



PSYCHOSOCIAL VULNERABILITY OF CHILDREN DUE TO EXPOSURE TO EXTREME WEATHER: A SYSTEMATIC LITERATURE REVIEW

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Abstract

According to UNICEF, by 2050, an estimated 2.2 billion children will face the direct impacts of global warming, with heat stress identified as a key consequence. This article presents a global systematic literature review examining the psychosocial vulnerability of children exposed to extreme weather. Using a qualitative descriptive approach, relevant studies were identified through searches on ResearchGate, Google Scholar, and PubMed. The review focused on publications from 2020 to 2025 and ultimately included eight studies that met the inclusion criteria. A total of 62 articles were initially screened. The findings reveal that exposure to high temperatures significantly increases the risk of mental health issues in children, such as stress, sleep disturbances, depressive episodes, and post-traumatic stress disorder. These psychosocial effects highlight the urgent need to enhance the resilience of vulnerable children and their families, enabling them not only to cope with the effects of climate change but also to adapt to evolving environmental conditions. Strengthening social and emotional support systems is essential to mitigate the long-term psychological impact of climate-induced extreme weather on younger populations.

Keywords : *Children Psychosocial Vulnerability, Extreme Weather Exposure, Mental Health*

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INTRODUCTION

According to the World Meteorological Organization (WMO), heatwave is a period where excessive local heat accumulates over several very hot days and nights. Significant climate change causes global temperature increases and causes heatwaves. In Indonesia, the hot temperatures are caused by surface heating due to the impact of the apparent solar cycle, so they can be categorized as daily hot temperatures and not as part of a heat wave. However, hot weather certainly has an impact on children, especially at an age that should spend time outdoors (Amekpor, 2025).

Reported by UNICEF, in 2050 it is estimated that at least 2.2 billion children will experience the direct impact of global warming. UNICEF itself explains that heat stress is directly correlated with global warming. Exposure to high temperatures and humidity with high physical activity makes the body work harder to cool itself. Heat-related illnesses will increase more intensively, such as mild rashes in babies, to more serious illnesses such as high risk of organ failure. Children themselves are more at risk of being affected when the weather warms because their metabolism is high but they produce less sweat than adults so they feel hot faster. UNICEF maps four serious impacts of extreme heat in terms of health, mental stability, education, and children's

nutrition (Conway, 2024).

Indonesian children are vulnerable to the impacts of climate change, as indicated by the country's ranking on the Children's Climate Risk Index (CCRI) (46 out of 163 countries). The MoEF, as reported in the NDC Roadmap on Adaptation, projects that by 2050 the impacts of climate change on needs (i.e. food, energy, water, and environmental health) will cost between 0.66 percent and 3.45 percent of Indonesia's GDP, with the poorest bearing the brunt of this burden. Children will increasingly face environmental and climate-related risks that will affect their health, food security and access to nutritious food, clean water and sanitation facilities, and their future livelihoods. In addition, children can face many psychosocial impacts after disasters, such as emotional stress and even post-traumatic stress disorder (PTSD). Therefore, it is critical to strengthen the resilience of disadvantaged children and families so that they not only cope with the impacts of climate change but also adapt to new climate conditions (Ministry Of Environment And Forestry Of The Republic Of Indonesia, 2023).

Increased mental health problems in children have been linked to high temperatures. Heat can cause high stress and sleep deprivation, which can lead to more

depressive episodes and post-traumatic stress disorder. Based on the discussion above, researchers are interested in knowing about psychosocial vulnerability of children due to exposure to extreme weather : a global systematic literature review.

METHOD

The research design used is a descriptive research method with a qualitative approach to literature study or systematic literature review using the internet and manual search. Data was collected using databases and search engines Researchgate, Google Scholar and PubMed. The search was carried out using the keywords "psychosocial vulnerability of children due to exposure to extreme weather : a global systematic literature review".

The inclusion criteria for this research are that the articles used as literature are research articles, both original articles and

studies/reviews. Articles or literature discussing psychosocial vulnerability of children due to exposure to extreme weather : a global systematic literature review were published from 2020-2025. Researchers found articles that matched these keywords with details from Researchgate (n = 32), Google Scholar (n = 25) and PubMed (n = 5) so that N = 62. The search results that were obtained were then checked for duplication using Mendeley and the same articles were found, so there were articles that were excluded or duplicated (n = 47). Researchers carried out screening based on the title (n = 31), then obtained abstracts (n = 15) then a complete copy was taken and assessed for suitability (n = 10) then screened based on inclusion and exclusion criteria on the entire text (full text) so that A total of (n = 8) were obtained which could be used in a systematic literature review. The results of article selection can be depicted in the Flow Diagram below.

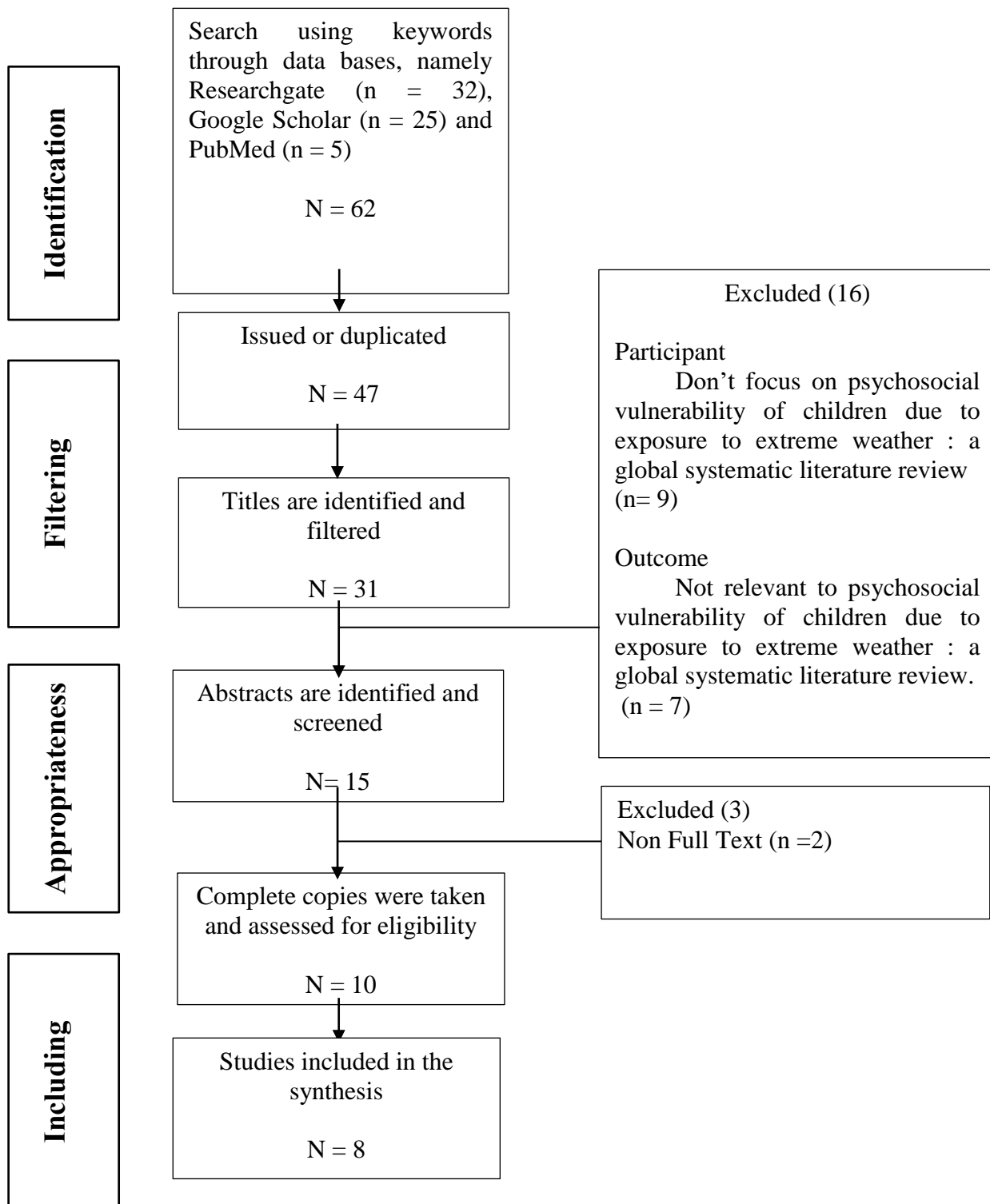


Figure 1. PRISMA Flow Chart

RESULTS AND DISCUSSION

The study results showed that 8 articles met the criteria based on the systematic literature review topic. The results of study characteristics

from 3 databases (Researchgate, Google Scholar and PubMed) are depicted in table 1 below:

Table 1. Summary of Reference

No	Author And Year	Research Title	Research Methods	Research Result	Databases
1.	Felix Amekpor, Waheed Sakariyau, Nathan Ezie Kengo, Nwodo Amarachukwu Sandra, Joseph Agyapong, Zakariya'u Dauda, Samuel Kwarteng, David Adeoye Adedokun and Gideon Darko (2025)	Integrating Maternal and Child Health Into Climate Change: A Holistic Approach	Narrative / Literature Review	It was discovered that, climate change negatively impacts food and water security, heat stress, extreme weather, and air pollution, with women and children most affected. The World Health Organization estimates 250,000 climate-related deaths annually by 2050, disproportionately affecting maternal and child health. Integrating climate and maternal health strategies could offer benefits, yet research on adapting to climate change's effects on pregnancy outcomes is limited. Addressing maternal and child health requires integrating health-focused strategies into environmental policies to reduce vulnerabilities to climate-related risks. A comprehensive approach can enhance resilience by improving healthcare access, education, and sustainable resource management, benefiting public health and environmental outcomes.	Researchgate https://www.ssph-journal.org/journals/public-health-reviews/articles/10.3389/phrs.2024.1607553/full
2.	Francesca Conway, Anayda Portela, Veronique Filippi, Doris Chou, Sari Kovats (2024)	Climate change, air pollution and maternal and newborn health: An overview of reviews of health outcomes	Systematic Literature Review	We found 79 reviews investigating the effects of climate hazards on MNH, mainly focussing on outdoor air pollution (n = 47, 59%), heat (n = 24, 30%), and flood/storm disasters (n = 7, 9%). Most were published after 2015 (n = 60, 76%). These reviews had consistent findings regarding the positive association of exposure to heat and to air pollution with adverse birth outcomes, particularly preterm birth. We found lim-	Google Scholar https://pmc.ncbi.nlm.nih.gov/articles/PMC11117177/

				<p>ited evidence for impacts of climate-related food and water security on MNH and did not identify any reviews on climate-sensitive infectious diseases and MNH. Climate change could undermine recent improvements in maternal and newborn health. Our review provides an overview of key climate risks to MNH. It could therefore be useful to the MNH community to better understand the MNH needs for each climate hazard and to strengthen discussions on evidence and research gaps and potential actions. Despite the lack of comprehensive evidence for some cli-mate hazards and for many maternal, perinatal, and newborn outcomes, we observed repeated findings of the impact of heat and air pollutants on birth outcomes, par-ticularly preterm birth. It is time for policy dialogue to follow to specifically design climate policy and actions to protect the needs of MNH.</p>	
3.	<p>Louise Wallerich, Amandine Fillo, Ana Rivadeneyra, Stéphanie Vandentorren, Jérôme Wittwer, Linda Cambon (2023)</p>	<p>Environment and child well-being: A scoping review of reviews to guide policies</p>	<p>Literature Review</p>	<p>Forty-seven articles were selected. Their analysis allowed us to identify five categories of interdependent environmental determinants of child health: i) urban design ii) contaminants, iii) parenting environment, iv) social conditions, v) climate change. Together and in a systemic way, they act on the health of the child. The review carried out allows us to propose a pragmatic framework for clarifying the effects of the physical, social, and economic environment on children's health and well-being.</p>	<p>Google Scholar https://pubmed.ncbi.nlm.nih.gov/37808945/</p>
4.	<p>Emma L. Lawrance, Rhiannon Thompson, Jessica Newberry Le</p>	<p>The Impact of Climate Change on Mental Health and Emotional Wellbeing: A</p>	<p>Literature Review</p>	<p>Climate change acts as a risk amplifier by disrupting the conditions known to support good mental health, including socioeconomic, cultural and environmental</p>	<p>PubMed https://www.tandfonline.com/doi/full/10.1080/09540261.2022.2128725</p>

	Vay, Lisa Page & Neil Jennings (2022)	Narrative Review of Current Evidence, and its Implications		conditions, and living and working conditions. The disruptive influence of rising global temperatures and extreme weather events, such as experiencing a heatwave or water insecurity, compounds existing stressors experienced by individuals and communities. This has deleterious effects on people's mental health and is particularly acute for those groups already disadvantaged within and across countries. Awareness and experiences of escalating climate threats and climate inaction can generate understandable psychological distress; though strong emotional responses can also motivate climate action. We highlight opportunities to support individuals and communities to cope with and act on climate change. Consideration of the multiple and interconnected pathways of climate impacts and their influence on mental health determinants must inform evidence-based interventions. Appropriate action that centres climate justice can reduce the current and future mental health burden, while simultaneously improving the conditions that nurture wellbeing and equality. The presented evidence adds further weight to the need for decisive climate action by decision makers across all scales.	
5.	Francis Vergunst and Helen L. Berry (2022)	Climate Change and Children's Mental Health: A Developmental Perspective	Systematic Literature Review	Climate change is a major global public-health challenge that will have wide-ranging impacts on human psychological health and well-being. Children and adolescents are at particular risk because of their rapidly developing brain, vulnerability to disease, and	PubMed https://pubmed.ncbi.nlm.nih.gov/35846172/

limited capacity to avoid or adapt to threats and impacts. They are also more likely to worry about climate change than any other age group. Drawing on a developmental life-course perspective, we show that climate-change-related threats can additively, interactively, and cumulatively increase psychopathology risk from conception onward; that these effects are already occurring; and that they constitute an important threat to healthy human development worldwide. We then argue that monitoring, measuring, and mitigating these risks is a matter of social justice and a crucial long-term investment in developmental and mental health sciences. We conclude with a discussion of conceptual and measurement challenges and outline research priorities going forward.

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| 6. | Vera Clemens, Eckart von Hirschhausen2 · Jörg M. Fegert (2022) | Report of the intergovernmental panel on climate change: implications for the mental health policy of children and adolescents in Europe—a scoping review | Systematic Literature Review | Climate change is a worldwide challenge. Its consequences do encompass severe threats not only for the existence and somatic health, but also for the mental health of children and adolescents. Mental health can be impaired by three types of consequences. Direct consequences of climate change, such as natural disasters and indirect consequences, such as loss of land, flight and migration, exposure to violence, change of social, ecological, economic or cultural environment. Moreover, the increasing awareness of the existential dimension of climate change in children and adolescents can influence their well-being or challenge their mental health. Consequences of climate change for somatic health may interact with | Researchgate

https://www.researchgate.net/publication/343890575_Report_of_the_intergovernmental_panel_on_climate_change_implications_for_the_mental_health_policy_of_children_and_adolescents_in_Europe-a_scoping_review |
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mental health or have psychological sequelae in children and adolescents. Based on the estimates by the United Nations Intergovernmental Panel on Climate Change, we have summarized current data on these differential pathways as to how climate change affects the mental health of children worldwide through selective literature research on Pubmed. Mental health sequelae of direct and indirect consequences of climate change, increased awareness and physical health problems caused by climate change are presented. We give insights into special vulnerabilities of children and adolescents and identify high-risk groups. As the “Fridays for Future” movement has been initiated in northern Europe, we will discuss these results with a focus on children and adolescents in Europe. The results indicate that climate change is a serious threat to children and adolescent mental health. Children’s rights, mental health and climate change should not continue to be seen as separate points; instead, they need to be brought together to address this major challenge determining the future of our children and their descendants.

7.	Rhea Rocque, Caroline Beaudoin, Ruth Ndjaboue, Laura Cameron, Louann Poirier- Bergeron, Rose- Alice Poulin- Rheault, Catherine Fallon, Andrea C Tricco, Holly O Witteman (2021)	J	Health effects of climate change: an overview of systematic reviews	Systematic Reviews	We included 94 systematic reviews. Most were published after 2015 and approximately one-fifth contained meta-analyses. Reviews synthesised evidence about five categories of climate impacts; the two most common were meteorological and extreme weather events. Reviews covered 10 health outcome categories ; the 3 most common were (1) infectious diseases, (2) mortality and (3) respiratory, cardiovascular or neurological outcomes. Most reviews suggested a deleterious impact of climate change on multiple adverse health outcomes, although the majority also called for more research. Most systematic reviews suggest that climate change is associated with worse human health. This study provides a comprehensive higher order summary of research on health impacts of climate change. Study limitations include possible missed relevant reviews, no meta- meta- analyses, and no assessment of overlap. Future research could explore the potential explanations between these associations to propose adaptation and mitigation strategies and could include broader sociopsychological health impacts of climate change.	PubMed https://pubmed.ncbi.nlm.nih.gov/34108165/
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8.	Myriam V. Thoma, Nicolas Rohleder and Shauna L. Rohner (2021)	Clinical Ecopsychology: The Mental Health Impacts and Underlying Pathways of the Climate and Environmental Crisis	Systematic Literature Review	Humankind is confronted with progressing climate change, pollution, environmental degradation, and/or destruction of the air, soil, water, and ecosystems. The climate and environmental crisis is probably one of the greatest challenges in the history of humankind. It not only poses a serious current and continuing threat to physical health, but is also an existing and growing hazard to the mental health of millions of people worldwide. This synergy of literature provides a current summary of the adverse mental health impacts of the climate and environmental crisis from the perspective of Clinical Psychology. Furthermore, it presents potential underlying processes, including biological, emotional, cognitive, behavioral, and social pathways. The existing data suggest that the climate and environmental crisis not only acts as a direct stressor, but can also exert a detrimental impact on the various pathways, with the potential to amplify an individual's biopsychosocial vulnerability to develop mental ill-health. This is a call for an increased investigation into this emerging research field of Clinical Ecopsychology by clinical psychologists and other researchers.	Researchgate https://www.frontiersin.org/journals/psychiatry/articles/10.3389/fpsyt.2021.675936/full
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Discussion

Based on the results of the systematic literature review analysis, the data obtained are as follows :

1. Climate Change

Climate change has increased the

frequency and intensity of extreme weather events, such as heavy rain, floods, heat waves, and storms. Young children are the most vulnerable group to its impacts, given that their immune systems are still developing. The impact of extreme weather

on children includes not only physical health but also psychological and social development (Wallerich, 2023).

2. Impact of Extreme Weather on Young Children

a. Physical Health

- 1) Respiratory Diseases : Air pollution due to heat waves or disasters such as forest fires can trigger asthma and respiratory infections in children.
- 2) Waterborne Diseases : Floods often carry the risk of diseases such as diarrhea, dengue fever, and leptospirosis, which are especially dangerous for children.
- 3) Dehydration and Heatstroke : Heat waves increase the risk of dehydration in children because they have a harder time regulating their body temperature (Lawrance, 2022).

Heat stress can lead to the risk of heat stroke and diarrhea due to dehydration. This leads to an increased risk of respiratory disease, organ dysfunction such as kidney failure, and chronic problems due to birth defects (Lawrance, 2022).

b. Mental Health

Increased mental health issues in

children have been linked to high temperatures. Heat can cause high stress and sleep deprivation, which can lead to more depressive episodes and post-traumatic stress disorder (Vergunst, 2022).

c. Psychological Health

Extreme weather and related disasters can cause trauma, anxiety, and insecurity in children. Young children may have difficulty expressing their feelings, requiring extra attention (Clemens, 2022).

Extreme Weather Events: Adverse Impact on Mental Health of Children It is feared that the future generations will react to climate change related information and understanding with feelings of despair. Children are known to show much more severe distress after disasters than do adults. Children are especially prone to predisaster anxiety and post-trauma illness, which may be either due to direct exposure to lifethreatening circumstances and likely separation from family and community supports, or due to “the reality of living with long term threat”. In a survey of Australian children, researchers noted that “a quarter of children are so troubled about the state of the world that they honestly believe it will come to an end before they get older”. It is the duty of

governments and public and the educational institutions to propagate information about climate change in a manner acceptable and suited for the age of children and increase their mental well-being by preparing them physically and mentally to face these events. For this, changes in curriculum are required so as to include disaster preparedness as a necessary tool to be given in the hands of our children by the educational system. This will help protect our children from harmful mental health impacts of these events (Rocque, 2021).

- d. Disruption to Activities and Learning
 - 1) Loss of Access to Education : Extreme weather such as flooding can disrupt learning activities in PAUD or Kindergarten. Hot weather is highly correlated with causing dehydration, which affects children's ability to concentrate, which will impact their performance at school.
 - 2) Impact on Social Development : Children lose the opportunity to play and socialize, which are important for their development (Ministry Of Environment And Forestry Of The Republic Of Indonesia, 2023).

3. Challenges in Dealing with Extreme Weather

- a. Lack of Weather-Resistant Facilities in Educational Institutions

Many PAUD or early childhood schools do not yet have adequate infrastructure to deal with extreme weather, such as flood-resistant learning spaces.

- b. Lack of Knowledge of Parents and Teachers

Not all parents and teachers have adequate understanding of extreme weather risk mitigation and child protection.

- c. Limited Medical and Psychological Resources

Health services and psychological support for children are often inadequate during or after disasters (Thoma, 2021).

4. The Emerging Psychosocial Challenge

After an extreme weather event, or other natural disasters, there are other constraints such as lack of resources and skills to deal with the challenge, including the immediate chaos and extensive distress in the affected people. Of greater concern is the fact that, at such times, the available mental health services for people already having mental disorders are disrupted and the new cases that emerge after a disaster remain untreated for a long while. It can be said that even the countries which have

well-established mental health services lack disaster preparedness to deal with the mental challenge posed after disaster. There is speculation that as a result of climate change related mental health challenges emerging after a disaster, pharmaceuticals companies may come up with new drugs. Some of these drugs could lead to extreme violent events, such as shootings and violence in future. There is a need to deliberate on measures through which we can prevent and mitigate the sufferings related to extreme weather events and to help the public adapt to such eventualities (Thoma, 2021).

Increasingly, government and various relief and aid agencies are emphasizing psychological and psychosocial support and interventions as a part of their overall response to disasters and other climate related emergencies. During the Indonesia countries' response to Tsunami, mental health and psychosocial services received due attention and emergency mental health services were a part of the disaster emergency services. Countries, across the globe, need to be prepared with these services to meet with the psychosocial consequences of these extreme events. The success of the mental health services in dealing with the impacts of climate change, in the long run, will depend upon the availability of skilled manpower and the extent to which these services are brought into the fold of related services, such as private and public health services, aid

organizations, and the government agencies which deliver essential services. Quick evacuation from a disaster facing area may also help in mitigating the mental health sufferings of people living in its vicinity. If we are prepared for the severe weather, there is bound to be less anxiety. It has been found that for families and children who are prepared for disaster emergencies, there is less anxiety. It definitely pays to plan and be prepared for extreme weather events. There is a realization that behavioral changes also need to be brought about in order to meet the climate change challenge. Psychologists have not yet understood what these behavioral changes are going to be, yet they are in agreement that day to day changes in behavior can lead to positive changes, on an extensive scale, in the long run. Thus, there is a need to emphasize behavioral changes regarding how we consume the earth's resources and the risks involved in overusing or abusing these resources. We need to pay attention to the consumption patterns, risk perceptions, and the emotions related to climate change, as these are very important factors in preventing and containing the threat to climate across the globe. There is an evident need to include social science and behavioral science research within climate change research, so that needed mental health services and help could be made available on time, then and there, following any population shifts that could arise as per projections of climate change research

(Amekpor, 2025).

5. Solutions To Reduce The Impact Of Extreme Weather On Early Childhood

- a. Parent and Teacher Education
 - 1) Provide training on extreme weather risk mitigation, such as how to keep children hydrated during heat waves or avoid exposure to contaminated floodwater.
 - 2) Teach the early signs of illness due to extreme weather, such as symptoms of dehydration or respiratory infections.
- b. Strengthening Child-Friendly Infrastructure
 - 1) Create safe and child-friendly classrooms with good ventilation to prevent excessive heat.
 - 2) Provide emergency evacuation spaces in schools to protect children from immediate dangers such as floods or storms.
- c. Psychosocial Support
 - 1) Hold play therapy activities to help children recover from trauma.
 - 2) Involve professionals in providing emotional support to children and their families.
- d. Collaboration with Government and Community
 - 1) The government can support

with extreme weather mitigation policies, such as building embankments in flood-prone areas or providing clean water during disasters.

- 2) Communities can be involved in providing education or logistical assistance during disasters.

- e. Increasing Environmental Awareness
 - Children can be taught environmental awareness from an early age, such as the importance of maintaining a clean environment to prevent flooding or planting trees to reduce the impact of heat waves (Amekpor, 2024).

UNICEF provides tips for dealing with hot weather to keep children comfortable and safe, including :

- a. Supervise children's activities even when playing indoors.
- b. Monitor early signs and symptoms of heat illness.
- c. Avoid being outdoors during hot days and evenings.
- d. Help them adjust slowly to any exercise or physical activity.
- e. Encourage them to rest and cool down in the shade when they start to feel hot.
- f. Remind children to drink water often to stay hydrated

(Clemens, 2022).

6. The Role of Psychologists

In order to address the direct and acute mental health consequences of extreme weather events resulting from climate change, the psychologists may be guided by the findings of disaster psychology and should aim at improving the long-term psychosocial adjustment of the affected people. To address the indirect mental health impacts of climate change, psychologists can employ individual and group therapies for those affected. The therapy they will use may depend on the clinical picture presented by the affected cases and the adherence of the concerned psychologist towards any of the therapeutic schools, such as “eco-psychology, grief/loss counseling, cognitive behavioral therapy, and interpersonal therapies, and group therapy. Psychologists can also intervene by providing life skill based training through “mitigation and adaptation behaviors” training, so as to increase the coping capacities of populations facing the mental health impacts of climate change (Clemens, 2022).

The government, public, and psychologists need to follow the findings and projections of climate change research with interest and purpose to prepare their capacities and skills, beforehand, in order to face the challenges that will be posed to them, as projected by these researches. The governments need to be prepared for mental health challenges of climate change related disasters, and they need to look at these as investments and as preventive and

mitigating measures. Additionally, the governments can continue to focus on pollution control and switching to cleaner energy options. They also need to encourage research that looks at the mental health impacts of climate change on society. At the same time, there is the need to address the mental health impacts of disasters that have already happened. There is a tremendous effort required from psychologists and behavioral scientists. They need to be future oriented and prepared in order to deal with this mental health challenge. Psychologists need to start organizing themselves into “ready to respond” teams in case of climate related extreme disasters causing mental health problems. They also need to address the free floating anxiety and worry of the general population related to actual and projected climate change related extreme disasters happening across the globe. Government and community initiatives need to be taken on a large scale to institutionalize the mechanisms for psychological support, along with other socioeconomic measures, for dealing effectively with the actual and projected climate related adverse mental health impacts (Rocque, 2021).

CONCLUSIONS

Increased mental health problems in children have been linked to high temperatures. Heat can cause high stress and sleep deprivation, which can lead to more depressive episodes and

post-traumatic stress disorder.

Indonesian children are vulnerable to the impacts of climate change. Children will increasingly face environmental and climate-related risks that will affect their health, food security and access to nutritious food, clean water and sanitation facilities, and their future livelihoods. In addition, children can face many psychosocial impacts after disasters, such as emotional stress and even post-traumatic stress disorder (PTSD). Therefore, it is critical to strengthen the resilience of disadvantaged children and families so that they not only cope with the impacts of climate change but also adapt to new climate conditions.

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