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Article

Climate Change Impacts on One Health and Policy Responses: A Systematic Review

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Abstract

Climate change affects One Health in a variety of ways, but for some locations, particularly in poor countries, there is sparse information about the projected changes in climate-related health risks. People respond to changes in climate-driven natural hazards—which affect health in ways that are often not captured by system-theory concepts. Community-level responses to repeated hazard impacts, such as shifts in social networks and economic strategy, can reduce welfare losses and raise collective risks elsewhere. This study is a scoping review, and numerous health risks associated with climate change are frequently ignored within a single one health data set or inadequately integrated into broader climate adaptation frameworks, particularly at the global level. To effectively address these issues, methodologies for precisely assessing the single one health risks associated with climate change developed and implemented. Provides a decision-support system for health that estimates a ‘heat-health watch/warning’ will require a set of decision thresholds to trigger dissemination of warnings and response plans by agencies with state-specific responsibilities. Concluded and acknowledged that numerous policies and training programs are necessary and that the insights gained from existing responses are more likely to be applicable in other industrialized contexts. Furthermore, the one health impacts of heat waves and cold waves is relatively robust, there is a pressing need to address additional topics that are pertinent to public health on a continental scale moving forward. Concern over climate change’s range of one health impacts has contributed directly to the widespread use of ad hoc protective measures.

Keywords: One Health; Public Health & Policies; policy response; environmental factors; climate change

Introduction

Climate change is a significant global issue that threatens the One Health and livelihoods of a large population [1]. The One Health Summit emphasizes the need to take a collaborative approach to address this crisis, focusing on preventive measures and scientifically informed strategies[2]. Climate change intensifies existing health challenges and introduces new ones [3], compounded by population growth, urbanization, and human encroachment on wildlife habitats [4]. This increases the risk of health impacts, particularly in lower-income countries, affecting food security, safety, nutrition, and overall health [5]. Climate change also hinders progress in addressing poverty, conflict resolution [6], gender discrimination, healthcare access, and other critical components of the Sustainable Development Agenda [7,8]. A holistic approach is crucial, addressing risk factors and mitigation strategies while recognizing achievable outcome targets [9]. A One Health approach to adapting to climate change can play a crucial role in enhancing food security by addressing various

aspects such as food and nutrition security, environmental sanitation, and climate change responses across multiple species to mitigate biodiversity loss [10]. The interconnectedness of health has gained support through the "One World – One Health" initiative [11]. However, it is important to note that current discussions regarding the health impacts of climate change have primarily focused on human health, often neglecting indicators related to animal health [12,13]. The One Health approach emphasizes the shared nature of health among humans, animals, and the environment and underscores the necessity for sustainable improvements in social and environmental services both locally and globally [14]. To address the objectives of this study's climate change impacts and policy responses on the One Health approach, cooperation, consistent procedures, and a commitment to addressing intricate new health risks are all required, according to the gaps in the literature. To identify and assess essential policy instruments for creative policies based on technical, environmental, organizational, and regulatory developments influencing climate change and one's health in order to suggest strategic pathways for the evolution of intelligent, human-centered, and flexible policies. The aim and scope of this study are to investigate new opportunities in climate change impacts on One Health and policy responses, and to provide a roadmap for how governance, global policies, organizations, and regulatory bodies may adjust to an increasingly complex risk environment in one health. To assess the present study's readiness to respond to climate-related and digital risk areas. To investigate models for intelligent policy and decentralized risk response. Key target areas include one-health systems, climate-adaptive risk planning, human-centered design, and worldwide harmonization of one-health and public health standards.

Materials and Methods

Methodology

This scoping review study combines current literature searches from Scopus, PubMed, Embase, and Web of Science, as well as databases and platforms from international organizations such as the European Union (E.U.), Copernicus, WHO/AFRO, ECDC, EUPHA, and others, until June 16, 2025, to identify knowledge gaps and lead future research. Scoping reviews provide a comprehensive overview of a broad topic, avoiding a critical assessment of specific studies. They synthesize diverse evidence sources and follow a flexible protocol, using logic models to summarize reviews and research priorities. The purpose of scoping reviews is to identify research gaps, map literature, facilitate collaboration, and determine the necessity of a systematic review. These reviews are typically conducted when the topic is broad, multidisciplinary, and requires public dissemination of relevant literature. This scoping study followed the Preferred Reporting Items for Systematic-Scoping Reviews (PRISMA) criteria, and flow chart diagram of this study's showing with Figure 1, [74].

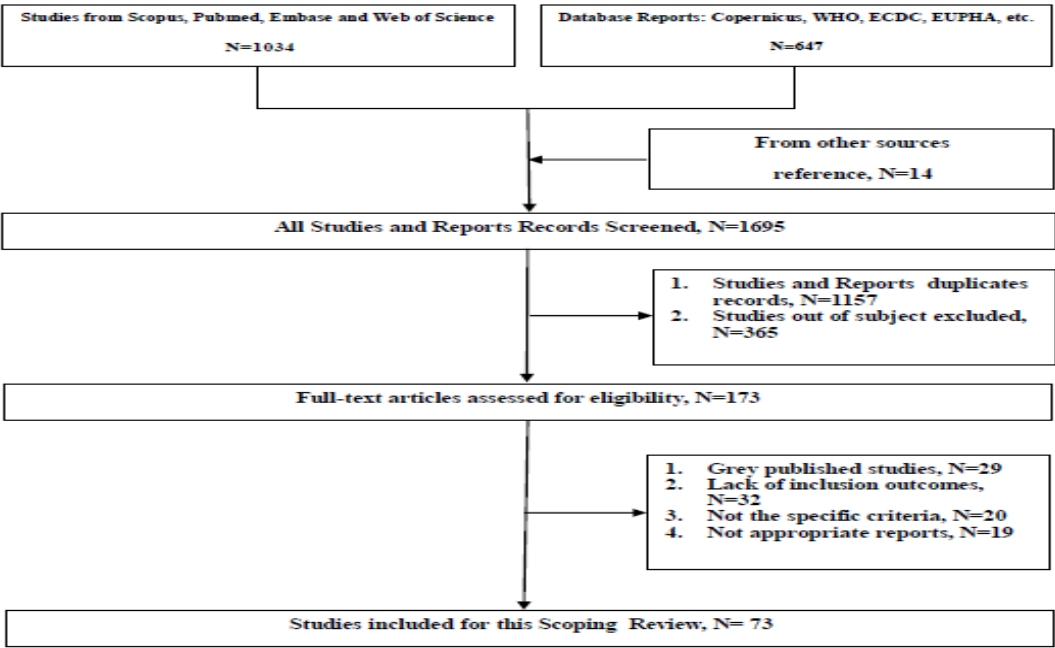


Figure 1. The methods and results diagram of the study.

Search Strategy

A search for "climate change" and "One Health" yielded 1695 hits in literature, studies, reports, primarily journal articles, conference papers. The literature was scrutinized to extract patterns in publications and citation counts. The search was restricted to title/abstracts from 2020 until June 2025, revealing 173 relevant hits. The current initiative focuses on climate change and one health issues related to policy responses, and relevant 9 studies selected hits as show in the Table 1.

Table 1. The basic situation and quality evaluation of the included studies.

	Author	Type of study	Sample	Treatment conditions	Main findings	Total number of cases investigated	Follow up	Limitations
1	Shanga et al. 2024	Meta-analysis	157	OHA	69.6% it is a beneficial to adopt OHA to enhance early detection and response to outbreaks and other health threats	Not mentioned	Not mentioned	Inadequate coordination and funding
2	Adamopoulos et al 2024	Review	25.000	Not mentioned	Climate crisis and disasters can have serious repercussions for public health	12.000	Not mentioned	Not mentioned
3	Agache et al. 2024	Review	4.4% of GHG emissions	Not mentioned	The evidence on the impact of climate change on health should inform the management plan for allergic diseases by inclusion of risk evaluation and of adaptation and mitigation measures tailored to the type of environmental stressor by shared decision-making with the patient	Not mentioned	Not mentioned	Numerous climate policies have failed to stop climate change

4	Jing-Shu Liu et al. 2023	Retrospective study	596	ELISA, biological therapy	The prevalence of EGPA in the SA population was 3.9% in cohort study	23	10 years	Cost and patient's preferences for biological therapy
5	Jing-Shu Liu et al. 2023	Review	56.34	SPO model	China ranks highest in food security (scores 72.56 and ranks 6th), and lowest in climate change (48.74, 11th)	Not mentioned	Not mentioned	Challenges in translating policies into practical measures
6	Zinsstag et al. 2023	Review	Not mentioned	IHR monitoring and evaluation framework and OIE performance of veterinary services pathway	The FAO, OIE and WHO currently play pivotal roles in stimulating OHO at the national and regional levels but will need increased support and allies to both strengthen current activities as well as address a wider set of health hazards across the Socio Ecological System	Not mentioned	Not mentioned	Not mentioned
7	Elnaiem et al. 2023	Review	Not mentioned	Not mentioned	Financing mechanisms that predominantly focus on response to crises, and the chronic underinvestment for epidemic and emergency prevention, mitigation, and preparedness activities	East Africa	Not mentioned	Not mentioned
8	Arredondo et al. 2021	Comparative analysis	Not mentioned	Not mentioned	The management of the impact of flood and droughts on health provided a good example of intersectoral collaborations achieved by sectoral integration	Ghana and India	Not mentioned	The onset of the global epidemic of AI became one among other successful cases of ISC for OH in most parts of the globe
9	Zinsstag 2018 et al.	Mini-Review	Not mentioned	PEP against rabies	Not mentioned	Not mentioned	Not mentioned	Failure of communication of public, animal health surveillance systems

The literature was analyzed for topics and issues that would benefit from integrated approaches to health, focusing on the benefits of closer cooperation between human and animal health in addressing climate change issues. A search for "climate change" and "One Health" yielded 1695 hits in the literature, studies, reports, journal articles, and conference papers. The literature was scrutinized to extract patterns in publications and citation counts. The current initiative studies results report of table 1 focuses on climate change and one health issues related to policy responses. The literature was analysed for topics and issues that would benefit from integrated approaches to health, focusing on the benefits of closer cooperation between human health and animal health in addressing climate change issues.

Inclusion and Exclusion Criteria

The results of a search for articles related to climate change and One Health were screened, resulting in adjectival publications. The methods and the results highlight the potential benefits of integrated approaches in addressing climate change-related health risks and addressing and flow chart diagram of this study showing with Figure 1.

The articles were categorized into health impacts of climate change, response systems to mitigate climate change-related health risks, and integrated approaches in relation to these policy responses. The screening criteria relating to the paradigm framework were employed, and the resulting categories included one health impacts, and approaches to mitigate health threats, also opportunities of integrated approaches in the policy recommendations, strategies and proposals management. Out of 73 selected abstracts, articles covering solutions to climate change impacts approaches on one health and policy responses were found to be relevant for this paradigmatic and peer-review approach to integrated.

Methodological Constraints

Research on the long-term effects of climate change on One Health faces methodological constraints, hindering comprehensive understanding of the complex web of interactive processes. Understanding heat waves and outbreaks of explosive parasites requires extensive multi-country research with detailed meteorologic time series and high-resolution space-time-resolved epidemiologic data. Long-term data for modeling reservoirs, vectors, and parasites is often absent or insufficiently fine-scaled. Despite the emergence of new systems to monitor and predict early warning signals of societal or environmental crises, crucial scientific challenges remain, such as disentanglement of climate change and variability from other mega-trends.

Results of Meta-Analysis

The exposure of health impacts in policy documents helps understand the prioritization of anticipated health risks. Climate change impacts, grouped by risk category, health effect, exposure sector, and world region, account for most of the 50 health impacts. Water availability, high-temperature exposed population, and disease vector spread pose more anticipated health risks than other categories. Policy documents mainly focus on high-income countries and developing regions, with health impacts covering wider world regions being included in fewer documents. This study assesses the exposure of anticipated climate change impacts on health in international policy documents and their correlation with countries' human development levels using meta-analysis. Countries with fair human development are less aware of climate change impacts on health compared to countries with high human development. Policymakers should ensure sustainable clean energy solutions are scaled up while managing health risks arising from energy transition strategies based on research evidence. More research on climate change impacts on health is needed to better inform policymakers, especially in developing and emerging countries.

Quality Assessment of Reviews

The scoping review study included nine reviews with appropriate inclusion criteria and risk of bias, influencing the conclusions drawn in the systematic review. The strength of the conclusions depends on the inclusion of reviews that meet a minimum standard of quality using the Robvis 2 risk-of-bias assessment figures tools. The quality of the reviews should be assessed to avoid being influenced by extraneous variables and focus on the quality of the conduct of the review. The only tool that has been validated as a means to assess the methodological quality of scoping and systematic reviews is the Robvis 2 associated with PRISMA [74,75], showing in Figures 2–4.

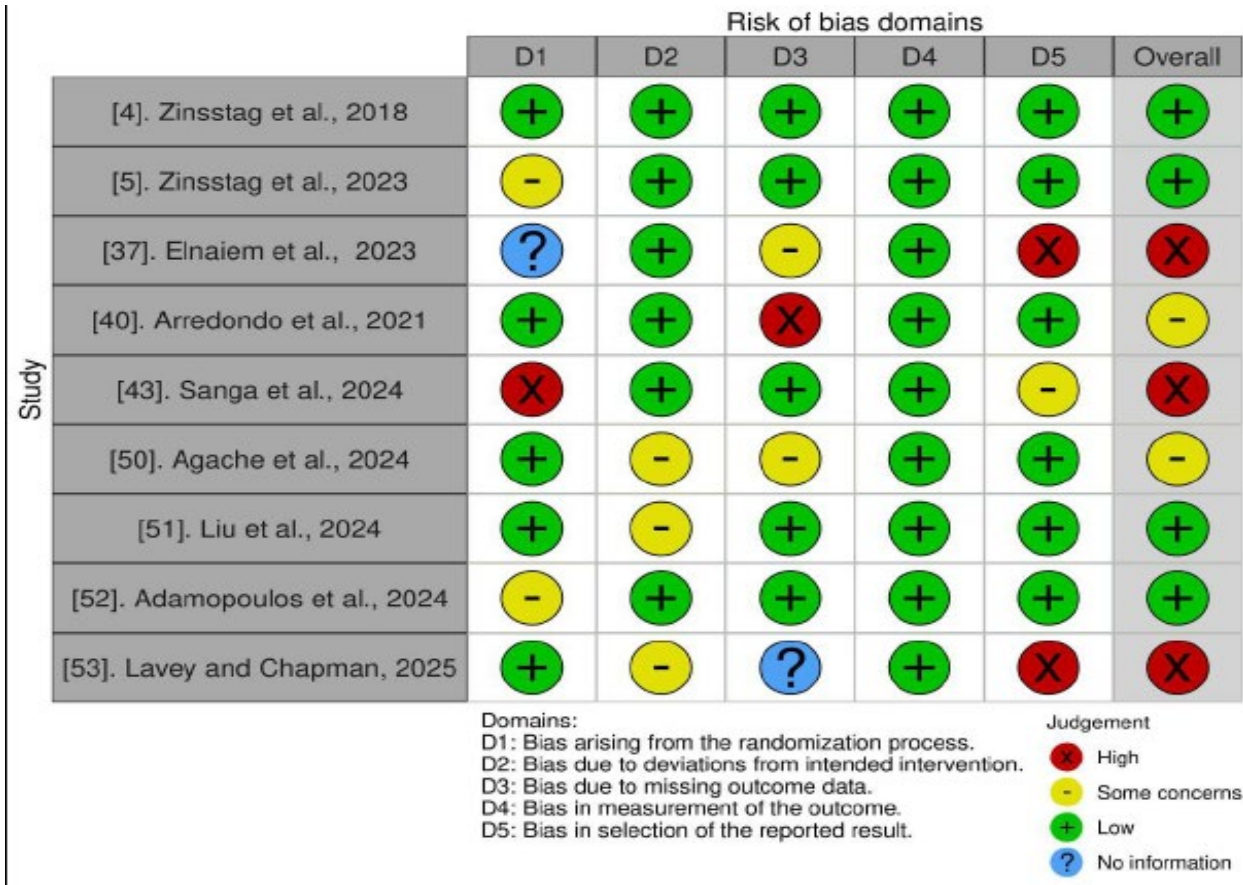


Figure 2. Traffic-light plot Risk of Bias of domains studies included in the scoping review.

Identifies the research question and inclusion criteria, data extraction by at least two independent data extractors, comprehensive literature review with searching of at least two databases, key word identification, detailed list of included/excluded criteria, studies and study characteristics, assessment of included studies, and consideration of quality assessments in analysis quality and conclusions. Understanding those interactions with climate knowledge provides a basis for optimized adaptive strategies through the One Health concept. Future research must address these facets relative to the sensitivities, vulnerabilities, resilience, and environmental sustainability of, respectively, local, regional, national and global One Health systems.

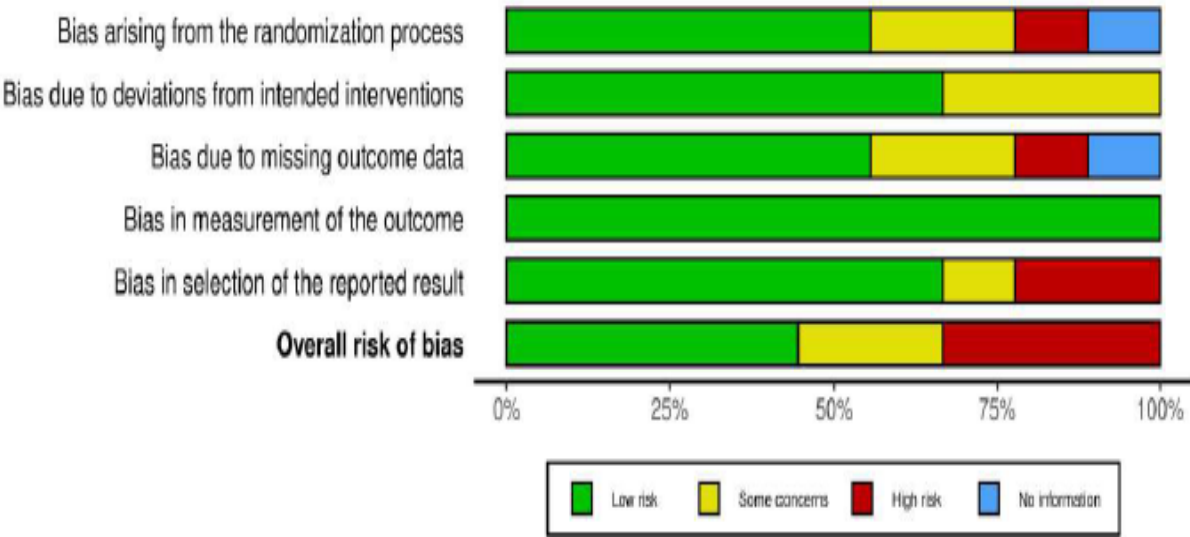


Figure 3. Summary Plot Risk of Bias of studies included in the scoping review.

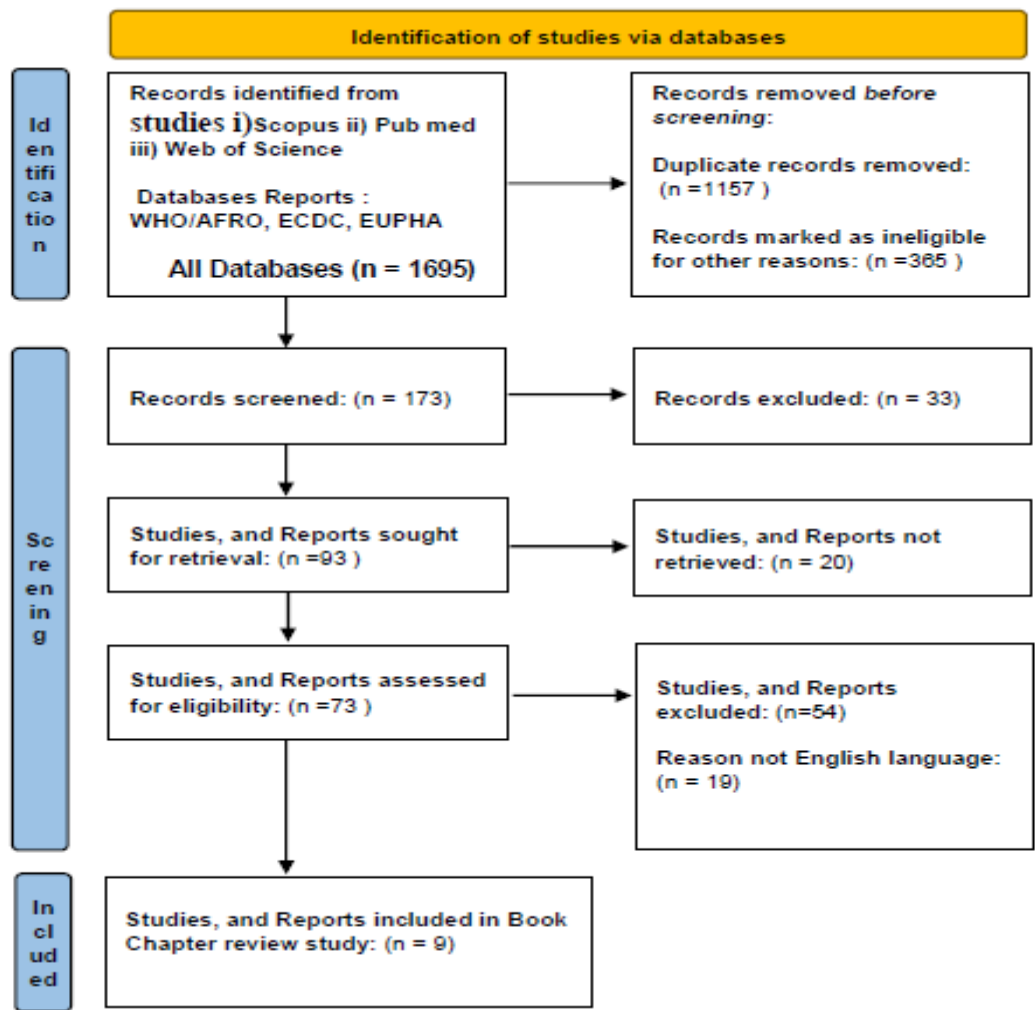


Figure 4. The PRISMA flow chart diagram of the selected analyzing studies of scoping review.

Statistical Analysis

The study summarizes a multidisciplinary approach to analyzing literature using review includes peer-reviewed research, and selected studies, excluding non-academic and predatory publications. PubMed, a search engine, has uncovered 73 relevant articles and abstracts on climate change and One Health approaches on policy responses in English language. The quality of the design and methodology of the included studies was evaluated within the framework of the current review evaluation of the reporting of statistical techniques and findings, as well as the methodology in Published Literature recommendations. The study uses the dual operators "AND" and "OR" to combine terms, using keywords in a two-stage search. The evaluation focuses on rigorous techniques and a thorough grasp of the extent, range, and character of the literature for the nine studies that were ultimately chosen.

The selection process is summarized in the PRISMA flow chart diagram shows in Figure 4.

Challenges Data Gaps and Limitations

A systematic search of the PubMed, especially in Scopus and Web of Science database revealed a lack of papers specifically addressing One Health aspects of climate change. The search was conducted in English, and most papers were biomedical and focused only on humans. The resilience of ecosystems depends on undisturbed functioning and diversity, and improved understanding of threshold effects and emergent responses is essential for establishing early warning systems.

Adaptive management, including vegetation, fauna, and humans, is often a pragmatic strategy for restoration. In the long term, integrated participatory surveillance and improvement measures that involve all stakeholders are the most promising response. The evidence for a framework aligning existing efforts and expanding them to animal health was proposed to assess the effects of climate change on the health of all organisms. A One Health approach to climate change may significantly contribute to food security, with a focus on animal source foods, extensive livestock systems, environmental sanitation, and the potential of integrated community-based syndromic surveillance and response systems in relation to climate change-related emerging diseases.

Results from Literature Review Studies

Impacts of Climate Change on Health

Climate change is a significant environmental and health equity challenge, with health impacts and health costs being far greater than other costs like crop yield losses or infrastructure damage [15]. The burden of climate-sensitive diseases is greatest for the poorest populations, highlighting health inequity [16]. Many of the health impacts of climate are particularly threat to poor people in low- and middle-income countries [17]. Mortality risk from weather-related natural disasters being 50 times greater, health costs related to flooding being more than 200 times greater [18], and vector-borne diseases being almost 300 times greater in developing nations than in developed countries [19]. Urban settings create local climate conditions that cause most of the direct human health hazards due to the urban-heat-island effect, increased air pollution, flooding or water shortages [20]. The health sector is engaged almost nowhere in climate change mitigation and adaptation planning, which is crucial to address the increasing number of deaths and diseases related to pollution from burning fossil fuels, increasing incidence, spatial expansion [21]. The intensity of extreme weather events, and developing knowledge and skills at the local level to implement prevention/adaptation programs [22]. To face these threats, actions need to be taken in the health system to strengthen primary health care, develop preventive programs [23]. Crucial deal with the emergence or re-emergence of infectious and vector-borne diseases associated with changes in climate, human habitation, and agricultural practices [24,25]. Global warming, a phenomenon affecting the Earth's temperature, has led to significant social, economic, and environmental changes [26]. The Earth has warmed by 2°C over a century, causing catastrophic secondary changes that become irreversible at 3°C, [27]. This synchronous increase in temperature and other changes significantly impacts vulnerable regions [28].

One Health Framework in Climate Change

Globally, human, animal, and plant health are being significantly impacted by climate variability and extremes [29]. Storms, droughts, floods, and heat waves are some of these consequences [30]. However, a lot of global frameworks ignore the wider environmental conditions necessary for the survival of both untamed and domesticated species of plants and animals in favor of concentrating on infrastructure, agriculture, and human health [31]. Efforts to lessen the adverse effects of climate change on people, animals, plants [32], and ecosystems are hampered by inadequate awareness and governance of environmental elements, which leads to incorrect responses from health systems [33]. Health is a complex issue that is intertwined with environmental vulnerabilities [8,33]. A health approach that integrates health into ecosystems can help address the impact of climate change and its effects on health [34]. A One Health approach, which emphasizes animal source foods, extensive livestock systems, adequate water, and environmental sanitation [35]. A significantly contribute to food security and health equity [36]. This approach can also help reduce health risks associated with climate change [37]. A robust and transparent implementation of this approach can significantly contribute to food security and health equity [38].

Integration of Health Systems

The health approach, a One Health approach, aims to address interrelated health issues by integrating diverse disciplines and practices [39]. This approach involves transdisciplinary processes to design, implement, and evaluate integrated solutions for various dimensions, including societal, cultural, political, and economic aspects [40]. The solutions are often context-specific, requiring broad application [41]. With climate change influencing health challenges, there is growing interest in integrated approaches and intersectoral collaboration [42]. Solutions derived from scientific evidence on a broader governance level may be needed to address global health challenges [43,44].

Key Findings Results

Global changes, including climate change, environmental changes, and demographic changes, are interconnected and interconnected. These changes can impact vector, reservoir, and pathogen lifecycles, seasonal patterns, and the management of diseases like paratuberculosis, foot-and-mouth disease, and brucellosis. Environmental changes include emerging diseases in wildlife, invasive alien species, and habitat destruction. To address these effects, a comprehensive framework recognizing the linkage between humans, animals, and their environment is needed. Ecosystem approaches to health frameworks, which consider the interconnected network of changes, can help devise predictive governance measures. Integrated community-based surveillance of zoonotic pathogens, a One Health approach, and enhanced livestock systems can contribute to food security and reduce outbreak costs. Regional and global integrated syndromic surveillance and response systems are also essential responses.

Discussion

Policy Responses to Climate Change

The One Health approach to climate change focuses on addressing interconnected issues across sectors, including the health of interdependent biota and socio-economic and political systems [45]. This approach emphasizes the importance of modeling biological and socioeconomic systems' behaviors and a pre-emptive response capacity to early warning signals [46]. A One Health approach to climate change can significantly contribute to food security by emphasizing animal source foods, environmental sanitation [47], and integrated syndromic surveillance and response systems [48]. Case studies from urban, peri-urban, and rural domains highlight the need for surveillance and early response of livestock and human syndromes likely driven by climate change [49–51]. This approach highlights the potential for co-distributed policy interventions in the context of socio-political settings.

Global Policies

Climate change is a global concern, and countries are urged to design national action plans to meet global climate goals [52]. Health, agriculture, and livestock sectors must demonstrate their national action plans to mitigate and adapt to climate change [53]. The One Health system has been the focus of several global policies, including the FAO's efforts to mitigate climate change's impact, environmental pollution, and disruption of biological interaction chains [54]. The WHO/AFRO coordinated the establishment of a Regional Working Group on Animal-Human Health Interface to combat zoonotic diseases and tackle climate change's effects on the One Health system [55]. Global policies like the WHO Climate Change and Health Coping Strategies focus on the human health side [56]. Addressing transboundary and emerging diseases of livestock, modeling links between climate change and human infectious diseases, animal and zoonotic diseases of wildlife, domestic reservoirs and vectors, biodiversity loss, and anthropogenic land use change [57]. However, WHO policy recognition of links between climate change and health, particularly food safety, is acknowledged [58].

National and International Strategies

Europe is implementing national multi-sectoral One Health strategies to address climate-induced risks for human, animal, and ecosystem health [59]. Governments are promoting collaboration platforms and objectives to mitigate risks [60]. Baseline assessments on health and climate risks are being conducted to highlight and prioritize risks for One Health and collaboration across sectors [61]. Health adaptation measures are being identified and implemented, with long-term objectives being concrete and specific enough for immediate action [62]. Countries with similar climate risks, such as heat in Europe and insect-borne diseases in Europe and South Africa, are jointly assessing risks and adaptation measures [63]. A variety of tools can assist in implementing multi-sectoral plans, with a focus on infectious disease transmission, environmental exposures [64], health services, vector control, and health co-benefits [65]. Monitoring and evaluation frameworks should be developed to enable continuous utilization of these tools and address unanticipated effects [66]. The Global Climate Crisis has significantly affected human health, with AI-Driven Analysis highlighting the negative effects on public health [67,68]. The crisis has led to increased risks in workplace hazards, among global populations and especially on the public health workforce [69,70]. The effects of heat stress on occupational safety, health, and hygiene are also evident [70,71]. The future food supply International faces challenges and AI-powered solutions needs with innovative policies, while air pollution and indoor air quality in high risk and sensitive populations with also health issues further exacerbate these negative effects [72,73].

Policy Recommendations and Future Research Directions

Evidence points to an increase in vector-borne zoonotic pathogens due to climate change in Lower and Middle Income Countries. Veterinary surveillance is crucial to mitigate these risks, but the cost may be lower if detected early. Community-based surveillance, involving participatory mapping and incentivised record keeping, can be a promising approach. This system supports literate norm-entrepreneurs and informal veterinary service provision along trade routes, empowering nano-scale entrepreneurship against human conflict and climate change. This non-hierarchical, fragmentation-tolerant organizational form is effective against human conflict and climate change. The health concept emphasizes sustainability in response to climate change. Understanding climate interactions and trends is crucial for optimizing adaptive strategies. The One Health concept, which includes mechanisms for food security, antimicrobial resistance control, and environmental sanitation, can help address these challenges and ensure sustainable health systems.

Experience with other emerging diseases suggests that outbreaks of emerging vector-borne zoonotic pathogens are much cheaper to control when detected early in the vector or livestock than later on at the human level. Integrated surveillance and response of a consortium of human and veterinary health authorities may be a promising avenue to reduce the health effects of climate change.

Limitations

Many trends remain theoretical or based on preliminary research, also the regional inequalities in resources and technology may cause delays in adoption of the One Health approach to climate change focuses on addressing policy responses.

Conclusions

The research community is optimistic about plausible climate projections and analyses, but must confront the limits of sustainability in the use of climate products, interpretation of scientific knowledge, and national interests. The global effort in climate modelling and observation has continued and even been enhanced over the last three decades, despite a long history of climate science denial and malaise regarding climate mitigation potential. Efforts to mitigate climate change remain fragmentary and deeply contested, with limited geopolitical funds leading to struggles to define causes and consequences of climate injustice. Climate change mitigation also risks on-

vulnerable states foregoing opportunities for socioeconomic development associated with fossil fuel resource extraction. Limits to sustainability in efforts to mitigate climate change justice among fossil fuel-holding states lead to limits in climate adaptation as the temporal and spatial risks associated with climate impacts move beyond limits. The resilience perspective's Achilles heel is its assumption that social-ecological systems can always recover from disturbances of anthropogenic climate change, and the potential collapse of crucial social-ecological systems remains largely unarticulated and unexplored.

Author Contributions: I.A. project administration conceived and supervised the study; I.A. designed the research and wrote the manuscript; I.A. performed the research, and wrote the revise of the the manuscript, and analyzed the data; N.S. helped with data analysis. All authors took part in the editing of the manuscript and reviewed the manuscript. All authors read and approved the final manuscript.

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Consent for publication: The authors give full consent to publish this research.

Data availability: The datasets used during the current study are available from the corresponding author on reasonable request.

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Abbreviations

AI	Artificial Intelligent
ECDC	European Centre for Disease Prevention and Control
EUPHA	European Public Health Association
E.U.	European Union
WHO	World Health Organization
PRISMA	Preferred Reporting Items for Systematic and Met-analysis
ML	Machine Learning

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