the SSA ($n = 6$), encompassing all studies from these regions. Furthermore, all studies from Eastern and South-Eastern Asia ($n = 9$) assessed climate-induced direct gendered mental health conditions.

3.2. Theoretical framing of studies reviewed

Theories vary in their fundamental assumptions and epistemologies, but they are relevant in shaping research processes and outcomes (Gatrell and Elliott, 2015). They are critical for comprehensively asking questions, obtaining the requisite information, and understanding the complexities underlying inequalities and behavior change (Aboud and Singla, 2012; Krieger, 2011). Of the 43 studies, only seven explicitly indicated the use of theory and the theoretical approaches and/or frameworks guiding their research. For instance, du Bray et al. (2019), Johnson et al. (2022), and Prati et al. (2022) indicated that their studies were informed by the concept of *intersectionality*. In these studies, they explored a wide range of sociodemographic indicators and how these influence the mental health conditions of their participants. The *sustainable livelihood framework* guided Goli et al. (2023) in their study on gender climate adaptation strategies among paddy farmers in northern Iran. Other indicated theoretical frameworks include Cohen's (2001) conceptual framework of denial (self-protective strategies) (Wullenkord and Reese, 2021), the Foucauldian-inspired conceptualization of discursive (im) mobility decision-making (Ayeb-Karlsson, 2020), and the framework on resilience by Thurston et al. (Jewkes et al., 2023). Adam and Nyantakyi-Frimpong (2021) adapted a combination of theories, including vulnerability studies, feminist political ecology, and the political ecology of health, in their study on mental health conditions and flooding in Ghana.

3.3. Impacts of climate change on mental health

All the reviewed 43 studies showed an association between climate change and mental health conditions and their direct or indirect differential effects on men and women. Some studies described the gendered mental health impacts of climate-induced events, including violence, economic impacts, and food and water insecurity, as indicated below. We classify and discuss the above-emerged themes as indirect impacts of climate change and extreme weather events.

3.3.1. Gendered direct mental health impacts

Twenty studies focused on the direct, gendered mental health impacts of climate change or weather extremes (Leonhardt et al., 2022; Wullenkord and Reese, 2021; Austin et al., 2020; Ramírez-López et al.,

2023; Yang et al., 2021; Chen et al., 2019). In this category, some studies drew connections between climate change or extreme weather events and mental health conditions such as ecoanxiety, suicide, stress, and suicidality, integrated into the differential roles of participants (*men's work vs. women's work*). For instance, Tawatsupa et al. (2010) indicated in their study in Thailand that more men than women worked in physical and labor-intensive jobs, exposing them to work under heat stress conditions, which impacted their psychological distress. Du Bray et al. (2019) found that gender and sensitivity impacted how men and women *expressed emotions toward climate impacts* in their studies conducted in Fiji, Cyprus, New Zealand, and London. Qualitatively, women expressed more sadness than men, who often expressed anger at changes in their local environment, the loss of local biodiversity, and shifts in culture.

Gendered mental health impacts, weather extremes, and climate change were discussed concerning *women's reproductive and maternal health*, including *pregnancy, miscarriages, and menopause*. Lin et al. (2017) conducted a study in Shanghai, China, which revealed an association between extreme temperatures and elevated maternal stress during pregnancy. Their research identified additional factors, such as low economic and educational levels, as well as pregnancy complications, that further contribute to climate-induced mental health outcomes. Weather changes affect women's bodies in various ways, influencing early menopause, child loss, and stress (Rich et al., 2012; Nosheen et al., 2023).

3.3.2. Gendered indirect mental health impact

3.3.2.1. Climate-induced violence impacts. Issues of violence were categorized as *gender-based violence (GBV)*, *intimate partner violence (IPV)*, *family violence*, and *community conflicts*. Twelve (12) of the studies examined various forms of violence following extreme weather events such as floods or in communities facing persistent weather extremes like prolonged drought (Díaz and Saldarriaga, 2023; Zhu et al., 2023; Alston et al., 2018; Singh et al., 2022; Cooper et al., 2019).

Climate-induced IPV and GBV linked to negative mental health challenges emerged as a result of economic insecurity and empowerment failures, particularly in regions where livelihoods depend heavily on the environment (Díaz and Saldarriaga, 2023; Zhu et al., 2023). Research has also shown a positive correlation between family violence or breakdown and the impacts of climate change or extreme weather events. In these situations, violence may extend to other family members, including children (Díaz and Saldarriaga, 2023; Alston et al., 2018). The consequences of extreme weather on men's income can undermine their masculinity and identity as family providers, potentially leading to violent behavior as a means to reassert their status and authority.

Secondly, at the community level, there is a lapse in the sense of security among displaced individuals, particularly women, following a major disaster. Studies have reported incidents of kidnapping, rape, and teenage pregnancies occurring in shelters and so-called "safe places" after a disaster, as well as the risk of walking long and unsafe distances to collect water (Nosheen et al., 2023; Lindvall et al., 2020).

The inequitable distribution of resources, such as water, fuels fear of contestation and conflict (Cooper et al., 2019; Jewkes et al., 2023). Men whose livelihoods are tied to the environment, such as pastoralists, are concerned about potential dangers and conflicts with other groups in resource-poor settings, particularly regarding water insecurity (Cooper et al., 2019).

3.3.2.2. Climate-induced economic insecurity. Studies on this theme were divided into the *loss of lives, property, and livelihoods; recovery burdens; workplace adjustment burdens; and sociocultural barriers disproportionately affecting women*. Twenty studies (20) examined the connection between the economic impacts of climate change and/or extreme weather effects on the mental health of men and women within the household,

community, and work environments (Austin et al., 2020; Alston et al., 2018; Matin and Taylor, 2015; Rich et al., 2012; Mamun et al., 2019).

There are significant economic stresses associated with the loss of lives, property, and businesses during extreme weather events. Studies have reported that community members have lost their shop inventory, crop farms, aquaculture (shrimp farms), and livestock, which takes a substantial emotional toll on both men and women (Adam and Nyantakyi-Frimpong, 2021; Matin and Taylor, 2015; Cooper et al., 2019; Mamun et al., 2019).

Generally, climate change and extreme weather events are linked to high costs of living and recovery. These disruptions to livelihood have been associated with negative emotions in previously self-reliant individuals who seek alternative menial jobs, default on loans, and face increased uncertainty in farming, among other issues (Goli et al., 2023; Austin et al., 2020; Matin and Taylor, 2015; Cooper et al., 2019; Rich et al., 2012; Mamun et al., 2019). Women often exhibit less resilience than men. The increased erratic nature and variability of weather conditions, such as rainfall, make livelihoods like farming increasingly stressful, challenging, and less lucrative.

The burden of workplace adjustments has also increased the labor burden of "women's work" and influences unjust labor divisions in workplaces and homes (Alston et al., 2018; Nosheen et al., 2023; Cooper et al., 2019; Rich et al., 2012). Women's work on farms and in other businesses is also regarded as an extension of their domestic work (Alston et al., 2018; Nosheen et al., 2023). These stresses manifest differently in women's bodies, influencing menopause issues and increasing the risk of miscarriages during pregnancies (Rich et al., 2012; Nosheen et al., 2023).

Sociocultural barriers further exacerbate the economic insecurity of women, particularly homemakers and female-headed households, due to climate change and extreme weather. The gendered nature of women's roles and responsibilities is often linked to scarce natural resources, which further diminishes their economic productivity. For example, women and female-headed households are disproportionately and inadequately prioritized in accessing watersheds and water bodies at necessary times, obtaining high-yield and larger farmlands, as well as facing unequal access to agro-professions (Goli et al., 2023; Nosheen et al., 2023; Alston et al., 2018).

3.3.3.2. Climate induced Food-water insecurity. Food-water security has emerged as a key indicator influencing wellbeing in a changing climate. Fifteen (15) studies highlighted issues related to food-water security, climate change, gender, and mental health (Johnson et al., 2022; Goli et al., 2023; Nosheen et al., 2023; Austin et al., 2020; Cooper et al., 2019). We further discuss the following subthemes: *emotions regarding food-water security, as well as the burden and implications of women's domestic work*.

Water insecurity lowers agricultural and aquaculture production, which in turn affects food security. There are mental health challenges associated with the increased risk of losing capital, the unpredictability of rainfed farming seasons, and difficulties engaging in agricultural activities after an extreme event, such as a flood (Alston et al., 2018; Johnson et al., 2022; Austin et al., 2020; Cooper et al., 2019; Lindvall et al., 2020). Food and water security are associated with positive emotions such as feeling empowered, confident, and secure. Conversely, insecurity evokes negative emotions like increased stress, aggression, heightened anxiety, impatience, threats to mental health, sensitivity, worry, anger, and irritability.

Women often worry or feel stressed about inadequate food in their households, often prioritizing the needs of their children, husbands, and other family members over their own (Beaumier and Ford, 2010; Nosheen et al., 2023). Water insecurity adds stress to women's responsibilities at home and increases the risk of IPV and insecurity among women (Johnson et al., 2022; Nosheen et al., 2023; Cooper et al., 2019; Jewkes et al., 2023; Myers et al., 2025).

3.3.3. Determinants of impacts of climate change and/or extreme weather events

3.3.3.1. Knowledge and climate-induced mental health.

Topics that emerged under this theme include *knowledge and behaviors; environmental awareness and mental health conditions; and Intergenerational knowledge transfer, identity, and well-being*.

Understanding climate change and extreme weather events is crucial for shaping mitigation, coping, adaptation, behaviors, and actions in changing environments (Wullenkord and Reese, 2021; Beaumier and Ford, 2010; Ramírez-López et al., 2023; Middleton et al., 2020; Leonhardt et al., 2022). Initial awareness of disasters and the impacts of the changing environment was a key determinant of the extent of impacts on populations. Knowledge influences the protective and adaptation behaviors that are implemented and adopted (Jewkes et al., 2023; Mamun et al., 2019; Ayeb-Karlsson, 2020).

Several studies have examined environmental awareness, knowledge of climate change, and their impact on mental health, including depression and stress (Leonhardt et al., 2022; Wullenkord and Reese, 2021; Ramírez-López et al., 2023). Wullenkord and Reese (2021), Johnson et al. (2022), Beaumier and Ford (2010), and Ramírez-López et al. (2023) further explored how this knowledge shapes eco-anxiety, pro-environmental behaviors, and the willingness to donate and protect the environment. Women often exhibit behaviors aimed at environmental protection.

Knowledge and the intergenerational transfer of environmental awareness and healthy adaptation practices were central determinants of wellbeing in indigenous and traditional communities (Johnson et al., 2022; Beaumier and Ford, 2010; Singh et al., 2022; Middleton et al., 2020; Mamun et al., 2019). This knowledge embodies their environment, human agency, and sense of place or identity, which is often a concern among women.

3.3.3.2. Sociodemographic indicators and intersectionality.

The degree to which an individual or household in the settlement is vulnerable is influenced by internalized power asymmetries related to socioeconomic status, occupation, education, social networks, gender, age, and racial heritage. All 43 studies, except for three, examined how the intersection of characteristics such as education, income, age, and political affiliation of both men and women shapes climate-induced mental health outcomes.

We sub-categorize this sub-theme based on the following topics: *women's intersectional identity and agency, household heads, and induced mental health conditions*.

Women's intersectional identity indicators have also become a central focus of studies. Research has examined how sociodemographic factors such as education, income, and age intersect with climate change to exacerbate mental health effects. These elements influence women's agency and their capacity to navigate power structures concerning their overall wellbeing, pregnancies, menopause, intimate partner violence, and situations at home, work, community, and beyond (Díaz and Saldaña, 2023; Lin et al., 2017; Zhu et al., 2023; Nosheen et al., 2023; Powers et al., 2012; Rahman et al., 2023a,b; Myers et al., 2025; Rich et al., 2012).

The identity of the head of the household in decision-making emerged as a key factor shaping climate-induced mental health impacts. Some studies have found that female-headed households are more vulnerable than male-headed households (Goli et al., 2023; Matin and Taylor, 2015; Nosheen et al., 2023). Additionally, both single male and female-headed households were more vulnerable to climate-induced mental health challenges, such as frustration and worry (Cooper et al., 2019).

3.3.3.3. Structural determinants and climate-induced gendered mental health impacts.

Structural factors and processes emerged as

determinants of climate-induced, gendered mental health impacts in ten studies (duBray et al., 2019; Austin et al., 2020; Alston et al., 2018; Johnson et al., 2022; Rich et al., 2012). The studies focused on *emotions towards inadequate reactive political action, along with insufficient robust government actions related to gender mainstreaming*.

Government failures to implement timely and proactive political action in addressing the numerous effects of climate change foster distrust and negative emotions such as anger and worry (duBray et al., 2019; Austin et al., 2020; Mamun et al., 2019; Johnson et al., 2022; Adams and Nyantakyi-Frimpong, 2021).

Inadequate and robust government actions have also emerged as triggers for climate-induced mental health challenges. These actions often lack gender mainstreaming or analysis, potentially reinforcing and exacerbating gender inequalities. Women's psychosocial needs and related requirements are frequently not adequately addressed (Alston et al., 2018; Johnson et al., 2022; Akinsemolu and Olukoya, 2020; Singh et al., 2022). The structural factors and processes mentioned above also hinder support-seeking behaviors among self-reliant women due to the embarrassment associated with the destitution caused by climate events (Johnson et al., 2022; Rich et al., 2012; Singh et al., 2022). At the workplace level, Tawatsupa et al. (2010) highlighted management's inability to address workplace hazards, particularly those affecting men's work in areas like construction.

3.3.4. Adaptation to climate change and/or extreme weather conditions

3.3.4.1. Coping strategies at the individual level. Subthemes that emerged include the *emotions towards capacity to adapt; individual behavior change; individual livelihood change, and gender, as well as gender and climate adaptation disparities*.

The intersectionality of sociodemographic indicators, such as education, income, and employment status, shaped access to resources and opportunities for adaptation necessary for sustained well-being (Myers et al., 2025; Urbild et al., 2023; Mamun et al., 2019; Akinsemolu and Olukoya, 2020; Ramírez-López et al., 2023; Ayeb-Karlsson, 2020; Singh et al., 2022). Male-headed households and men accessed better financial resources, including credit and insurance (Goli et al., 2023; Matin and Taylor, 2015; Gepp et al., 2022; Nosheen et al., 2023). Additionally, the adaptability of women whose partners suffered from substance abuse was significantly lower (Beaumier and Ford, 2010; Johnson et al., 2022).

Some participants reported feeling less stressed due to changes in their behavior and practices, such as implementing self-protective strategies and installing efficient technology. For example, reinforcing built environments during disasters also emerged as a means to alleviate the mental burden of forced evacuation and the feeling of unsafety in "safe places" (Matin and Taylor, 2015; Ayeb-Karlsson, 2020).

Changes in individual livelihood strategies, such as seeking alternative livelihoods —i.e., shifting toward trade-oriented businesses—have emerged as adaptations to climate change. Additionally, borrowing money with interest (Goli et al., 2023; Wullenkord and Reese, 202; Urbild et al., 2023; Johnson et al., 2022; Nosheen et al., 2023; Ramírez-López et al., 2023; Myers et al., 2025) reflects these strategies. Women adjusted their gendered roles, often securing lower-ranking and lower-paying jobs, thereby bearing the burden of seeking additional or alternative livelihoods to address the household's needs (Alston et al., 2022; Johnson et al., 2022; Matin and Taylor, 2015; Jewkes et al., 2023). Other studies concluded that women exhibited lower resilience scores and capacities compared to men (Matin and Taylor, 2015; Nosheen et al., 2023).

Women played more prominent roles in climate change adaptation behaviors; however, they face the burden of household responsibilities and unjust labor divisions, which limit their mobility (Goli et al., 2023; Nosheen et al., 2023; Gepp et al., 2022; Singh et al., 2022; Akinsemolu and Olukoya, 2020). This immobility restricts women's ability to achieve economic independence, enhance human capital, and maintain

health and well-being. Consequently, men often engage in out-migration, regarded as an adaptation strategy primarily for physically intense labor jobs for which men are generally more suited (Nosheen et al., 2023; Goli et al., 2023; Johnson et al., 2022; Prati et al., 2022; Myers et al., 2025; Akinsemolu and Olukoya, 2020). Interestingly, Prati et al. (2022) found in their study that women felt burdened after taking responsibility for the decisions and finances of their households while their husbands out-migrated for job opportunities.

3.3.4.2. Decision-making and empowerment. The decision-making process is crucial to adaptation and sustained well-being at the household level and beyond. We categorize this theme under two topics: *decision-making and sustained well-being, as well as emotions toward social barriers to women's active participation*.

Social barriers hinder women's active participation in decision-making, preventing them from building their adaptive capacity and fostering a sense of hopelessness and powerlessness. Some studies highlight the oversimplification and tokenistic nature of public participation and decision-making, indicating a lack of attention to gender that does not comprehensively capture men's and women's experiences of climate change (Goli et al., 2023; Singh et al., 2022; Nosheen et al., 2023; Prati et al., 2022; Ayeb-Karlsson, 2020; Myers et al., 2025; Akinsemolu and Olukoya, 2020).

Women and men are often involved in specific issues related to their gender roles. For instance, decisions regarding agricultural adaptation measures are frequently made by men (Goli et al., 2023; Ayeb-Karlsson, 2020; Singh et al., 2022; Alston et al., 2018). Women have expressed negative emotions associated with decision-making and the development of resources typically considered within the domain of women, such as water distribution among households and communities (Johnson et al., 2022; Alston et al., 2018).

3.3.4.3. Interventions and coping strategies beyond the individual level. The key themes that emerged from this topic include *community efforts and collective adaptation strategies, such as the agency and social capital of women's groups, as well as emotions toward local governments and aid institutions' (mal)adaptation*.

In some instances, long-established community-sharing systems enhance adaptability, resilience, and overall wellbeing (Johnson et al., 2022; Singh et al., 2022; Beaumier and Ford, 2010; Jewkes et al., 2023). Community efforts that incorporate women's agency and social capital demonstrate collective adaptation strategies, a theme that shapes adaptive capacity, particularly among women's groups and their emotional well-being. These social groups have influenced water rights, facilitated capacity-building efforts, improved women's access to land use and tenure in many areas, and promoted participation in decision-making and community development while considering gender differences (Goli et al., 2023; Matin and Taylor, 2015; Singh et al., 2022).

Beyond community initiatives, some local governments and other aid institutions have provided support to enhance adaptation or mitigate the effects of climate change and extreme weather events (Matin and Taylor, 201; Mamun et al., 2019). Some interventions have led to maladaptation, exacerbated the burden on communities, and increased negative emotions in the short or long term. For instance, Matin and Taylor (2015) noted that alternative livelihoods, such as shrimp aquaculture, can increase salinity and have a negative impact on the local ecosystem. Ayeb-Karlsson (2020) highlighted the insecurity in shelters for displaced people, especially for women, while Alston et al. (2018) pointed out the inadequate integration of gender mainstreaming in drought policies, which affects social outcomes and women's wellbeing.

Others expressed positive emotions regarding interventions designed to enhance resilience. Beaumier and Ford (2010) emphasized the effectiveness of cooking classes introduced by the Canada Prenatal Nutrition Program. Singh et al. (2022) noted that the Fiji government, in

collaboration with other state institutions, implemented initiatives such as basic computer skills training and entrepreneurial skills development to improve employability and create opportunities, including the Small Business Grant Scheme.

4. Discussion

The current study is one of the few studies to explore the gendered impact of climate change on mental health. Overall, we identified 43 studies published since 2010 that focused on the gendered effects of climate change on mental health. These studies employed various designs, including both quantitative and qualitative methodologies, and were conducted in both LMICs and HICs. Although the designs, contexts, and findings of the reviewed studies varied, they were sufficiently comparable to enable the development of themes.

Climate change has compounding health and wellbeing effects due to a complex web of direct and indirect causal mechanisms, as well as an amplifier of existing gender inequalities (WHO, 2014; van Daalen et al., 2020). The literature reviewed consistently demonstrates an association between climate change and mental health, with differentiated effects on men and women (Stone et al., 2022; Rothschild and Haase, 2023). These effects can be direct, including extreme heat exposure, and air pollution, as well as their mental health implications. Indirectly, climate change affects mental health through various mechanisms, such as food-water insecurity, economic strain, violence, disasters, and displacement. The mental health outcomes stemming from these direct and indirect climate-related events range from mild stress-such as anxiety and difficulty sleeping-to more chronic conditions, including suicidal ideations, depression, and in some cases, post-traumatic stress disorder (PTSD). For example, individuals have reported experiencing PTSD after losing a close relative in floods and other climate change-related disasters (Cruz et al., 2020; Tunstall et al., 2006). For women, who often bear the brunt of climate change impacts, the consequences can include miscarriages. The gendered factors negotiating climate-induced mental health impacts include differences in men and women's roles or work at the household and beyond, physical and reproductive health, sociocultural constraints and resource access as well as reactive and unconventional policies and interventions. These gendered impacts vary by location. In more developed regions, men are reportedly more likely to experience negative consequences from climate-related mental health issues, such as suicidal ideation and isolation, which increase their mortality risk (van Daalen et al., 2020). Furthermore, the mortality rate among unmarried men is reported to be higher than that of unmarried women during heat waves (van Daalen et al., 2020). Conversely, a study by Aylward et al. (2024) that examined how climate change affects young people in Canada revealed that these young individuals face various emotional and mental health consequences related to climate change, with the majority of participants (70 %) reporting feelings of helplessness, anger, and anxiety. Gender differences in these findings indicated that cisgender women and non-binary respondents experienced higher average levels of climate-related distress compared to cisgender men. Similarly, within the African context, Ndetei et al. (2024) observed that females were subjectively more concerned about the two threats of climate change—worry and fear—than their male counterparts.

Our analyses indicate that climate change can impact individuals' and communities' mental health and well-being through climate-related events, such as heatwaves. Extreme heatwaves can have devastating effects on mental health disorders such as anxiety, depression, and schizophrenia (IPCC, 2021; Vicedo-Cabrera et al., 2021), leading to poor mental health outcomes, including suicide, suicidal ideation, hospitalization, and, in many instances, death (Freichel & O'Shea, 2023; Liu et al., 2021; Thompson et al., 2023; Meadows et al., 2024). For instance, a meta-analysis by Thomson et al. (2023) indicates a correlation between periods of heatwaves and hospital admissions. Additionally, Meadows et al. reported that individuals experiencing mental illness or

disorders are three times more likely to die during a heatwave (Meadows et al., 2024). During the second and third trimesters of pregnancy, heatwaves are associated with lower birth weights and a higher risk of preterm birth (Konkel, 2019). In addition to behavioral and motor problems, as well as reduced IQ, lower school attendance, and economic activity have also been observed during childhood and adulthood in those experiencing heatwaves. In terms of vulnerability, there are gender differences, with heatwaves in Europe resulting in higher mortality among women compared to men (Ballester et al., 2023). Furthermore, there is a greater risk of anxiety and mood disorders among women, youth, and impoverished individuals following disasters such as heat waves (Rony and Alamgir, 2023), which are significantly influenced by social factors.

Other indirect factors strongly influenced by climate change that result in mental health issues include intimate partner violence and food and water insecurity. Emerging literature has linked climatic events to intimate partner violence for both males and females (Eistein Joshua, 2018; Roy et al., 2022). Men who are unable to provide for their families due to climate-related events often experience verbal abuse from their significant others. This, in many settings, affects their self-worth as men and, consequently, has a psychological impact on them. Women, on the other hand, are more likely to endure both verbal and physical abuse from their partners (Munala et al., 2023). For instance, Munala et al. found that severe weather events act as a catalyst for intimate partner violence in agricultural communities. Their study revealed increased odds of reporting intimate partner violence in areas experiencing extreme weather events. In many parts of the world, women bear the responsibility for securing household necessities such as water and food. The literature on water, for example, highlights that women unable to provide water to their households due to climatic conditions (e.g., drought) report feelings of shame and anger, and some have reported experiencing physical abuse from their partners (Cole et al., 2024; Tallman et al., 2023). This finding supports the growing body of evidence indicating that climate change-related events heighten the vulnerability of women and girls to violence.

The reviewed studies indicate that the severity of the mental health impact of climate events, such as prolonged droughts and floods, is influenced by one's ability to mitigate and adapt, which is further determined by structural and sociodemographic indicators intersecting at various levels. Some literature has highlighted the burden of coping strategies such as borrowing money to buy food and repaying with interest; others have pointed out the use of efficient technologies, switching to trade-oriented businesses, and, in the case of drought-related water scarcity, walking long distances to acquire water (Goli et al., 2023; Wullenkord and Reese, 2021; Urbild et al., 2023; Johnson et al., 2022; Nosheen et al., 2023; Ramírez-López et al., 2023; Myers et al., 2025). This finding aligns with those of Van Aelst and Holvoet (2016) and Achore et al. (2020), who reported household coping strategies to mitigate water insecurity and its associated mental health impacts. Like these studies, we found that women tend to bear the brunt of climate change and are thus at the forefront of these coping and adaptation strategies. As men emigrate, women remain in these climate-affected environments and are therefore compelled to employ climate-related mitigation and adaptation strategies. Several factors contribute to this gender divide—first, women's role in natural resource management. Women are chiefly responsible for supplying food and water to their households, primarily through managing local resources. Thus, in the event of climate disruptions, their deep knowledge of resource management enables them to develop contextually relevant adaptation and coping techniques. Secondly, women have primary care responsibilities towards other family members, particularly the sick, elderly, and children. Therefore, during climate crises, they must devise innovative ways to keep these individuals healthy, which includes diversifying agricultural practices or traveling long distances to obtain clean drinking water. That said, it is essential to note that emigrating (or climate migration) can be a viable coping strategy. The men in these

situations not only migrate to escape climate risk but also to seek economic stability for their families, and these migrations are also linked to mental health issues such as anxiety and depression.

An intersection of other factors, such as income, educational level, knowledge of climate change, and age, tends to directly or indirectly influence the severity of climate change-related mental health outcomes. For instance, women, particularly those with low levels of education and women in developing countries, are most vulnerable to climate change and its related mental health outcomes (Caretta et al., 2015; Van Aelst and Holvoet, 2016). These are contexts where a multitude of interwoven institutional inefficiencies continue to compromise various social determinants of health and wellbeing. Regarding climate change knowledge, individuals aware of climate change and its associated adverse effects employ mitigation techniques to protect themselves and their immediate environment. In situations where the mitigation strategies fail, they are mentally prepared to adapt or cope with the consequences (Wullenkord and Reese, 2021; Johnson et al., 2022; Beaumier and Ford, 2010; Ramírez-López et al., 2023). Thus, individuals with a certain level of knowledge about climate change tend to fare better mentally than their counterparts. The growing literature has indicated an association between climate change knowledge and reduced depression and stress (Leonhardt et al., 2022; Wullenkord and Reese, 2021; Ramírez-López et al., 2023).

Beyond individual and household adaptation and coping strategies, some literature, albeit limited, highlights structural factors, including community, government, and donor-level interventions that assist with coping efforts. For instance, social capital has been used as a tool to address climate challenges. Social capital is essential in fostering collaboration, resilience, collective action, and building trust. It provides a system of mutual support and collective knowledge and has been utilized for emergency preparedness, advocacy, policy influence, and coping with the psychological impacts of climate events. Social capital offers emotional support to community members, aiding them in adjusting to climate-related psychological trauma and the fear of future climatic occurrences. For instance, in Ghana, social capital plays a crucial role in flood resilience through the establishment of early warning systems and coordinated evacuations (Abunyewah et al., 2023). Community networks have provided mutual aid during floods in various settings, particularly in SSA. Social capital encompasses both the representation and technical expertise of men and women. Thus, women play a crucial role in community-level decision-making, leading to improved adaptation and coping strategies (Goli et al., 2023; Matin and Taylor, 2015; Singh et al., 2022).

Additionally, structural factors such as inadequate government investments and interventions, as well as a lack of gender mainstreaming, are identified as determinants of climate-induced gendered mental health. Governments have neglected to focus mainly on climate change in most contexts, contributing to severe climatic events (Granderson, 2014; Nightingale, 2017). Similarly, the review found that donor agencies and governments have implemented swift but short-term interventions during climate crises. The World Bank, the United Nations, UNHCR, and local NGOs provide aid to victims of climate change as a form of intervention. Over the years, governments have provided temporary residences, often in the form of tents, to individuals displaced by climate change. In many instances, this ostensibly short-term measure turns into a long-term solution, with victims residing in these temporary shelters for years. Women tend to be disproportionately affected both physically and psychologically, as these shelters often do not consider their safety (Alston et al., 2022). In cases where attention is given, measures are often not executed through a cultural-political lens (Granderson, 2014) and as established in this review, often bar some gender groups from accessing the appropriate support. The reasons for this neglect or inaction range from developmental challenges and economic interests to a lack of political will to prioritize "pertinent" country-specific issues over climate change. Moreover, in many countries that have committed to the Paris Agreement, gender

mainstreaming is not integrated into their climate change programming (UN Women, 2022). A 2022 UN Women report indicated that only a handful of the 37 countries that referenced gender in their national reports acknowledged women as critical decision-makers in climate change who can drive change (UN Women, 2022). Empowering women to engage in climate-related decision-making is essential not only for climate justice but also for effective adaptation and mitigation. Women's involvement in climate governance has been associated with better and more effective policy outcomes.

5. Gaps in literature and recommendations

Literature highlights that women bear the brunt of climate change, particularly regarding mental health and limited research focus in depth on men's unique experiences. Most studies collect data on both men and women and analyze gender differences; however, this approach may overlook the complex, intersectional factors that shape men and women's mental health outcomes. To complement these comparative studies, future research should also prioritize dedicated investigations into men's climate-related mental health experiences, especially through intersectional lenses. Similarly, much of the literature addresses only the combined experiences of men and women, often neglecting the experiences of gender non-conforming, transgender, and non-binary individuals. This approach overlooks the climate change-related experiences of these individuals as they do not conform to traditional gender roles, especially within the African context. Additionally, very few studies focus on the gendered impacts of climate change on children and adolescents. Future research should examine childhood experiences as a social determinant of health in the context of climate change, gender, and mental health. This is crucial given the growing body of literature on increasing child marriages and "bride price mortgages." Additionally, we identified studies that explored climate change and issues of reproductive health, motherhood, and care among women. However, there is limited documentation on the effects of climate change or ecoanxiety and the urge to reproduce, especially in the Global South, where climate-related economic and health impacts are most severe, while population growth rates are significantly increasing. This research stream, which addresses issues of climate concerns and ecoanxiety, as well as family planning, is underexplored in grey literature (Rousseau, 2023). Furthermore, the Western psychological framework dominates the literature; it is therefore imperative to adopt more culturally sensitive approaches, as cultural settings significantly influence people's perceptions and experiences of climate change and its associated mental health impacts. Our review also found a short-term focus on mental health, as the current literature primarily examines the mental health impacts of climatic events, such as PTSD. Much of this literature investigates the relationship between climate change events and mental health outcomes immediately following these events. Few longitudinal studies track individuals over time to assess the impact of these events on their mental health and how these issues are resolved, especially in sub-Saharan Africa (SSA). This is particularly significant because gender differences are not cross-sectional; they develop over time. While some studies have explored interventions implemented during and after climate-related events, there is a scarcity of longitudinal or randomized controlled trials (RCTs) to test and report the effectiveness and efficacy of these interventions. Furthermore, the literature on gender-responsive mental health interventions related to climate change is also limited. Therefore, future studies should identify and test climate and mental health interventions through longitudinal research or RCTs to determine how these services can be best tailored to meet the unique needs of all genders. In line with the above is the lack of cause-and-effect studies. The current review found that most of the studies are correlational. No studies are exploring the causal relationship between climate change and mental health and their differential impacts on different genders. Thus, we recommend the use of RCTs and quasi-experimental designs to investigate the cause-and-effect relationship between climate change

and mental health and the pathways through which these relationships are realized. This review also espoused the impacts of reactive climate intervention and policies which often inadequately integrate the socio-cultural context, including gender. We recommend more comprehensive and systematic approaches to adaptation and intervention design that encompass all aspects often missed or excluded by reductionist approaches. Such systematic approaches can enhance the socio-cultural appropriateness and sustainability of interventions.

6. Limitations

This scoping review primarily relied on peer-reviewed articles published in English since 2010. As a result, studies published in grey literature and other languages are excluded from this review. This may overlook other contextual situations of climate change, gender, and mental health in non-English-speaking settings.

7. Conclusion

In this review, we synthesized existing literature on the gendered mental health impacts of climate change while exploring the role of climate responses in perpetuating differential mental health outcomes across multiple contexts and social settings. Despite the various contexts of the studies conducted, women and men negotiated social and power

structures differently, which influenced their mental health outcomes. The review highlights a shortage of studies exploring the correlations and associations between climate change and its impacts on the mental health of men and women. The studies reviewed in this analysis primarily examined the indirect, gendered mental health impacts of climate change and related interventions. These studies further emphasize the complex and interrelated nature of environmental, social, and economic factors, and wellbeing.

CRediT authorship contribution statement

Thelma Z. Abu: Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **Meshack Achore:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization.

Statement of Ethical Approval

This work is a scoping review and Ethical Approval is not applicable.

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Appendix 1. Extended summary of themes

	Author(s)	Area	Method	Study type	Participant type	Themes
1.	Cooper et al. (2019)	SSA	Qualitative	Cross-sectional	Both men and women	Gendered Indirect Climate Induced Mental Health Induced Violence Economic Security Food and Water Security
2.	Lindvall et al. (2020)	SSA	Qualitative	Cross-sectional	Both men and women	Gendered Indirect Climate Induced Mental Health Induced Violence Economic Security Food and Water Security
3.	Jewkes et al. (2023)	SSA	Qualitative	Cross-sectional	Both men and women	Gendered Indirect Climate Induced Mental Health Induced Violence Economic Security Food and Water Security
4.	Myers et al. (2022)	SSA	Mixed methods	Cross-sectional	Women	Gendered Indirect Climate Induced Mental Health Induced Violence Economic Security Food and Water Security
5.	Adams and Nyantakyi-Frimpong (2021)	SSA	Qualitative	Cross-sectional	Both men and women	Gendered Indirect Climate Induced Mental Health Economic Security Food and Water Security
6.	Akinsemolu and Olukoya (2020)	SSA	Qualitative	Cross-sectional	Women	Gendered Indirect Climate Induced Mental Health Economic Security Food and Water Security
7.	Joseph et al. (2023)	North Africa & Western Asia	Quantitative	Cross-sectional	Both men and women	Gendered Indirect Climate Induced Mental Health Economic Security
8.	Goli et al. (2023)	Central and southern Asia	Qualitative	Cross-sectional	Both men and women	Gendered Indirect Climate Induced Mental Health Economic Security Food and Water Security
9.	Zhu et al. (2023)	Central and southern Asia	Quantitative	Cross-sectional	Women	Gendered Indirect Climate Induced Mental Health Induced Violence Food and Water Security
10.	Nosheen et al. (2023)	Central and southern Asia	Qualitative	Cross-sectional	Women	Gendered Indirect Climate Induced Mental Health Induced Violence Economic Security Food and Water Security

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Author(s)	Area	Method	Study type	Participant type	Themes
11. Matin and Taylor (2015)	Central and southern Asia	Mixed methods	Cross-sectional	Both men and women	Gendered Indirect Climate Induced Mental Health Economic Security Food and Water Security
12. Prati et al. (2022)	Central and southern Asia	Mixed methods	Cross-sectional	Both men and women	Gendered Indirect Climate Induced Mental Health Economic Security
13. Ayeb-Karlsson (2020)	Central and southern Asia	Qualitative	Cross-sectional	Both men and women	Gendered Indirect Climate Induced Mental Health Induced Violence Economic Security
14. Rahman et al. (2023)a	Central and southern Asia	Quantitative	Cross-sectional	Women	Gendered Indirect Climate Induced Mental Health
15. Gepp et al. (2022)	Central and southern Asia	Quantitative	longitudinal	Women	Induced Violence Gendered Indirect Climate Induced Mental Health Economic Security Food and Water Security
16. Mamun et al. (2019)	Central and southern Asia	Quantitative	Cross-sectional	Women	Gendered Indirect Climate Induced Mental Health Economic Security
17. Lin et al. (2017)	Eastern and South-Eastern Asia	Quantitative	Cross-sectional	Women	Gendered Direct Climate Induced Mental Health
18. Yang et al. (2021)	Eastern and South-Eastern Asia	Quantitative	longitudinal	Both men and women	Gendered Direct Climate Induced Mental Health
19. Chen et al. (2019)	Eastern and South-Eastern Asia	Quantitative	longitudinal	Both men and women	Gendered Direct Climate Induced Mental Health
20. Zhang et al. (2023)	Eastern and South-Eastern Asia	Quantitative	Cross-sectional	Both men and women	Gendered Direct Climate Induced Mental Health
21. Pan et al. (2021)	Eastern and South-Eastern Asia	Quantitative	longitudinal	Both men and women	Gendered Direct Climate Induced Mental Health
22. Tawatsupa et al. (2010)	Eastern and South-Eastern Asia	Quantitative	Cross-sectional	Both men and women	Gendered Direct Climate Induced Mental Health
23. Zhou et al. (2023)	Eastern and South-Eastern Asia	Quantitative	longitudinal	Both men and women	Gendered Direct Climate Induced Mental Health
24. Díaz and Saldarriaga (2023)	Latin America and the Caribbean	Quantitative	longitudinal	Women	Gendered Indirect Climate Induced Mental Health Induced Violence Economic Insecurity
25. Ramírez-López et al. (2023)	Latin America and the Caribbean	Quantitative	Cross-sectional	Both men and women	Gendered Direct Climate Induced Mental Health
26. Hanigan and Chaston (2022)	Australia and New Zealand	Quantitative	longitudinal	Both men and women	Gendered Direct Climate Induced Mental Health
27. Austin et al. (2020)	Australia and New Zealand	Qualitative	longitudinal	Both men and women	Both
28. Alston et al. (2022)	Australia and New Zealand	Mixed methods	Cross-sectional	Women	Gendered Indirect Climate Induced Mental Health Induced Violence Economic Security Food and Water Security
29. Johnson et al. (2022)	Australia and New Zealand	Qualitative	Cross-sectional	Women	Gendered Indirect Climate Induced Mental Health Induced Violence Food and Water Security
30. Hanigan et al. (2018)	Australia and New Zealand	Quantitative	Cross-sectional	Both men and women	Gendered Direct Climate Induced Mental Health
31. Powers et al. (2012)	Australia and New Zealand	Quantitative	longitudinal	Women	Gendered Direct Mental Health
32. Rich et al. (2012)	Australia and New Zealand	Qualitative	longitudinal	Women	Gendered Indirect Climate Induced Mental Health Economic Security
33. Patrick et al. (2023)	Australia and New Zealand	Quantitative	Cross-sectional	Both men and women	Gendered Direct Climate Induced Mental Health
34. Xu et al. (2018)	Australia and New Zealand	Quantitative	longitudinal	Adolescents and children	Both
35. Singh et al. (2022)	Oceania	Qualitative	Cross-sectional	Women	Gendered Indirect Climate Induced Mental Health Induced Violence Economic Security Food and Water Security
36. Rahman et al. (2023)b	Europe and North America	Quantitative	longitudinal	Both men and women	Gendered Direct Climate Induced Mental Health
37. Leonhardt et al. (2022)	Europe and North America	Quantitative	Cross-sectional	Adolescents and children	Gendered Direct Climate Induced Mental Health
38. Wullenkord and Reese (2021)	Europe and North America	Quantitative	Cross-sectional	Both men and women	Gendered Direct Climate Induced Mental Health
39. Beaumier and Ford (2010)	Europe and North America	Qualitative	Cross-sectional	Women	Gendered Indirect Climate Induced Mental Health

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Author(s)	Area	Method	Study type	Participant type	Themes
40. Urbild et al. (2023)	Europe and North America	Quantitative	Cross-sectional	Both men and women	Economic Security Food and Water Security Gendered Direct Climate Induced Mental Health
41. Middleton et al. (2020)	Europe and North America	Qualitative	Cross-sectional	Both men and women	Both
42. DuBray et al. (2019)	multiple	Qualitative	Cross-sectional	Both men and women	Gendered Direct Climate Induced Mental Health
43. Florido Ngu et al. (2021)	multiple	Quantitative	longitudinal	Both men and women	Gendered Direct Climate Induced Mental Health

Data availability

No data was used for the research described in the article.

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