

## Health Impacts of Climate Change on Children and Adolescents: A Protocol for Review of Reviews

<sup>1</sup>Rilwan Yahaya\*, <sup>2</sup>Salifu Sharif Alhassan, <sup>3</sup>Rosemary Sitsofe Ayebi-Arthur, <sup>4</sup>Regina Boatemaa Berchie, & <sup>5</sup>Edward Wilson Ansah

<sup>1-5</sup>Department of Health, Physical Education and Recreation, University of Cape Coast, Cape Coast, Ghana.

*\*Corresponding author:*

Rilwan Yahaya

[rilwan.yahaya001@stu.ucc.edu.gh](mailto:rilwan.yahaya001@stu.ucc.edu.gh)

+233544802122

### Abstract

**Introduction:** Climate change is a contemporary phenomenon of grave concern to global public health. Climate change events like extreme heat, rising sea levels, floods, food insecurity and others, significantly affect local, regional, and global life conditions. The climate crisis affects the health of the elderly, adults, workers, children and adolescents. However, climate change events are gravely impacting the current and future health and well-being of children and adolescents. Though there are evidence from syntheses their integration is vital for policy and practice to protecting children and adolescents in the ever-changing climate. Therefore, this review aims to re-map the existing reviews of the impact of climate change on the health and well-being of children and adolescents.

**Method:** This review will be carried out according to Arksey and O'Malley's (2005) recommendations and report based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension of Scoping Reviews (PRISMA-ScR). Scopus, JSTOR, Web of Science, PubMed, Embase and PsycInfo will be searched to identify relevant records for inclusion in this review. Additional searches will be conducted in Google Scholar and Google for other relevant articles.

**Analysis:** Extracted data will be analysed using thematic content analysis, where data are summarised and qualitatively synthesised according to the recommendations of PRISMA-ScR and Tricco et al. (2018). The results and findings regarding the impacts of climate change on the health and safety of children and adolescents will be compiled, categorized, and presented using a qualitative narrative synthesis.

**Keywords:** Protocol, Climate Change, Health, Children, Adolescents, Review of Reviews, Well-being

### Introduction

Climate change has become a major global public health of the twenty-first century, affecting individuals of all age groups, from children to adolescents to workers, adults, and the elderly [1,2]. The present and future health and well-being of children and adolescents are disproportionately threatened by global climate change crisis [3], because children grow optimally in stable homes, communities, schools, and neighbourhoods [4], settings that are being compromised by the climate crisis.

Climate change refers to a gradual atmospheric shift, manifesting in extreme weather patterns, including rising temperatures, rising sea level, floods, food insecurity, and other phenomena that profoundly and negatively impact local, regional, and global living conditions [5,6]. Evidence suggests that the climate crisis is largely anthropogenic, by human activities, such as fossil fuel combustion for energy, industrial processes [7], rapid urbanisation [8], and deforestation, which are accelerating adverse atmospheric changes [9]. The consequences of these are mostly on the life of the very vulnerable people like children and adolescents.

The rate and severity of life-threatening weather events like droughts, storms, floods, heatwaves and wildfires have increased considerably owing to the adverse changing climate [10], further causing community disruptions, property damage, climate-related illnesses, and fatalities, becoming more frequent, intense [11]. For example, the 2023 wildfires in Hawaii and the floods in Vermont were intense and frequent because of the changing climate [12]. Moreover, over six hundred million people have already moved from the 'human climatic niche' because of the effects of climate change [13]. Accordingly, heatwaves will displace up to three billion people by the end of this century [14]. Unfortunately, adolescents and children have been particularly impacted by the detrimental health effects of climate change; this very vulnerable group bears up to 88% of the global burden of climate-related illness, placing them at severe threat [15,16,17].

Climate change significantly affects the well-being, health and safety of adolescents and children because of their sensitivity to environmental risks, and damage sustained during these crucial periods may have long-term effects on such persons [18,19]. Moreover, the vulnerability of children to environmental changes is pronounced because of their smaller stature, physiological and cognitive fragility, and their complete reliance on caregivers for safety and protection [20]. The issue is that children have rights to survival, education, good health, quality nutrition, and welfare, recognized and upheld by Sustainable Development Goals (SDGs) and the Convention on the Rights of the Child [21,22]. Unfortunately, climate events are threatening and taking away the fundamental human rights from children and adolescents. For example, the recent rise in malaria, malnutrition, diarrhoea, mental health challenges and risk of under-five mortality, wasting and stunting, are associated with climate change [21,23,24].

Several recent review studies conducted on the impact of climate change on children's health [14,21,25] demonstrated both direct and indirect effects of climate change on children's health, with implications for higher morbidity and mortality from various climate-

related diseases. However, these results though important, they are fragmented with limited collation of evidence into drawing conclusions for policy and practice. Thus, there is a need for re-collation of existing reviews to have a thorough understanding of the possible short-term and long-term health effects of the climate crisis on the health of children and adolescents to aid policy and practice.

A review of reviews becomes an essential method to re-examine the breadth and depth of available review evidence on the effects of climate change on the health of children and adolescents. Fortunately, several scoping, narrative and other reviews provided some level of understanding of the impact of climate change on the health of children and adolescents [21,23,24]. These reviews concluded that adolescents in vulnerable populations, especially those living in low-income areas, are disproportionately affected by climate change events. Accordingly, climate change increases the risk of mental health issues, substance addiction, and unintentional injuries among adolescents [26,27].

Despite the increasing volume of primary research, scoping and other reviews regarding the health consequences of climate change on adolescents and children are but a few [28,29]. One specific area that needs more exploration is the specific health impacts of climate change on adolescents and children. The health impact on adolescents and children in low- and middle-income countries (LMICs), indigenous communities, and individuals with pre-existing health conditions, is also not explored in the existing reviews. More importantly, though there are a number of reviews on this subjects that provide robust evidence [8,14,21,24,25], the discrepancies in methodological approaches demands the collation of reviews into one stop shop to aid policymakers and practitioners. Moreover, such review of reviews would help to identify gaps in the existing review literature.

So, protocols become important approach to providing a comprehensive method for review into existing evidence. Protocols like the current one are methodological maps for the main review, which aims to aid future researchers who may want to replication the study. When protocols are published, it helps other researchers with similar ideas to stop their review or look for the available gap literature rather than just duplicating existing reviews. Therefore, there is a need for up-to-date critical evidence, making a stronger case for research, policy and evidence-based interventions that protect and promote the health, safety and well-being of children and adolescents in the ever-worsening climate variability.

Other researchers, government officials, and policymakers will find this synthesis useful. The aim of the review is to gather current evidence from existing reviews on the effects of climate change on the well-being, health, and safety of children and adolescents.

## **Method and Materials**

This scoping review uses the guidelines by Arksey and O'Malley [30]. The review involves the following steps: (1) identifying and stating research objectives; (2) identifying relevant studies; (3) study selection; (4) data collecting; (5) data summary and synthesis of results; and (6) consultation. Again, we report the results and findings from this review in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) 2020 standards [31]. The review protocol is registered at Open Science Framework: [osf.io/a7deq](https://osf.io/a7deq).

The Arksey and O'Malley's guidelines provide a clear and orderly methodological framework for conducting a scoping study and ensure a thorough evaluation by requiring researchers to document their activities and decisions systematically [30]. The guidelines facilitate collaboration among researchers by providing a common framework and terminology for conducting and reporting scoping reviews. Arksey and O'Malley's framework can be applied to various subjects making it an excellent resource for researchers. These principles guide future research and policy decisions while emphasizing the need to identify research gaps and areas that require further exploration. The guidelines also promote transparency in the review process, which could increase the validity and trustworthiness of results and findings from reviews [30].

## **Research Questions**

The review will be guided by the following three research questions: (1) What are the impacts of climate change on the health and safety of adolescents and children? (2) What factors make adolescents and children more susceptible to climate change impacts? (3) What health promotion and public health interventions are available to protect adolescents and children from the impacts of climate change?

## **Search strategy**

A comprehensive search will be performed across six databases: Scopus, PubMed Central, PsycINFO, Web of Science, JSTOR, and Embase. The goal is to identify relevant review articles for the current review. Additional search will be conducted in Google

Scholar and Google for other relevant articles that could be selected into the review. We developed a search strategy that utilized keywords, Medical Subject Headings (MeSH) terms, and controlled vocabularies for the initial search in PubMed Central (See Table 1). After that, the search terms are modified to allow for further database searches (Scopus, Web of Science, JSTOR, Embase and PsycINFO). This becomes necessary because each database has a unique search strategy demanding specific balloon search terms for retrieval of very relevant results.

We intend to extract appropriate peer- reviewed papers that are published in English language spanning January 2000 later, to enable us to retrieve up-to-date relevant articles for the current review. This is because though climate change issues have been published over several decades, the popularity of health-related climate change literature started to increase in recent time.

**Table 1: Search Strategies**

	<b>PubMed Central - Search Strategy</b>
#1 Search to find climate change	Climate change [MeSH Term] OR Global warming [MeSH Term] OR Environmental change* OR Climate cris* OR Temperature ris* OR Greenhouse effect [MeSH Term] OR Weather extreme*
# 2 Search to find Children	Child [MeSH Term] OR Children* OR Baby OR Infant* OR Pediatric* OR Infants*
#3 Search to find Adolescents	Adolescent* [MeSH Term] OR Adolescents* OR Teens* OR Teenagers*
#4 Search to identify outcome	Outcome* OR Result* OR Consequence* OR Effect* OR Impact* OR Implication*
Broader search strategy	#1 AND #2 AND #4 AND NOT animal* #1 AND #3 AND #4 AND NOT animal* (Filters activated: English, from 2000/01/01)
	<b>Web of Science - Search Strategy</b>
# 1 Search to find climate change	("climate change" OR "global warming" OR "climate variability")
# 2 Search to find children	("children" OR "Infants")
# 3 Search to identify Adolescents	("adolescent" OR "teenagers")
# 4 Search to identify outcome	("impacts" OR "outcome" OR "results")

Broader search strategy	#1 AND #2 AND #3 and not animal" #1 AND #3 AND #4 and not animal" (English filters activated, 2000/01/01)
	<b>Scopus - Search Strategy</b>
# 1 Search to identify climate change	("climate change" OR "global warming" OR "climate variability")
# 2 Search to identify children	("children" OR "Infants")
# 3 Search to identify Adolescents	("adolescent" OR "teenagers")
# 4 Search to identify outcome	("impacts" OR "outcome" OR "results")
Overall search strategy	#1 AND #2 AND #3 and not animal" #1 AND #4 AND #4 and not animal" (English filters activated, 2000/01/01)
	<b>JSTOR - Search Strategy</b>
# 1 Search to identify climate change	("climate change" OR "global warming" OR "climate variability")
# 2 Search to identify children	("children" OR "Infants")
# 3 Search to identify Adolescents	("adolescent" OR "teenagers")
# 4 Search to identify outcome	("impacts" OR "outcome" OR "results")
Overall search strategy	As stated in the English filters enabled on January 1, 2000, "#1 AND #2 AND #3 and not animal" #1 AND #3 AND #4 and not animal"
	<b>PsycInfo - Search Strategy</b>
# 1 Search to identify climate change	("climate change" OR "global warming" OR "climate variability")
# 2 Search to identify children	("children" OR "Infants")
# 3 Search to identify Adolescents	("adolescent" OR "teenagers")
# 4 Search to identify outcome	("mental health" OR "psychological impacts")
Overall search strategy	#1 AND #2 AND #3 and not animal" #1 AND #3 AND #4 and not animal" (English filters activated, 2000/01/01)
	<b>Embase - Search Strategy</b>
# 1 Search to identify climate change	('climate change'/exp OR 'global warming'/exp OR 'climate variability')
# 2 Search to identify children	('children' OR 'Infants' 'paediatrics')
# 3 Search to identify Adolescents	('adolescent' OR 'teenagers')
# 4 Search to identify outcome	('health impact'/exp OR 'children's health'/exp OR 'adolescent health'/exp OR 'paediatric health'/exp)

Overall search strategy	#1 AND #2 AND #3 and not animal' #1 AND #3 AND #4 and not animal' (The English filters were activated from January 1, 2000)
-------------------------	--

## Study Selection

The retrieved records will be imported into the Mendeley software, where these records are deduplicated or duplicated records are eliminated. Moreover, a three-stage screening process will be applied to the remaining records to enable us select appreciate published reviews for the study. First, six graduate students will screen the titles and abstracts of the retrieved records to find full-text records for further screening. This stage of the screening will be supervised by authors RY and RSAA. The second stage will involve that authors RBB, SSA, and RSAA search the reference lists of selected full-text records to identify further pertinent articles for assessment. This is important because it is assumed that full-text articles contain very relevant list of references that researchers could use to get additional articles for their current study. The third stage will involve screening the full-text records independently by two groups of authors (RY and SAA, and RSAA and RBB), done according to the eligibility criteria (See Table 2). These processes ensure that only the very relevant published evidence synthesis peer-review articles are included in the current review. Besides, there would be cross-over screening where screening done by a group is cross-checked by another group. The process helps to provide valid and reliable results and findings for the review. Led by author EWA, researchers will have weekly meetings to discuss the screening process, and any discrepancies will be resolved by consensus. See the PRISMA flow diagram that represents the selection process (See Figure 1, Model PRISMA floor diagram

**Table 2: Eligibility criteria**

Items	Criteria
Inclusion criteria	Paper should be:
	The review paper must peer-reviewed, like scoping reviews, systematic reviews, rapid reviews, systematic living reviews, topical reviews, and meta-aggregative reviews.
	Reviews articles that are published in the English language.
	Review articles from January 2000 to March 2025.
	Articles examining how children and adolescents aged 0 to 18 are affected physically and mentally by climate change.



Exclusion criteria	The paper should be:
	Review papers focusing solely on adults or older adults.
	Grey literature, conference proceedings, and editorials.
	Primary research studies.
	Non-English language publications.
	Other review papers, i.e. meta-analytic reviews, meta-regression reviews, review of reviews or umbrella reviews or review that involved quantitative analysis.

### **Data extraction and charting**

Like in the primary research, data extraction is a key component of the conducting a systematic review. However, while a researcher could collect data in primary research, data extraction for review demands that multiple individuals carry out the assignment. There is a further need to prepare, review and pilot test data extraction sheet according to study objective or research questions. The aims are to increase consistency in data extraction to improve study validity. It is important to note that data extraction sheet is not finite, it is iterating since new variables could face while reading the selected articles.

Two authors (RY and RAT) will carry out data extraction independently, which will be reviewed by authors SSA and EWA, to aid data accuracy, reliability and consistency. While author RY extracts data on the authors, year of publication, study objectives, and the type of review (systematic review, scoping review, rapid review, living systematic review, umbrella review, topical review, and others), author RBB will gather data regarding climate change events (extreme heat, floods, droughts, etc.), effects of climate change on the various forms of health, safety and well-being of adolescents and children from the selected review articles. Moreover, data on reported vulnerability factors, health promotion or public health initiatives intended to protect adolescents and children from the negative impacts of climate change on their well-being and health, will be extracted by author RSAA. Authors will cross-validate the extraction done by other authors while author EWA reviews the extracted data from the other authors to finalise the data. The purpose of the review and cross-validation is to improve the consistency, reliability of the extracted data. This also helps to ensure that the extracted data are complete and accurate to represent our stated research questions.



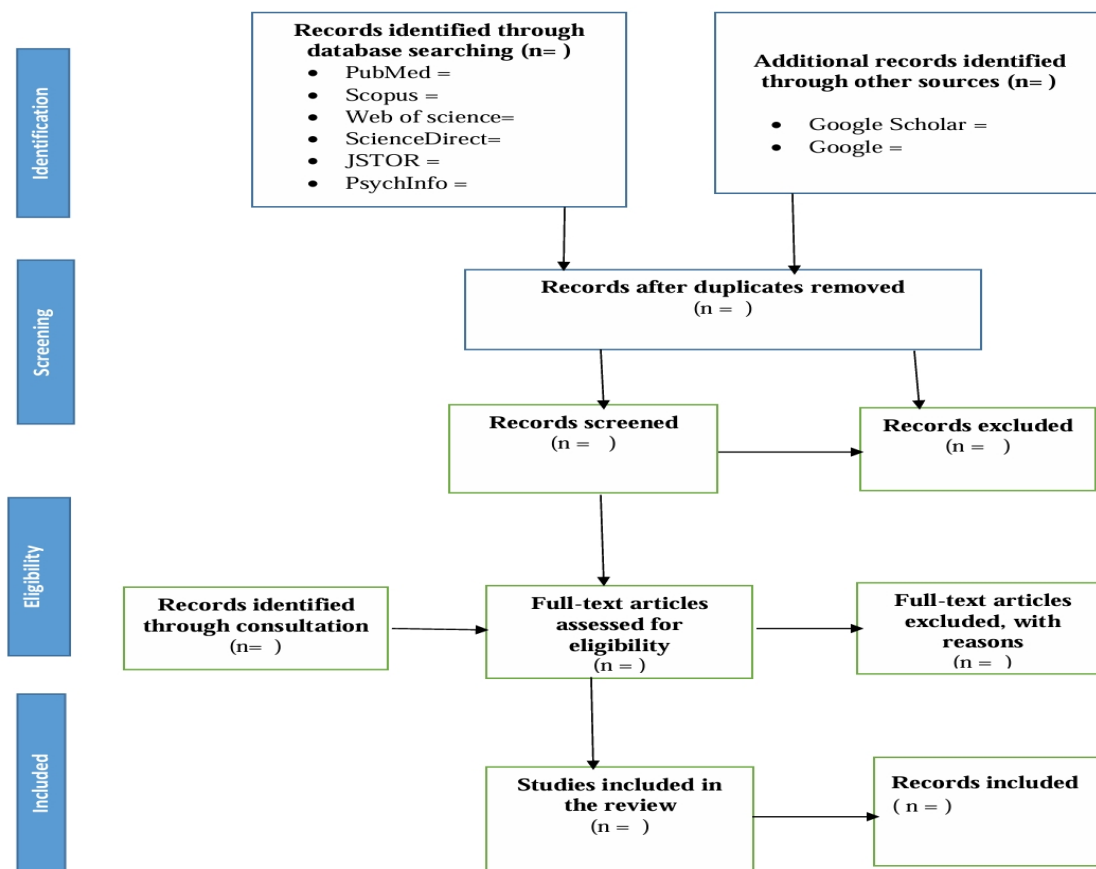


Fig. 1. PRISMA Flow diagram of the selection process of included reviews

## Quality assessment

Methodological quality assessment is important for the review articles that are selected and included in synthesised studies. Thus, we will use AMSTAR – a measurement tool to assess the methodological quality of systematic reviews [32] to assess the quality of selected and included reviews. AMSTAR is an 11-item validated quality appraisal [33] instrument that assesses published review papers. The 11-items for assessing review studies included; whether review questions and inclusion criteria established before the review; duplicate study selection and data extraction performed; comprehensive literature search performed; publication (i.e. grey literature) used as an inclusion criterion; list of studies (included and excluded) provided; characteristics of the included studies provided; scientific quality of the included studies assessed and documented; scientific quality of the included studies used appropriately in formulating conclusions; methods used to combine the findings of studies appropriate; likelihood of publication bias assessed; and whether

conflict of interest stated [32]. Each of these 11-item assessment criteria is used to rate published review articles as Yes, No, I don't know or Not Applicable [33], which we applied in assessing the quality of the included review articles.

### **Data analysis and synthesis**

Extracted data will be analysed using thematic content analysis, where data are summarised and qualitatively synthesised according to the recommendations of Arksey and O'Malley [30] and PRISMA-ScR [31]. As a result, we will summarize, categorize using induction approach, and present the results and findings regarding the interactions between climate change events and health, safety and well-being parameters of children and adolescents. This is a methodical procedure in which the data is coded and categorized into themes and sub-themes according to the stated questions [34,35]. The initially provided descriptive codes are then used as a basis for creating new and detailed ones to answer the stated research questions [34]. This approach aims to enhance comprehensive understanding of how climate change events impact the health and well-being of children and adolescents, as reported by published review papers.

The findings from the analysis then allows us to synthesize, present and provide in-depth discussion of the findings to draw conclusions and recommendations concerning the effects of climate change on the health and well-being of children and adolescents, and policy and practice relevance of the findings. Using a qualitative synthesis then enables the researcher to explore the short-term and long-term effects of the climate distress on the health and well-being of children and adolescents. Besides, this qualitative synthesis and narrative analysis help distil the gap in research literature and draw attention to the needed directions for future research from our discussion of the findings from the review.

### **Consultation**

Consultations are important for carrying out scoping reviews. We consulted Dr Mustapha Amoada, a Research Fellow, who also reviewed both the search teams and search strategies, and may also review the extracted data. He is a review expert and climate change and health researcher. Additionally, we are consulting chartered librarian at the Sam Jonah Library of the University of Cape Coast who is helping the design of the search and assisting in conduct of the search for relevant records.

### **Declarations**

### **Patient and public involvement**

This study has not involved, nor will it involve, any patients or members of the public in its design or implementation.

### **Ethical approval and informed consent**

Ethical approval is not required because there will be no collection of primary data, or patient involvement. We are expecting to publish the findings of this article in reputable a journal and or present the findings at climate change conferences and workshops. The protocol is registered at OSF; [osf.io/a7deq](https://osf.io/a7deq)

### **Data availability**

Materials used for this manuscript are included and available in the manuscript

### **Competing interests**

No conflicting interests are disclosed by the authors.

### **Funding**

The review received no financial assistance or grants from a public, commercial, or non-profit organization.

### **Author Contribution**

Conceptualization: SSA, RY, RSAA, RBB and EWA, Supervision: EWA, Writing, original draft: SSA, RY, RSAA, RBB and EWA, Writing review & editing: RY and EWA. The guarantor, EWA, takes full responsibility for the conduct of this study, the final product, and the decision to publish. All authors approved the final manuscript for publication.

### **Acknowledgment**

Dr. Mustapha Amoada of Biomedical and Clinical Research Center, UCC for the inputs into the review. We are equally grateful to the librarian at the Sam Jonah Library who assisted us to design our search terms.

### **References**

1. Gaziulusoy Aİ. The experiences of parents raising children in times of climate change: Towards a caring research agenda. *Curr Res Environ Sustain.* 2020;2:100017.

2. World Health Organization. COP26 Special Report on Climate Change and Health: The Health Argument for Climate Action. Geneva: World Health Organization; 2021.
3. United Nations Children's Fund. The Climate-Changed Child: A Children's Climate Risk Index Supplement. New York: UNICEF; 2023.
4. Sandstrom H, Huerta S. The Negative Effects of Instability on Child Development: A Research Synthesis. Washington, DC: Urban Institute; 2013.
5. Malhi GS, Kaur M, Kaushik P. Impact of Climate Change on Agriculture and Its Mitigation Strategies: A Review. *Sustainability*. 2021;13(3):1318.
6. Robinson WA. Climate Change and Extreme Weather: A Review Focusing on the Continental United States. *J Air Waste Manag Assoc*. 2021;71(10):1186-209.
7. Lee TM, Markowitz EM, Howe PD, Ko CY, Leiserowitz AA. Predictors of public climate change awareness and risk perception around the world. *Nat Clim Chang*. 2015;5(11):1014-20.
8. Ansah EW, Amoade A, Obeng P, Sarfo JO. Climate change, urban vulnerabilities and adaptation in Africa: A scoping review. *Clim Change*. 2024;177:71.
9. Khairullina ER, Bogdanova VI, Slepneva EV, Nizamutdinova GF, Fatkhullina LR, Kovalenko YA, et al. Global climate change: Cyclical nature of natural and permanent nature of man-made processes. *EurAsian J BioSci*. 2019;13(2):2311-6.
10. Frame DJ, Rosier SM, Noy I, Harrington LJ, Carey-Smith T, Sparrow SN, et al. Climate change attribution and the economic costs of extreme weather events: A study on damages from extreme rainfall and drought. *Clim Change*. 2020;162:781-97.
11. Masson-Delmotte V, Zhai P, Pirani A, Connors SL, Péan C, Berger S, et al. Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press; 2021.
12. Vigliotti J. Before It's Gone: Stories from the Front Lines of Climate Change in Small-Town America. New York: Simon and Schuster; 2024.
13. Lenton TM, Xu C, Abrams JF, Ghadiali A, Loriani S, Sakschewski B, et al. Quantifying the human cost of global warming. *Nat Sustain*. 2023;6(10):1237-47.
14. Weeda LJ, Bradshaw CJ, Judge MA, Saraswati CM, Le Souëf PN. How climate change degrades child health: A systematic review and meta-analysis. *Sci Total Environ*. 2024;170944.

15. Ahdoot S, Baum CR, Cataletto MB, Hogan P, Wu CB, Bernstein A, et al. Climate change and children's health: Building a healthy future for every child. *Pediatrics*. 2024;153(3):e2023065505.
16. Graber J, Widmer K, Walker J, Vounatsou P, Pozzoli L. Climate Health Risks to Children and Adolescents: Exposures, Policy and Interventions. European Topic Centre on Human Health and the Environment; 2024.
17. Philipsborn RP, Chan K. Climate change and global child health. *Pediatrics*. 2018;141(6).
18. Bennett CM, Friel S. Impacts of climate change on inequities in child health. *Children*. 2014;1(3):461-73.
19. Sheffield PE, Landrigan PJ. Global climate change and children's health: threats and strategies for prevention. *Environ Health Perspect*. 2011;119(3):291-8.
20. Anderko L, Chalupka S, Du M, Hauptman M. Climate changes reproductive and children's health: A review of risks, exposures, and impacts. *Pediatr Res*. 2020;87(2):414-9.
21. Helldén D, Andersson C, Nilsson M, Ebi KL, Friberg P, Alfvén T. Climate change and child health: A scoping review and an expanded conceptual framework. *Lancet Planet Health*. 2021;5(3):e164-e175.
22. United Nations Children's Fund. For Every Child, Reimagine: UNICEF Annual Report 2019. New York: UNICEF; 2020.
23. Ma T, Moore J, Cleary A. Climate change impacts on the mental health and wellbeing of young people: A scoping review of risk and protective factors. *Soc Sci Med*. 2022;301:114888.
24. Proulx K, Daelmans B, Baltag V, Banati P. Climate change impacts on child and adolescent health and well-being: A narrative review. *J Glob Health*. 2024;14:04061.
25. Picetti R, Juel R, Milner J, Bonell A, Karakas F, Dangour AD, et al. Effects on child and adolescent health of climate change mitigation policies: A systematic review of modelling studies. *Environ Res*. 2023;117102.
26. Palinkas LA, Wong M. Global climate change and mental health. *Curr Opin Psychol*. 2020;32:12-6.
27. Patz JA, Frumkin H, Holloway T, Vimont DJ, Haines A. Climate change: challenges and opportunities for global health. *JAMA*. 2014;312(15):1565-80.

28. Arpin E, Gauffin K, Kerr M, Hjern A, Mashford-Pringle A, Barros A, et al. Climate change and child health inequality: a review of reviews. *Int J Environ Res Public Health*. 2021;18(20):10896.
29. Roche IV, Ubalde-Lopez M, Daher C, Nieuwenhuijsen M, Gascon M. The Health-Related and Learning Performance Effects of Air Pollution and Other Urban-Related Environmental Factors on School-Age Children and Adolescents—A Scoping Review of Systematic Reviews. *Curr Environ Health Rep*. 2024;1-17.
30. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. *Int J Soc Res Methodol*. 2005;8(1):19-32.
31. Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Ann Intern Med*. 2018;169(7):467–73.
32. Shea BJ, Grimshaw JM, Wells GA, Boers M, Andersson N, Hamel C, et al. Development of AMSTAR: a measurement tool to assess the methodological quality of systematic reviews. *BMC Med Res Methodol*. 2007;7:10.
33. Shea BJ, Bouter LM, Peterson J, Boers M, Andersson N, et al. External Validation of a Measurement Tool to Assess Systematic Reviews (AMSTAR). *PLoS One*. 2007;2(12):e1350.
34. Hannes K, Macaitis K. A move to more systematic and transparent approaches in qualitative evidence synthesis: Update on a review of published papers. *Qual Res*. 2012;12(4):402-42.
35. Noyes J, Popay J, Pearson A, Hannes K, Booth A. Qualitative research and Cochrane reviews. In: Higgins JPT, Green S, editors. *Cochrane Handbook for Systematic Reviews of Interventions*. Chichester: John Wiley & Sons; 2008. p. 571-91.

This manuscript is a preprint and has not been peer reviewed. The copyright holder has made the manuscript available under a Creative Commons Attribution 4.0 International (CC BY) license and consented to have it forwarded to EarthArXiv for public posting.

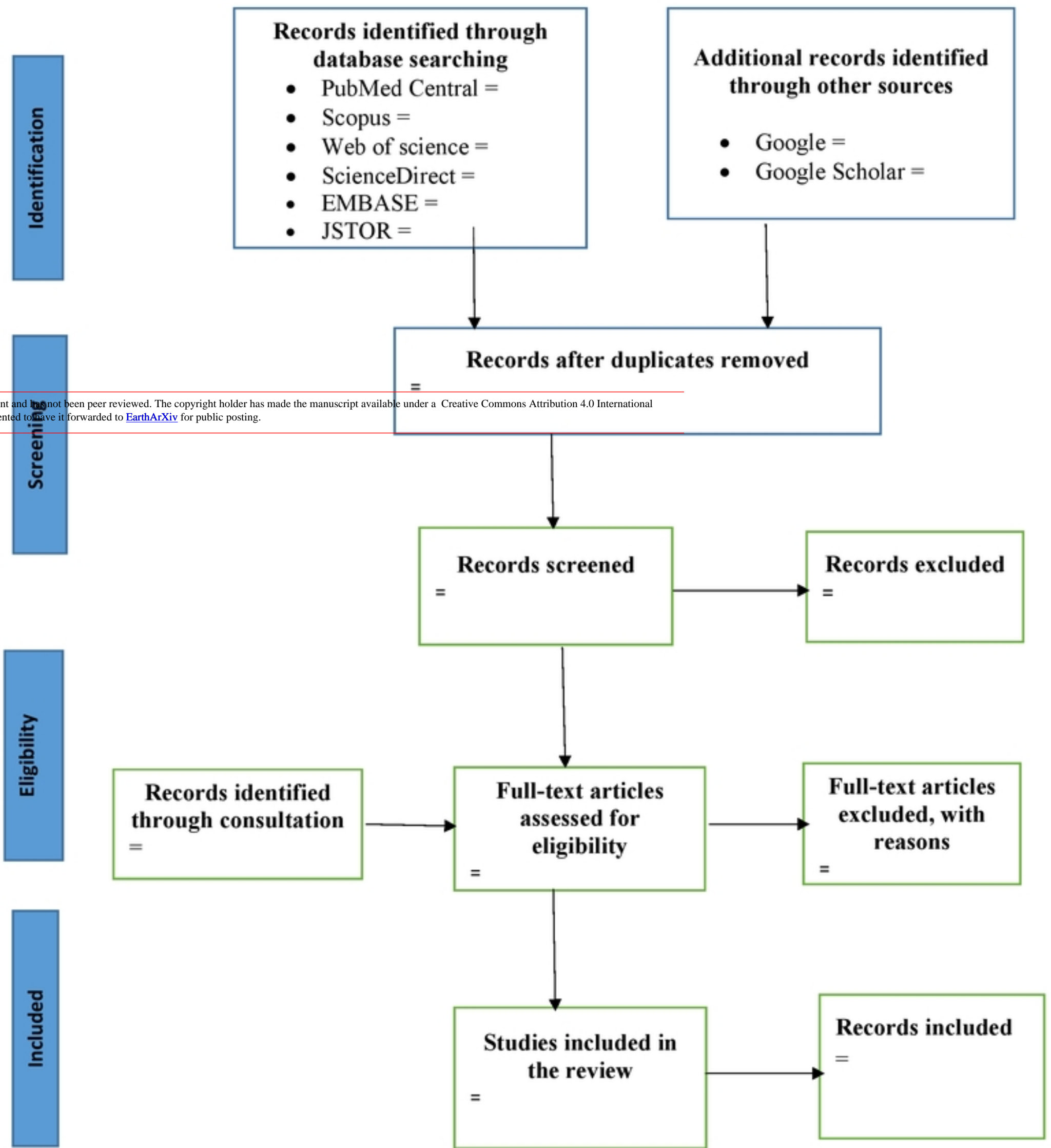


Fig. 1. PRISMA Flow diagram of the selection process of included reviews