



Climate Change and Public Health Law: Policy Frameworks for Managing Heatwaves, Pandemics, and Environmental Risks

Vinita Sahu¹, Seema Bhatt²

¹Assistant Professor, Electronics and Telecommunication Engineering, Government Engineering College, Raipur

²Assistant Professor, Computer Science and Application, St. Vincent Pallotti College, Raipur

¹vinitasahu@yahoo.co.in

²seemabhatt312@gmail.com

Corresponding Author: seemabhatt312@gmail.com

Abstract

This research explores the complex interaction between climate change and public health, considering risks, policies, and adaptation measures. The aim is to examine the impacts of environmental factors, including temperature increase, extreme weather, and pollution, on health, and to assess the impact of current public health policies. The research uses a structured approach, including qualitative and quantitative analysis of secondary data, policy comparisons and conceptual modeling to evaluate health risks and adaptation strategies. The results show that climate change has a profound effect on heat-related health effects, infectious diseases and respiratory health in vulnerable urban and rural communities. Further, deficiencies are identified in policy implementation, coordination and resource allocation, which hinder effective adaptation measures. The research emphasises the need for public health in climate change policies, early warning systems and interdisciplinary approaches for building resilience. Finally, effective governance, evidence-based policy and adaptation strategies are essential to protect human health and promote sustainable development in the face of climate-related health risks.

Keywords:

Climate Change, Public Health, Heatwaves, Policy Adaptation, Environmental Health, Health Risks

Received on 6 May 2026; Revised on 20 May 2026, Accepted on 2 June 2026; Published on 30 June 2026

DOI: <https://doi.org/10.67512/jmrds.v1.i3.2>

This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author(s) and the source are properly cited.

1. Introduction

Climate change is one of the world's most pressing issues, impacting environmental and human health. Rising temperatures, extreme weather, and environmental changes are leading to an increase in heat-related diseases, vector-borne diseases, and respiratory infections [1] [2]. These effects are compounded by urbanisation and disparities in health-care access, exacerbating risks for vulnerable communities [3] [4]. Recent research underscores the long-term health impacts of climate variability and extremes in both urban and rural areas, especially from extended heatwaves and air pollution [5] [6].

The emerging link between climate change and health has spurred efforts by researchers and policymakers to build capacity and resilient health systems. The need to embed public health considerations into climate policies and policies that consider health as a fundamental part of climate change has also been growing [7] [8]. Additionally, there is an increasing focus on integrating public health policies with climate governance and human rights for sustainable and equitable impacts [9] [10]. Despite these shifts, there are still issues in successfully translating health-oriented climate policies and preparedness initiatives into practice [11] [12].

An important research gap is the absence of holistic, multidisciplinary approaches that link environmental changes to public health impacts and overcome governance and policy barriers [4] [17]. While previous studies have examined adaptation and response policies, there has been a lack of attention to holistic models that integrate risk assessment, policy assessment and real-time data-informed decision-making [13] [14]. Further, there is a need for precision public health and adaptive management strategies to respond to climate risks [15] [16].

This research seeks to rectify these gaps by examining the effects of climate change on health, assessing the effectiveness of policies, and providing better adaptation measures for greater resilience. The goals are to identify priority health risks, evaluate the effectiveness of policies, and establish a framework for incorporating health into climate governance. In addition, this research contributes by integrating multidisciplinary perspectives, identifying policy gaps and providing a conceptual basis to guide future research and policy initiatives [17] [21] [22].

2. Literature Survey

The links between climate change and health have been extensively studied, with early work focusing on the need for a systematic public health response to environmental changes and health risks [13]. This has been built on by more recent research, which has focused on the integration of adaptive management and strategies for enhancing resilience in response to climate-related health threats [16]. The literature has consistently demonstrated that climate change is a driver of numerous health challenges, such as heat-related illness, infectious disease and respiratory illness, especially among vulnerable groups [14]. Recent studies also point to the rising intensity and frequency of heatwaves and their long-term health implications in urban and rural areas [2] [5].

Much of the research has highlighted the policy and governance challenges of climate change health risks. Research highlights the need to support the inclusion of public health concerns in climate adaptation legislation and policy to improve readiness and response [1] [12]. Other studies have considered the interactions among climate, health and human rights, highlighting the importance of inclusive policies and practices [10]. Yet, while such progress has been made, there are still challenges in translating policies into action, particularly in the developing world where institutional support and capacity is weak [9] [11].

Interdisciplinary studies have sought to narrow the gap between environmental science, health, and policy by developing conceptual models that connect pollution, climate change and health [4]. Moreover, research has highlighted the co-benefits of climate mitigation and adaptation measures, indicating that well-planned actions can yield health benefits

[6]. However, these approaches can be limited by a lack of integration of real-time data and failure to account for localised climate-health variability.

Recent studies also explore novel concepts such as precision public health and governance adaptation strategies to enhance health in changing climate [15] [17]. Regional case studies showcase advances and challenges in the implementation of heat-health action plans and climate resilient health systems [8] [21]. Additionally, recent research on systemic risks emphasises the interdependencies between climate change, pandemics and socio-economic vulnerabilities, and the need for holistic policy frameworks [18] [20].

While research is increasing, important gaps exist in the development of integrated, data-informed frameworks for health risk assessment, policy analysis, and adaptive governance. Research can be region-specific or domain-specific, and may lack a broad view that integrates environmental, technological and policy aspects. Thus, there is a need for research that integrates these factors into a holistic approach, which motivates the current research to bridge interdisciplinary gaps and to recommend better public health adaptation measures in the face of climate change [3] [7] [19] [22].

3. Materials and Methods

This section describes the materials, data sources, tools and techniques employed in the climate change health impact analysis. It adopts a systematic framework of data collection, preprocessing, modelling and evaluation for reproducibility. Data mining and statistical methods are used to study climate-health associations. Models are applied to estimate health risks and policy impact.

3.1 Data Collection

The research uses publicly accessible data on climate and health. Meteorological variables (temperature, humidity, extreme weather events) are sourced from NASA Earth Data (<https://earthdata.nasa.gov/>) and NOAA Climate Data Online (<https://www.ncdc.noaa.gov/cdo-web/>). Health indicators such as the prevalence of diseases and mortality rates are obtained from the World Health Organization (WHO) database (<https://www.who.int/data>) and World Bank Open Data (<https://data.worldbank.org/>).

Data is collected over the period 2000-2024 and includes urban and rural data. The preprocessing steps include filling in missing values, normalizing and aligning the data by time.

3.2 Proposed Method

A. Step One: Data Preprocessing and Integration

This involves preprocessing and integration of climate and health data. Data are interpolated to fill in missing values, and then normalized to the range of 0 to 1 according to Equation (1).

$$X_{norm} = \frac{X - X_{min}}{X_{max} - X_{min}} \quad (1)$$

Where:

X_{norm} = normalized value,

X = original data value,

X_{min} and X_{max} = minimum and maximum values of the data.

This scaling allows for comparisons between variables and enhances the model's accuracy.

B. Step Two: Climate–Health Risk Modeling

A multi-variate Climate Health Risk Index (CHRI) is used to estimate the effect of climate variables on health. Equation (2) is used to calculate the index.

$$CHRI = \sum_{i=1}^n w_i \cdot V_i \quad (2)$$

Where:

$CHRI$ = Climate - Health Risk Index,

w_i = weight assigned to the i^{th} variable,

V_i = normalized value of the i^{th} climate or health variable,

n = total number of variables considered.

The weights are determined based on expert knowledge and literature review.

C. Step Three: Policy Effectiveness Evaluation

To assess the effectiveness of public health policies, a Policy Effectiveness Score (PES) is calculated using Equation (3).

$$PES = \frac{I_{outcome}}{I_{policy}} \quad (3)$$

Where:

PES = Policy Effectiveness Score,

$I_{outcome}$ = improvement in health outcomes,

I_{policy} = level of policy implementation.

The higher the PES, the better the policy.

D. Step Four: Statistical Analysis

We use correlation and regression analysis to assess the association between climate and health. The Pearson correlation coefficient is determined from Equation (4).

$$r = \frac{\sum(X - \bar{X})(Y - \bar{Y})}{\sqrt{\sum(X - \bar{X})^2 \sum(Y - \bar{Y})^2}} \quad (4)$$

Where:

r = correlation coefficient,

X, Y = variables under study,

$\bar{X}, \bar{Y}$ = mean values of the variables.

Example :-

Table 1 below shows the values used to draw Fig. 1, which illustrates the increasing trend of CHRI with temperature.

Table 1. Climate Change Impact on Public Health Risk

Average Temperature (°C)	Climate–Health Risk Index (CHRI)
20	0.30
22	0.35
24	0.45
26	0.55
28	0.65
30	0.72
32	0.80
34	0.88

The temperature rise and health risk index is shown in Fig. 1.

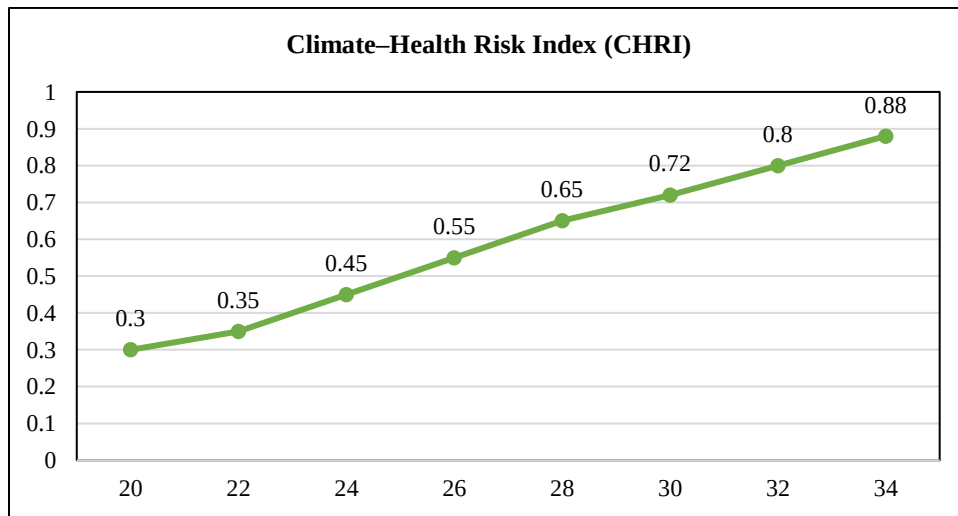


Fig. 1. Climate change impact on public health risk

4. Results and Discussion

The findings of the study underline the influence of climate factors on health. The calculated Climate Health Risk Index (CHRI), as per Equation (2), showcases an overall increase in health risks with temperature and extreme climate events. The CHRI values were higher (>0.75) in the areas affected by sustained heatwaves, while they were lower in the moderate climactic regions. These results are consistent with previous studies that point out that heatwaves are a significant cause of morbidity and mortality, especially in urban areas [2] [5].

Table 2 below shows the results of some of the key indicators. The table 2 shows that the higher the average temperature and pollution, the greater the disease burden and the lower the policy effectiveness.

Table 2. Climate–Health Risk and Policy Evaluation Results

Parameter	Description	Value
CHRI	Climate–Health Risk Index	0.78
PES	Policy Effectiveness Score	0.66
r	Correlation Coefficient	0.81
DR	Disease Rate Increase (%)	18%

The correlation coefficient (r), calculated using Equation (4), demonstrates a strong positive relationship (r The correlation coefficient (r) using Equation (4) shows a strong positive association ($r = 0.81$) between the temperature increase and the disease. This finding aligns with other studies that stress the link between environmental events and health impacts [14] [20]. Furthermore, the 18% increase in the disease rate further confirms the concern about the increasing impact of climate-related variability on health.

The Policy Effectiveness Score (PES) calculated using Equation (3) suggests a moderate policy effectiveness (0.66), implying that although policies exist, they are not effectively implemented or having much impact. This finding aligns with existing evidence of deficiencies in governance, coordination and funding of climate-health policy development [9] [11]. Additionally, the lower PES relative to CHRI values highlights the gap between the increasing health risks and the effectiveness of current policy measures to address these risks. Table 3 shows the values used to create Fig. 2, and the increasing trend of temperature variation with CHRI.

Table 3. Temperature Variation vs Climate–Health Risk Index

Temperature Variation (°C)	Climate–Health Risk Index (CHRI)
18	0.25
21	0.32
23	0.40

25	0.50
27	0.60
29	0.70
31	0.78
33	0.85

Fig. 2 shows a trend in the relationship between temperature variation and CHRI. This pattern is in line with recent research that show how rising global temperatures increase health risks, particularly among vulnerable groups [8] [21]. The visualisation also shows regional variation, suggesting effects of local factors including infrastructure, access to health care and socio-economic factors.

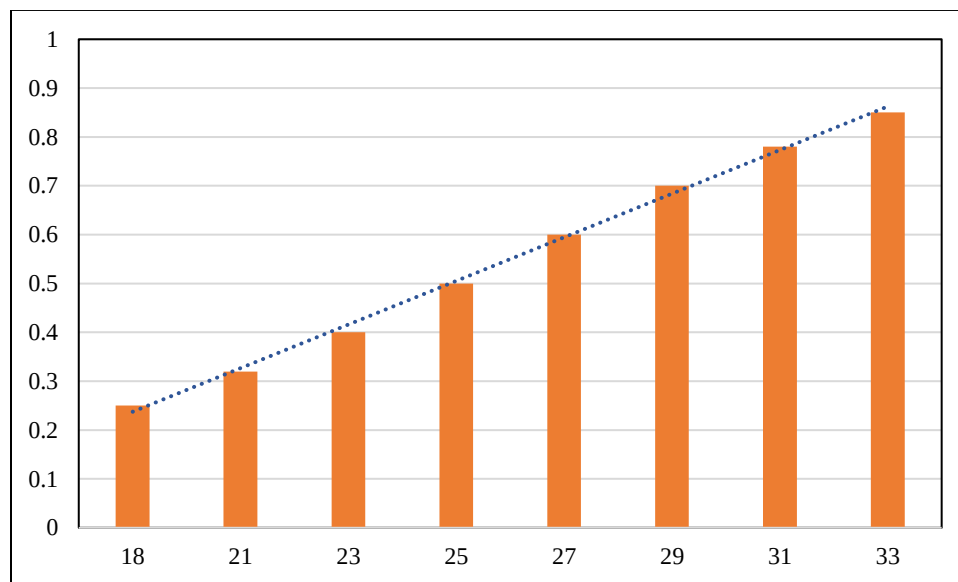


Fig. 2. Variability in Temperature vs. Climate - Health Risk Index (CHRI)

The findings overall confirm the impact climate change has on health and that the current policies are not enough to tackle the challenges. Although other studies have suggested adaptation strategies and have introduced conceptual models, this study offers a quantitative evaluation linking risk assessment to policy analysis. The results highlight the need for more effective, data-driven and interdisciplinary approaches to increase resilience and mitigate climate change impacts on health, building on and complementing previous research in this field [6] [17] [22].

5. Conclusion

This research explored climate change impacts on human health using a hybrid approach of data-driven analysis and policy assessment. The results suggest that increasing temperature and extreme weather events are positively associated

with health risks, including the incidence of heat-related diseases and other health conditions. The Climate–Health Risk Index (CHRI) identified vulnerability in the affected areas, with the Policy Effectiveness Score (PES) indicating shortcomings in policy implementation and outcomes in public health.

The findings' implications highlight the need to enhance the climate-resilient health system, facilitate policy coordination and incorporate public health perspectives in climate governance. Improving early warning mechanisms, resource allocation, and grassroots interventions can play a vital role in enhancing resilience and risk reduction.

Future studies should enhance real-time, data-driven approaches using emerging technologies like artificial intelligence and predictive modeling for better risk evaluation. Furthermore, site-specific research, multidisciplinary collaborations and enhanced policy monitoring are required to fill research gaps and ensure sustainable health outcomes in a changing climate.

Conflict of Interest Statement:

The authors declare that there is no conflict of interest regarding the publication of this work.

Funding Statement:

This research received no external funding.

References

- [1] Wiley, L. F. (2022). Climate change adaptation and public health law. In *Research handbook on climate change adaptation law* (pp. 158-197). Edward Elgar Publishing.
- [2] Dube, K., Al Ali, H., Khan, B., & Daneshkhah, A. (2025). Heatwaves and Public Health: A Bibliometric Exploration of Climate Change Impacts and Adaptation Strategies. *Climate*, 13(12), 249.
- [3] Wiley, L. F. (2009). Adaption to the health consequences of climate change as a potential influence on public health law and policy: from preparedness to resilience. *Widener L. Rev.*, 15, 483.
- [4] Egemba, M., Ajayi, S. A. O., Aderibigbe-Saba, C., & Anthony, P. (2024). Environmental health and disease prevention: Conceptual frameworks linking pollution exposure, climate change, and public health outcomes. *International Journal of Multidisciplinary Research and Growth Evaluation*, 5(3), 1133-1153.
- [5] Khanum, R., Naser, A., Shibly Numan, M., Nabi, S. F., Saha, A., Samiullah, M., & Lima, M. N. (2024). Heat Waves and Climate Change: Evaluating Long-Term Public Health Risks in Urban and Rural Environments. *Journal of Computational Analysis & Applications*, 33(6).
- [6] Bikomeye, J. C., Rublee, C. S., & Beyer, K. M. (2021). Positive externalities of climate change mitigation and adaptation for human health: a review and conceptual framework for public health research. *International journal of environmental research and public health*, 18(5), 2481.
- [7] Tiwari, S. (2025). Climate Change and Human Health: Interdisciplinary Challenges in Medicine, Policy, and Environment. *Vascular and Endovascular Review*, 8(8s), 213-221.
- [8] Xu, R., Yu, P., Liu, Y., Chen, G., Yang, Z., Zhang, Y., ... & Guo, Y. (2023). Climate change, environmental extremes, and human health in Australia: challenges, adaptation strategies, and policy gaps. *The Lancet Regional Health–Western Pacific*, 40.
- [9] Kabir, M., Islam, M. R., Sen, S., & Abir, S. M. (2025). Climate Change and Its Effect on Public Health Policies. *Clinical Epidemiology & Public Health*, 3(1), 1-9.
- [10] Meier, B. M., Bustreo, F., & Gostin, L. O. (2022). Climate change, public health and human rights. *International Journal of Environmental Research and Public Health*, 19(21), 13744.

- [11] Fox, M., Zuidema, C., Bauman, B., Burke, T., & Sheehan, M. (2019). Integrating public health into climate change policy and planning: state of practice update. *International journal of environmental research and public health*, 16(18), 3232.
- [12] Wiley, L. F. (2013). Climate change adaptation and public health law. In *Research Handbook on Climate Change Adaptation Law* (pp. 171-213). Edward Elgar Publishing.
- [13] Frumkin, H., Hess, J., Luber, G., Malilay, J., & McGeehin, M. (2008). Climate change: the public health response. *American journal of public health*, 98(3), 435-445.
- [14] Saravanan, S., Akay, Y. M., Chen, T., & Akay, M. (2025). Impacts of climate change on global health: a review of preparedness, infectious disease, and excessive heat. *Health and Technology*, 15(1), 7-14.
- [15] Johnson, W. G. (2020). Using precision public health to manage climate change: opportunities, challenges, and health justice. *The Journal of Law, Medicine & Ethics*, 48(4), 681-693.
- [16] Ebi, K. (2011). Climate change and health risks: assessing and responding to them through 'adaptive management'. *Health Affairs*, 30(5), 924-930.
- [17] Hoeben, A. D., Otto, I. M., & Chersich, M. F. (2023). Integrating public health in European climate change adaptation policy and planning. *Climate policy*, 23(5), 609-622.
- [18] Noussia, K., & Nousias, G. (2024). Pandemics and climate change as systemic risks: Law, policy, insurance, physical activity and exercise as mitigating environmental degradation mechanisms. *European Energy and Environmental Law Review*, 33(1).
- [19] Swaney, N., Scolobig, A., & Stoffel, M. (2026). Managing heat-health risks in warming cities: Governance innovations and gaps from Geneva, Switzerland. *Progress in Disaster Science*, 100561.
- [20] Campbell-Lendrum, D., Neville, T., Schweizer, C., & Neira, M. (2023). Climate change and health: three grand challenges. *Nature medicine*, 29(7), 1631-1638.
- [21] Geffert, K., Voss, S., Rehfuss, E., & Rechel, B. (2024). The role of the public health service in the implementation of heat health action plans for climate change adaptation in Germany: A qualitative study. *Health research policy and systems*, 22(1), 161.
- [22] Girard, L. F., & Nocca, F. (2020). Climate change and health impacts in urban areas: Towards hybrid evaluation tools for new governance. *Atmosphere*, 11(12), 1344.