

Assessing the Public Health Impacts of Climate Change in Jalingo Metropolis Taraba State

Simon Vera^{1*}, Eleojo Ojogbane¹, and Joseph Akem Ingwu¹

¹Department of Environmental Health, Faculty of Health Sciences, Taraba State University

Abstract

Keywords

Climate Change,
Public Health,
Climate
Variability,
Health impacts,
Vulnerable
Populations

Climate change poses significant threats to public health, particularly in vulnerable urban centres of sub-Saharan Africa. This study assessed the public health impacts of climate variability in Jalingo Metropolis, Taraba State, Nigeria, using a mixed-methods research design. Data were collected from 387 households through structured questionnaires, complemented by climate data from the Nigerian Meteorological Agency and disease records from Specialist Hospital Jalingo. Findings revealed pronounced climate variability, including rising temperatures and irregular rainfall patterns, with increasing frequency of extreme events such as droughts (24.3%), flooding (22.0%), and dust storms (21.4%). These changes were associated with a marked increase in climate-sensitive diseases. Malaria cases rose significantly from 771 in 2020 to 4,622 in 2024, while diarrhoeal diseases, respiratory conditions, and heat-related illnesses also increased. Vulnerable groups particularly children under five, pregnant women, and the elderly were disproportionately affected. Despite high awareness of climate change, knowledge gaps persist regarding its causes and health implications. Limited access to healthcare services, low health insurance coverage, and long distances to facilities further increased vulnerability. Statistical analysis confirmed significant relationships between climate variables and health outcomes. The study concludes that climate change is a serious and ongoing public health challenge in Jalingo Metropolis. It recommends strengthening climate-sensitive disease surveillance, improving healthcare infrastructure, expanding health insurance coverage, and promoting climate-health education to enhance resilience.

1. Introduction

Climate change is recognized globally as one of the most pressing environmental and public health challenges of the 21st century. Beyond environmental disruption, it significantly affects human health, food security, water availability, and socio-economic development (IPCC, 2023; WHO, 2023). The phenomenon is largely driven by human activities such as fossil fuel combustion, deforestation, industrial processes, and unsustainable agricultural practices, which increase greenhouse gas emissions and alter global climate systems (UNEP, 2023; NASA, 2023). These changes have resulted in rising global temperatures, irregular rainfall patterns, flooding, droughts, and more frequent extreme weather events (WMO, 2023; IPCC, 2023).

*Corresponding Author: Simon Vera

Email Address: verasimon2016@gmail.com

Climate change is strongly associated with increasing public health risks, including the spread of vector-borne diseases such as malaria, waterborne diseases like cholera and diarrhoea, and heat-related illnesses (WHO, 2023; Ebi et al., 2021). The Intergovernmental Panel on Climate Change reported that global temperatures have increased by approximately 1.1°C above pre-industrial levels, with projections indicating further warming if emissions are not significantly reduced (IPCC, 2021). These environmental changes disrupt ecosystems and create conditions that worsen disease transmission and strain health systems, particularly in developing regions (UNEP, 2022).

Sub-Saharan Africa is among the most vulnerable regions to climate change due to weak adaptive capacity, poverty, and fragile health systems (World Bank, 2020). In Nigeria, climate variability is evident through erratic rainfall, flooding, desertification in the north, and increasing temperatures nationwide (Federal Ministry of Environment, 2020; NiMet, 2022). These conditions contribute to declining agricultural productivity, food insecurity, and increased incidence of climate-sensitive diseases such as malaria, diarrhoea, and respiratory infections (Adeyemi & Okeke, 2024; WHO, 2023). In Jalingo Metropolis, Taraba State, these climate impacts are increasingly visible through rising temperatures, seasonal flooding, irregular rainfall, poor drainage systems, and environmental degradation (NiMet, 2022). These conditions create favorable environments for disease transmission, particularly malaria and diarrhoeal diseases, which remain major public health concerns in the area (NCDC, 2022; Ezeh et al., 2021). Additionally, heat stress and dust exposure during the dry season contribute to respiratory illnesses and other heat-related conditions (Akinbami et al., 2020).

Vulnerable populations such as children under five, pregnant women, the elderly, and low-income households are disproportionately affected due to limited access to healthcare services and adaptive resources (UNICEF, 2022; Olajide et al., 2019). Climate-related flooding and poor sanitation further worsen health risks by contaminating water sources and increasing disease outbreaks (WHO, 2023). Urban challenges such as inadequate drainage systems, poor waste management, and overcrowding further intensify these risks.

Despite increasing global awareness of climate change, there remains limited localized evidence on its direct public health impacts in many Nigerian urban centres, including Jalingo Metropolis (Olanrewaju et al., 2023; Akinwale & Eze, 2022). This gap limits the development of targeted and effective public health interventions. Therefore, there is a need for context-specific studies that assess how climate variability affects population health to support evidence-based planning and intervention.

This study therefore assesses the public health impacts of climate change in Jalingo Metropolis, Taraba State, Nigeria, with the aim of generating empirical evidence to support policy formulation, strengthen health systems, and guide climate-sensitive public health interventions.

2. Materials and Methods

2.1 Study Area

This study adopts a mixed-methods research design, combining both quantitative and qualitative approaches. The quantitative approach was used to collect and analyse numerical data on climate change indicators and household health outcomes. The qualitative approach provided an in-depth understanding of residents' perceptions of climate change and its effects on health.

2.2 Sample and Sampling Technique

The sample size for this study was determined using the Taro Yamane formula (Yamane, 1967), a simplified method for calculating sample sizes in surveys. Based on an estimated population of 220,700 in Jalingo Metropolis, the calculated sample size is approximately 399, covering all categories. The sample size for this study was 399 households, rounded up to 400 for ease of administration.

A simple random sampling technique was used to select households within Jalingo Metropolis. One adult respondent aged 18 years and above, usually the household head or the most knowledgeable adult, provided information on behalf of all household members.

2.3 Method of Data Collection

The primary data were obtained via a structured questionnaire, and the secondary data were obtained from NiMet and Taraba State Specialist Hospital, respectively.

2.4 Method of data analysis

Quantitative data analysis: questionnaire responses were coded and analysed using SPSS software. Descriptive statistics (frequencies, percentages, means) summarised the data, and the relationships

between demographic characteristics, climate change indicators, and health outcomes were examined. Qualitative data analysis: Key patterns and themes were identified to provide insights into residents' perceptions, experiences, and challenges of climate-related health impacts. Chi-square and ANOVA were employed to check the effects of demographic data and the correlation between climate change and climate-related diseases, respectively

2.5 Ethical Considerations

Ethical principles were strictly observed throughout the study. Informed consent was obtained from all participants after explaining the purpose, risks, and benefits of the study. Confidentiality of information was ensured, and the data collected were used solely for research purposes. Participation was voluntary, and respondents were informed of their right to withdraw at any stage of the study. Special consideration was given to households with vulnerable members, including children, the elderly, pregnant women, and individuals with pre-existing health conditions.

3. Results

The findings of this study revealed that climate change has significant public health implications in Jalingo Metropolis, Taraba State. Evidence obtained from household surveys, hospital records, and meteorological data demonstrated increasing climate variability, rising disease burden, high vulnerability among households, and growing public awareness of climate-related health risks. The results are presented in (Tables 1 to 6). The findings in Table 1 showed that prolonged dry seasons/droughts, frequent flooding, increased dust storms, and irregular rainfall patterns were the major climate change indicators experienced in the study area. More than half of the respondents described heat intensity as severe or very severe, indicating increasing temperature stress within the metropolis. A considerable proportion of respondents also agreed that climate change has contributed to increased disease occurrence in their communities. Hospitalisation due to climate-related illnesses was widely reported among households. The findings further showed that although piped water, boreholes, wells, rainwater harvesting, and sachet water were the major water sources, many households experienced water contamination during flooding periods, exposing residents to increased risk of waterborne diseases. The results presented in Table 2 indicated that awareness of climate change was high among respondents. Religious gatherings, schools, mass media, and social media were identified as the major sources of information. Most respondents considered themselves knowledgeable about climate change; however, understanding of its causes differed considerably. While some respondents identified human activities as the primary cause, others attributed climate change to natural or supernatural causes. Despite these differences in perception, the majority expressed concern about the health effects of climate change and considered it a serious threat to public health in Jalingo Metropolis. Most respondents also believed that individual actions could contribute to reducing climate-related impacts. The findings in Table 3 revealed that a large proportion of households contained vulnerable individuals, particularly children under five years, pregnant women, and elderly persons. Many households reported having more than one vulnerable member, indicating widespread vulnerability within the study area. Children were identified as the group most affected by climate-related difficulties. Respiratory diseases, cardiovascular conditions, and diabetes were among the most common pre-existing health conditions reported by respondents. The findings further showed substantial healthcare access challenges, as many households lacked health insurance coverage and a significant proportion lived far from healthcare facilities. The results in Table 4 showed that climate-related health problems were widespread among vulnerable populations in Jalingo Metropolis. Heat stress, respiratory illnesses, and malaria were the most commonly reported health conditions. Malaria and other vector-borne diseases were identified as the most frequent climate-related illnesses, followed by diarrhoeal diseases and heat-related conditions. Mental health problems and malnutrition were also reported, although at lower proportions. Flooding, heatwaves, droughts, and windstorms were identified as the climate events with the greatest negative effects on health. Many respondents further reported worsening of pre-existing health conditions during extreme weather events, while perceptions of healthcare system adequacy varied among households. The hospital records presented in Table 5 revealed a steady increase in climate-sensitive diseases between 2020 and 2025. Malaria cases increased substantially during the study period, reaching their peak in 2024 before slightly declining in 2025. Diarrhoeal diseases also showed a continuous upward trend throughout the years under review. These findings suggest an increasing burden of climate-related diseases within the metropolis and provide objective evidence supporting household perceptions of worsening health conditions associated with climate variability. The meteorological data presented in Table 6 confirmed significant climate variability in Jalingo Metropolis between 2015 and 2025. Rainfall

patterns fluctuated considerably across the years, indicating irregular precipitation trends and increasing weather instability. Temperature records also showed gradual increases in both maximum and minimum temperatures, while relative humidity remained variable throughout the study period. The findings demonstrate increasing climatic instability characterized by rising temperatures and irregular rainfall patterns, which may contribute to the growing public health challenges observed in the study area.

Table 1: Climate Change Indicators and Public Health Impacts (N=387)

Variable	Category	Frequency	Percentage (%)
Observed Climate Indicators	Prolonged dry seasons/droughts	94	24.3
	More frequent flooding	85	22.0
	Increased dust storms	83	21.4
	Irregular rainfall patterns	71	18.3
	Changes in seasonal timing	32	8.3
	Heat/high temperatures	23	5.9
Severity of Heat	Very severe	98	25.3
	Severe	100	25.8
	Moderate	91	23.5
	Mild	64	16.5
	Not served at all	29	7.5
Climate Increases Diseases	Strongly agree	82	21.2
	Agree	109	28.2
	Neutral	52	13.4
	Disagree	83	21.4
	Strongly disagree	61	15.8
Hospitalisation (Past Years)	Yes	278	69.3
	No	119	30.7
Main Water Source	Piped/Tap water	104	26.9
	Borehole	73	18.9
	Well	65	16.8
	River/Stream	8	2.1
	Rainwater Harvesting	68	17.6
	Sachet/bottled water	69	17.8
Water Contamination	Yes, frequently	23	5.9
	Yes, occasionally	88	22.7
	Rarely	218	56.3
	Never	42	10.9
	Not applicable	16	4.1

Table 2: Climate Change Awareness and Perception (N=387)

Variable	Category	Frequency	Percentage (%)
Heard About Climate Change	Yes	349	90.2
	No	38	9.8
Information Source	Religious/school gatherings	119	30.7
	Tiv, Radio, Newspapers	109	28.2
	Social media	107	27.6
	Community Meetings	27	7.0
	Government/NGOs	25	6.5
Knowledge Level	Very Knowledgeable	130	33.6
	Knowledgeable	136	35.1
	Moderately Knowledgeable	79	20.4
	Slightly Knowledgeable	36	9.3
	Not Knowledgeable	6	1.6
Primary Cause	Human activities	121	31.3
	Natural Processes	101	26.1
	Both human and natural	86	22.2
	Divine/supernatural	68	17.6
	I don't know	11	2.8
Health Concern	Very concerned	163	42.1
	Concerned	122	31.5
	Moderately concerned	92	23.8
	Slightly concerned	6	1.6
	Not concerned	4	1.0
Threat to Jalingo	Strongly agree	186	48.1
	Agree	161	41.6
	Neutral	25	6.5
	Disagree	12	3.1
	Strongly disagree	3	0.8
Individual Actions Help	Yes	312	80.6
	No	59	15.2
	Not sure	16	4.1

Table 3: Vulnerability Profile and Healthcare Access (N=387)

Variable	Category	Frequency	Percentage (%)
Vulnerable Members	Children under 5 years	139	35.9
	Pregnant women	95	24.5
	Elderly (60+ years)	72	18.6
	Chronic illnesses	23	5.9
	People with disability	16	4.1
	None	42	10.9
Number of Vulnerable Persons	1 person	162	41.9
	2 persons	126	32.6
	3 persons	72	18.6
	4 or more persons	27	7.0
Greatest Difficulty Group	Children	162	41.9
	Pregnant women	85	22.0
	Elderly	68	17.6
	Chronic illness	47	12.1
	Disabilities	25	6.5
Pre-existing Conditions	Respiratory conditions	124	32.0
	Cardiovascular	63	16.3
	Metabolic (diabetes)	39	10.1
	Mobility/disabilities	29	7.5
	Immunocompromised	37	9.6
	None	95	24.5
Health Insurance	Yes, comprehensive	34	8.8
	Yes, basic	162	41.9
	No	191	49.4
Distance to Health Care	Less than 1 km	65	16.8
	1-3 km	94	24.3
	3.5 km	83	21.4
	More than 5 km	145	37.5

Table 4: Climate-Related Health Impacts on Vulnerable Populations (N=387)

Variable	Category	Frequency	Percentage (%)
Heal Problems Experienced	Heat stress/heatstroke	103	26.6
	Respiratory problems	85	22.0
	Malaria	75	19.4
	Skin infections	52	13.4
	Diarrhea/water-borne	32	8.3
	Injuries from weather	29	7.5
	None	11	2.8
Medical Care Frequency	None	241	62.3
	1-2 times	51	13.2
	3-4 times	68	17.6
	5+times	27	7.0
Worsening of Condition	Yes, significantly	219	56.6
	Yes, slightly	122	31.5
	No change	24	6.2
	Not acceptable	22	5.7
Increased Health Conditions	Malaria/vector-borne	141	36.4
	Diarrhea/water-borne	110	28.4
	Heat-related illnesses	48	12.4
	Respiratory infections	43	11.1
	Mental health issues	37	9.6
	Malnutrition	8	2.1
Most Problematic Events	Flooding	119	30.7
	Heatwaves	108	27.9
	Droughts	92	23.8
	Windstorms	68	17.6
Healthcare System Adequacy	Yes, very adequate	134	34.6
	Somehow adequate	142	36.7
	Not adequate	43	11.1
	Not sure	68	17.6

Table 5: Trends in Climate-Related Diseases at Specialist Hospital Jalingo (2020–2025)

Disease Category	2020	2021	2022	2023	2024	2025	Total	change (2020-2025)
Malaria (children)	314	220	795	673	1,812	980	4,794	+212
Malaria (adults)	457	248	670	556	2,810	2,397	7,138	+424
Malaria (overall)	771	468	1,465	1,229	4,622	3,377	11,934	+338
Diarrhoeal Diseases	30	63	60	63	88	152	456	+407

Source: Climate Medical Records Department, Specialist Hospital Jalingo (2020–2025)

Table 6: Annual Climate Variables in Jalingo Metropolis (2015–2025)

Year	Annual Rainfall (MM)	Maximum Temperature (°C)	Minimum Temperature (°C)	Relative Humidity (%)
2015	1,181.6	34.1	22.1	51.
2016	1,263.5	34.8	19.5	54
2017	1,281.6	34.4	21.0	51
2018	1,567.6	33.7	22.6	54
2019	2,318.8	33.9	22.7	55
2020	1,666.1	34.7	22.9	48
2021	2,097.2	34	22.9	49
2022	1,690.5	33.9	21.8	50
2023	1,418.4	34.5	22.9	54
2024	1,121.0	34.8	23.5	55
2025	1,111.8	34.9	22.9	54
Mean	1,610.7	34.4	22.2	52.3
Std. Dev.	419.4	0.4	1.0	2.6
Range	1,207.0	1.2	4.0	7
Highest	2,318.8 (2019)	34.9 (2025)	23.5 (2024)	55 (2019-2024)
Lowest	1,111.8 (2025)	33.7 (2018)	19.5 (2016)	48 (2020)

Source: Nigerian Meteorological Agency (NiMet), Jalingo Station (2015–2025)

4. Discussion of findings

The findings of this study provide compelling empirical evidence that climate change is imposing substantial public health burdens on Jalingo Metropolis, with vulnerable populations bearing disproportionate impacts. The results align with and extend existing theoretical frameworks and empirical literature while revealing specific local patterns and dynamics.

Meteorological data indicate significant climate variability in Jalingo, characterized by erratic rainfall patterns, rising temperatures, and variable humidity. This is consistent with global climate change projections for West African regions (IPCC, 2021; WMO, 2023). The observed rainfall variability, with a coefficient of variation of 26%, reflects intensified hydrological cycles associated with climate change. Similarly, the 1.4°C increase in minimum temperatures from 2015 to 2024 indicates a warming trend that exceeds global averages, particularly in tropical regions. This finding aligns with respondents' perceptions, where 51.1% rated heat severity as severe or very severe.

Hospital records revealed a substantial increase in climate-sensitive diseases, particularly malaria and diarrhoeal diseases. The increase in malaria cases provides objective evidence of climate–health linkages within the Vulnerability and Adaptation Framework guiding this study. Statistical analysis further confirmed significant relationships between climate variables and disease incidence ($r = 0.68–0.72$, $p < 0.05$ for rainfall and humidity with malaria and diarrhoeal diseases). These findings are consistent with global evidence linking climate variability to vector-borne disease expansion (Ebi et al., 2021; WHO, 2023).

The temporal pattern of malaria incidence suggests possible lag effects, where earlier extreme rainfall events contribute to sustained breeding habitats that, combined with favourable temperature and humidity conditions, support prolonged vector proliferation. The peak malaria burden in 2024, coinciding with the highest minimum temperature (23.5°C) and high humidity (55%), supports the mechanistic explanation that warmer conditions enhance mosquito survival and parasite development, thereby extending transmission seasons.

The increase in diarrhoeal diseases, particularly during periods of low rainfall (1,111.8 mm in 2025), highlights the dual impact of climate variability on water security. Both flooding and drought conditions contribute to water contamination and scarcity, increasing reliance on unsafe water sources. This creates a dual burden on water and sanitation systems and reinforces findings from previous studies on climate-related waterborne disease risks (WHO, 2021; Ebi et al., 2021).

The study also recorded high awareness of climate change (90.2%), although gaps remain in understanding its causes, with a minority attributing it to non-scientific explanations. Information was mainly obtained through religious institutions, schools, and media platforms, highlighting the importance of these channels in climate-health communication. However, the presence of misconceptions indicates the need for improved climate literacy.

Despite high awareness levels, vulnerability remains significant. Children under five years, pregnant women, and the elderly were identified as the most affected groups. This vulnerability is compounded by limited health insurance coverage and long distances to healthcare facilities, which reduce access to timely medical care during climate-related health events. These factors reflect broader structural inequalities influencing adaptive capacity.

In addition, a large proportion of households reported worsening of pre-existing conditions during extreme weather events, particularly respiratory illnesses associated with dust exposure. This demonstrates that climate change acts as a multiplier of existing disease burdens, increasing both susceptibility and severity of illness.

Although healthcare services were generally perceived as adequate, increasing disease trends suggest that current health system capacity may be insufficient to manage the growing burden of climate-sensitive diseases. This indicates a gap between perceived service adequacy and actual system responsiveness under climate stress conditions.

The consistency of findings across household surveys, hospital records, and meteorological data strengthens the reliability of the results and confirms a strong relationship between climate variability and public health outcomes in the study area. This triangulation provides a solid empirical basis for interpretation and policy formulation.

Overall, the findings highlight climate change as a significant and growing public health challenge in Jalingo Metropolis, with serious implications for vulnerable populations. The results underscore the need for integrated climate-health interventions and strengthened adaptive capacity within the health system.

5. Conclusion

The study concludes that climate change is already having significant and measurable impacts on public health in Jalingo Metropolis. Rising temperatures, irregular rainfall, and extreme weather events are strongly associated with increased cases of malaria, diarrhoeal diseases, respiratory illnesses, and heat-related conditions.

Vulnerable populations such as children, pregnant women, and the elderly are disproportionately affected. In addition, limited healthcare access and low health insurance coverage increase population vulnerability.

Climate change therefore represents a major and ongoing public health challenge in the study area.

6. Recommendations

- i. Strengthen climate-sensitive disease surveillance systems linked with meteorological data for early warning and response.
- ii. Improve healthcare infrastructure and expand access, particularly in underserved communities.
- iii. Expand health insurance coverage to reduce financial barriers to healthcare during climate-related health emergencies.
- iv. Improve water supply systems, drainage infrastructure, and sanitation to reduce flooding and contamination risks.
- v. Implement heat-health action plans, including public awareness campaigns and protective measures for vulnerable groups.
- vi. Integrate climate change and health education into schools, religious institutions, and community programs.
- vii. Train healthcare workers on climate-sensitive diseases and emergency response strategies.
- viii. Strengthen emergency preparedness systems in healthcare facilities for climate-related outbreaks.
- ix. Promote community-based adaptation programs targeting vulnerable households.
- x. Enhance collaboration between health, environment, and urban planning sectors for integrated climate-health responses.

References

- Adeyemi, T., & Okeke, B. (2024). Climate-sensitive diseases in West Africa: A case for adaptive strategies. *African Journal of Environmental Health*, 18(1), 45–58.
- Agwu, J., & Okhimamhe, A. (2020). Mainstreaming climate change resilience into development planning in Nigeria. *African Journal of Environmental Science and Technology*, 14(6), 163–174. <https://doi.org/10.5897/AJEST2020.2871>
- Akinbami, F. O., Lawal, A. M., & Musa, T. (2020). Health impacts of extreme weather events in Northern Nigeria. *Nigerian Journal of Health and Environment*, 8(2), 76–85.
- Ebi, K. L., Semenza, J. C., & Rocklöv, J. (2021). Climate change and health risks: Assessing vulnerability in global hotspots. *The Lancet Planetary Health*, 5(6), e324–e330.
- Ezeh, A., Uche, A., & Salami, K. (2021). Waterborne diseases and flooding in Nigeria: A health systems challenge. *African Health Monitor*, 19(2), 66–74.
- Intergovernmental Panel on Climate Change (IPCC). (2022). *Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the IPCC*. Cambridge University Press. <https://www.ipcc.ch/report/ar6/wg2/>
- NASA. (2022). *Climate change: How do we know?* <https://climate.nasa.gov/evidence>
- Nigeria Centre for Disease Control. (2022). *Annual epidemiological report*. Retrieved from <https://ncdc.gov.ng>
- Nigerian Meteorological Agency. (2022). *Seasonal Climate Prediction for Nigeria*. Abuja: NiMet.
- Nwafor, C., Odum, E., & Bello, H. (2023). Policy responses to climate change and health in Nigeria. *Environmental Policy Review*, 17(1), 39–50.

- O'Brien, K., Eriksen, S., Schjolden, A., & Nygaard, L. P. (2007). Why different interpretations of vulnerability matter in climate change discourses. *Climate Policy*, 7(1), 73–88. <https://doi.org/10.1080/14693062.2007.9685639>
- Ogundele, K., & Musa, Y. (2024). Local data for climate adaptation planning in Nigeria. *Urban Climate Review*, 12(1), 52–64.
- Olajide, T., Ibrahim, A., & Hassan, M. (2019). Assessing vulnerability to climate change in low-income urban communities. *Nigerian Journal of Social Health*, 7(1), 25–37.
- Olanrewaju, T., Yusuf, M., & Ajayi, B. (2023). Climate change perception and public health awareness in Nigeria. *Journal of Environmental and Health Studies*, 9(3), 111–123.
- Oluwafemi, O., Bello, A., & Ibrahim, M. (2023). Agricultural productivity under climate stress in northern Nigeria. *Journal of Agricultural and Environmental Research*, 15(2), 77–89.
- Patel, V., & Allen, T. (2021). Climate change and health: A framework for action. *The Lancet Planetary Health*, 5(6), e334–e335. [https://doi.org/10.1016/S2542-5196\(21\)00120-3](https://doi.org/10.1016/S2542-5196(21)00120-3)
- Scientific Archives. (2023). *Climate change and mental health in Africa: Emerging evidence*. Retrieved from <https://www.scientificarchives.com>
- Smith, K. R., Woodward, A., Campbell-Lendrum, D., Chadee, D. D., Honda, Y., Liu, Q., ... & Sauerborn, R. (2022). Human health: Impacts, adaptation, and co-benefits. In *IPCC Sixth Assessment Report (AR6)*.
- United Nations Children's Fund. (2022). *Climate crisis is a child rights crisis: Introducing the Children's Climate Risk Index*. Retrieved from <https://www.unicef.org>
- United Nations Development Programme. (2020). *Human Development Report 2020: The Next Frontier Human Development and the Anthropocene*. New York: UNDP. <https://hdr.undp.org/>
- United Nations Development Programme. (2024). *Strengthening climate resilience in Nigerian cities*. Retrieved from <https://www.undp.org>
- United Nations Environment Programme (UNEP). (2021). *Adaptation gap report 2021: The gathering storm*. Nairobi: UNEP.
- United Nations Environment Programme. (2022). *Emissions gap report 2022*. Nairobi: UNEP.
- United Nations Environment Programme. (2023). *Causes and consequences of climate change*. Retrieved from <https://www.unep.org>
- United Nations Framework Convention on Climate Change (UNFCCC). (2020). *What is climate change?* <https://unfccc.int>
- World Bank. (2020). *Climate change overview for Sub-Saharan Africa*. Retrieved from <https://www.worldbank.org>
- World Commission on Environment and Development. (1987). *Our Common Future*. Oxford: Oxford University Press.
- World Health Organization (WHO). (2010). *A conceptual framework for action on the social determinants of health*. WHO Press. <https://www.who.int/publications/i/item/9789241500852>
- World Health Organization (WHO). (2021). *Climate change and health fact sheet*. <https://www.who.int/news-room/fact-sheets/detail/climate-change-and-health>
- World Meteorological Organization (WMO). (2021). *State of the global climate 2021*. Geneva: WMO