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Is climate change the hidden catalyst behind the next pandemic? A systematic literature review

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Abstract:

BACKGROUND: The relationship between pandemics and climate change has emerged as a critical area of study, particularly underscored by the COVID-19 pandemic, which exposed vulnerabilities in global health systems and environmental governance. Although direct evidence linking climate change to the spread of COVID-19 remains limited, rising global temperatures and ecosystem disruptions have intensified human–wildlife interactions, increasing the risk of zoonotic disease emergence.

AIMS AND OBJECTIVES: This study aims to synthesize existing research on the interconnections between climate change and emerging infectious diseases, identify key knowledge gaps, and provide insights to guide integrated health and environmental policy development.

MATERIALS AND METHODS: A systematic literature review was conducted using peer-reviewed articles published within the past two decades. Relevant studies were identified through scientific databases, focusing on evidence linking climate variability, ecosystem shifts, and zoonotic transmission dynamics.

RESULTS: Findings indicate that climate-induced changes—such as rising temperatures, altered precipitation patterns, and habitat disruption—affect vector ecology and wildlife migration, facilitating conditions for pathogen spillover. However, existing research remains fragmented, with limited longitudinal analyses and region-specific data to quantify these associations.

CONCLUSION: The interconnectedness of human health, environmental health, and biodiversity underscores the need for a holistic One Health approach. Strengthening interdisciplinary collaboration and integrating climate resilience into public health strategies are vital to addressing the multifaceted challenges posed by climate change and emerging pandemics.

Keywords:

Climate change, ecosystem shifts, pandemic, public health policy, zoonotic diseases

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Introduction

The relationship between pandemics and climate change is an increasingly critical area of study, particularly in light of the COVID-19 pandemic, which has exposed vulnerabilities in our health systems and environmental policies. While we may not have direct evidence linking climate change to the spread of COVID-19, the broader implications of climate change on our interactions with other species are undeniable. As the climate continues to warm, the dynamics of ecosystems are shifting, leading to altered habitats and migration patterns for various species. This disruption can facilitate the transmission of pathogens between animals and humans, thereby increasing the risk of zoonotic diseases. Understanding this relationship is

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essential for developing effective public health strategies and environmental policies that can mitigate the risks associated with future pandemics.

According to the Harvard T. H. Chan School of Public Health (2024), the separation of health and environmental policy is a dangerous delusion that undermines our ability to address the interconnected challenges posed by climate change and pandemics. Our health is inextricably linked to the health of the planet and the myriad organisms with which we share it. As climate change alters ecosystems, it can lead to increased human-wildlife interactions, creating opportunities for pathogens to jump from animals to humans. This highlights the need for a holistic approach to policymaking that recognizes the interdependence of human health, environmental health, and biodiversity.

As the planet heats up, species are migrating toward the poles in search of cooler habitats, leading to unprecedented interactions between previously isolated populations.[1-5] This phenomenon not only increases competition for resources but also raises the likelihood of pathogen spillover events. For instance, when animals that typically do not interact come into contact, they may exchange pathogens, which can then adapt to new hosts, including humans.[6,7] This underscores the importance of understanding the ecological consequences of climate change and how they can influence the emergence and spread of infectious diseases. A systematic literature review can help synthesize existing research on these dynamics, providing valuable insights into the mechanisms through which climate change may facilitate pandemics.

Moreover, many of the root causes of climate change, such as deforestation and industrial agriculture, are also significant contributors to the risk of pandemics.[8-10] Deforestation, primarily driven by agricultural expansion, is the leading cause of habitat loss worldwide as natural habitats are destroyed, and wildlife is forced to migrate, increasing the likelihood of contact with other species, including humans.[5] This not only heightens the risk of zoonotic disease transmission but also disrupts the delicate balance of ecosystems, further exacerbating the impacts of climate change. Establishing the relationship between pandemics and climate change is essential for developing effective policies that safeguard public health and the environment. The evidence suggests that climate change is reshaping our interactions with other species, increasing the risk of zoonotic diseases and pandemics.

The objective of this study is to perform a systematic literature review that will serve as a vital resource for synthesizing existing research on the relationship between pandemics and climate change, highlighting the complex connections between these two urgent global challenges Specifically, this study aims to assess the extent to which climate change is recognized in the discourse surrounding the emergence and spread of pandemics, as well as its implications for public health systems and responses. Ultimately, this study seeks to establish a consolidated scientific evidence base that emphasizes the necessity of an integrated approach to health and environmental policy, thereby enhancing resilience against future health crises.

Methodology

Overall research framework

In conducting a comprehensive investigation into the relationship and impact of climate change on pandemics and public health, I recognized the critical importance of establishing a robust overall research framework that encompasses a well-defined search strategy, relevant keywords, and appropriate databases. To effectively capture the breadth and depth of existing research in this complex field, I developed a meticulous search strategy centered around a carefully curated set of key terms, including "climate change," "pandemic," "public health," "infectious diseases," and "health outcomes." I utilized the Scopus and PubMed databases as primary resources for sourcing relevant publications, ensuring access to a wide array of peer-reviewed literature. In line with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework, I implemented systematic approaches for extracting data from the selected studies, which facilitated a thorough analysis of the findings. Furthermore, I employed analytical methods grounded in the PICOC framework to synthesize the findings, allowing for a nuanced understanding of the intricate dynamics between climate change, pandemics, and public health. This comprehensive research framework not only guided the investigation but also ensured that the resulting insights are well founded and relevant to the ongoing discourse on health security and climate action.

Timeframe for the literature search

To investigate the relationship and impact of climate change on pandemics and public health, I established a comprehensive timeframe for the literature search that began in the 2010s. This strategic decision was made to ensure that the review encompassed a significant period during which substantial research and developments in these critical areas have emerged.

By focusing on studies published from the 2010s onward, I was able to capture the evolving discourse surrounding climate change and its implications for public health, particularly in the context of emerging infectious diseases and pandemics. This timeframe facilitated a thorough exploration of the literature, enabling me to assess how climate change has been recognized and addressed within the framework of public health emergencies. My aim was to evaluate the extent to which climate change is acknowledged as a contributing factor to the emergence and spread of pandemics, as well as its impact on public health systems and responses. This investigation is crucial for understanding the broader implications of climate change on health security and for informing future strategies that integrate climate action with public health preparedness and response efforts.

Search strategy, keywords, and search terms

In conducting a thorough investigation into the relationship and impact of climate change on pandemics and public health, I recognized the necessity of developing a comprehensive search strategy that would effectively capture the breadth and depth of existing research in this complex field. To achieve this, I centered my search around a carefully curated set of key terms that are directly relevant to the study. The primary search terms included "climate change," "pandemic," "public health," "infectious diseases," and "health outcomes."

This selection of terms was not arbitrary; rather, it was meticulously chosen to encapsulate the multifaceted nature of the research topic. Each term represents a critical component of the overarching theme, allowing for a holistic exploration of how climate change influences various aspects of public health, particularly in the context of pandemics. For instance, "climate change" serves as the foundational term, linking environmental shifts to health implications, while "pandemic" and "infectious diseases" highlight the urgent health crises that can arise as a result of these environmental changes. "Public health" encompasses the broader systems and policies in place to manage health outcomes, and "health outcomes" focuses on the specific effects that climate change and pandemics have on population health.

By employing this strategic selection of search terms, I aimed to ensure that the literature search would yield a wide array of studies that address the intricate connections between these critical areas. This approach not only facilitated a comprehensive understanding of the existing literature but also allowed for the identification of patterns, trends, and gaps in knowledge. Ultimately, this thorough investigation is essential for informing future research directions and public health strategies that can effectively address the challenges posed by the intersection of climate change and health.

Database and source

I utilized the Scopus and PubMed databases as a primary resource for searching relevant publications. Scopus and PubMed provided a comprehensive platform for accessing a wide range of scholarly articles and research studies in the field. However, I did not include gray literature sources, reports, and policy documents from reputable organizations such as World Health Organization (WHO), Centers for Disease Control and Prevention, and Intergovernmental Panel on Climate Change in this search to maintain a focus on peer-reviewed academic sources. With the research articles available from Scopus, I was able to access high-quality research articles and academic publications that contributed valuable insights to the systematic literature review.

Approaches for extracting data from selected studies

To effectively extract data from the selected studies while adhering to the PRISMA framework, I employed a systematic approach that ensured comprehensive and transparent data collection. This process began with the identification of relevant studies through a rigorous literature search, followed by the application of predefined inclusion and exclusion criteria to select studies that specifically addressed the relationship between climate change, pandemics, and public health. Once the studies were selected, I utilized a standardized data extraction form to systematically gather key information, including study characteristics, methodologies, findings, and conclusions related to the acknowledgment of climate change as a contributing factor to the emergence and spread of pandemics. This structured approach enabled the identification of shared themes and patterns across the studies, which facilitated a comparative analysis of the relationship between climate change and pandemics, particularly in how climate change affects public health systems and their responses. By synthesizing the extracted data, I aimed to assess the degree to which climate change is acknowledged as a critical factor in public health emergencies related to pandemics, thereby emphasizing its broader implications for health security. This focus on the intersection of climate change and pandemics is essential for understanding the potential risks and challenges that arise in public health contexts, ultimately informing more effective strategies for preparedness and response.

Analytical methods for synthesizing findings

In synthesizing findings related to the intricate relationship between climate change, pandemics, and

public health, I employed analytical methods grounded in the PICOC framework. The population of interest encompasses studies that explore the intersections of climate change, pandemics, public health, and health security. The primary intervention focuses on investigating the relationship and impact of climate change on pandemics and public health systems. To facilitate a comprehensive understanding, I utilized descriptive and thematic synthesis to compare the data extracted from various studies, allowing for the identification of key themes and patterns. The outcomes of this analysis aim to evaluate the extent to which climate change is recognized as a significant factor in public health emergencies, particularly in the context of pandemics. This exploration is set against the backdrop of the complex interplay between pandemics, public health, security, diplomacy, and health security issues, highlighting the urgent need for integrated strategies that address these interconnected domains. Such an understanding is essential for driving effective climate action and fostering global cooperation toward sustainable solutions, ultimately enhancing global health resilience in the face of ongoing environmental challenges.

Inclusion and exclusion criteria

Table 1 presents the application of the PICOC framework, outlining the key components that guide the scope of this systematic literature review. It highlights how studies addressing climate change, pandemics, and public health are analyzed through a structured approach that identifies the population of interest, the central issue under investigation, and the methods of comparison. The framework further emphasizes evaluating outcomes related to climate change awareness in public health emergencies and the broader contextual interplay among global health, security, and diplomacy, thereby supporting the development of integrated and resilient adaptation strategies.

Table 1: PICOC framework in the scope of the systematic literature review

Concept	Climate change, pandemic and public health
Population	Studies which involve climate change, pandemic, public health and health security
Intervention/Issue of Interest	Investigating the relationship and impact of climate change on pandemics and public health
Comparison	Descriptive and thematic synthesis the data
Outcomes	Evaluate the extent of climate change recognition on public health emergencies specific to pandemics and promotes integrated solutions for adaptation and resilience strategies
Context	The intricate interplay between pandemics, public health, security, diplomacy, and health security issues underscores the imperative for comprehensive strategies that integrate these domains to drive effective climate action and foster global cooperation towards sustainable solutions. Within the intersection of climate change, pandemics, and public health, understanding the complex dynamics is crucial for enhancing global health resilience

Table 2 presents the PRISMA structure outlining the identified inclusion and exclusion criteria for framing climate change as a health security issue. The identification phase involves searching the PubMed and Scopus databases using specific search terms such as climate change impacts, pandemic preparedness, public health resilience, infectious diseases, climate change mitigation, and health outcomes. Figure 1 illustrates the systematic screening process employed in this review, incorporating clearly defined inclusion and exclusion criteria. Research articles published between 2010 and 2024 [Figure 2] in reputable journals focusing on environmental science and public health [Figures 3 and 4] were included for analysis. Studies falling outside these parameters or lacking relevance to the intersection of climate change, pandemics, and public health were excluded to ensure the rigor and relevance of the final dataset. Moving to the eligibility phase, the comprehensive criteria encompass studies investigating the direct impacts of climate change on public health outcomes, preparedness for pandemics in the context of climate change, the relationship between climate change impacts and infectious diseases, the effectiveness of mitigation measures, and the interconnectedness of climate change, pandemics, and public health. Conversely, exclusion criteria involve studies not directly addressing these relationships, not meeting quality standards, or lacking relevance to the specified search terms. This structured approach ensures a rigorous selection process for identifying relevant research on the complex interactions between climate change, pandemics, and public health, emphasizing the need for integrated approaches to address these critical challenges effectively.

Results

The application of the PRISMA framework in the identification and screening of articles for this systematic literature review, conducted during a 4-month review from September to December 2024, yielded a comprehensive dataset that highlights the intricate relationships between climate change, pandemics, and public health. Initially, a total of 107 studies were identified that establish theoretical or conceptual links between climate change and pandemics, providing a foundational understanding of these interconnected

Table 2: Preferred Reporting Items for Systematic Reviews and Meta-Analyses structure for identified inclusion and exclusion criteria for framing climate change as a health security issue

Identification	
Database: PubMed and Scopus	
Search terms: climate change, pandemic, public health, infectious diseases, health outcomes	
Screening	
Inclusion criteria	**Exclusion criteria**
Types of study	Not a research article study
1. Research Articles	
Research Articles published from 2010–2024	Research Articles published before 2010
Journal publication related to environmental science, public health and social science	Journal publication not related to environmental science, public health and social science
Eligibility	
Studies that establish the relationship between climate change, pandemics, and public health either in theory or concept	Studies that do not establish the relationship between climate change, pandemics, and public health either in theory or concept
	Exclude studies that do not provide a clear theoretical or conceptual connection between climate change and the occurrence or severity of pandemics
	Exclude research that fails to address how climate change-related pandemics affect public health outcomes or the effectiveness of health systems
	Exclude studies that do not integrate insights from multiple disciplines, such as epidemiology, environmental science, and public health, when examining the interplay between climate change and pandemics
Studies that investigate the direct and/or indirect impacts of climate change on public health outcomes, including but not limited to infectious diseases, health resilience, and overall health outcomes	Studies that do not investigate the direct and/or indirect impacts of climate change on public health outcomes, including but not limited to infectious diseases, health resilience, and overall health outcomes
	Exclude studies that do not directly or indirectly explore the effects of climate change on public health outcomes
	Exclude research that does not address the relationship between climate change and infectious diseases as part of its public health analysis
	Exclude studies that do not consider health resilience or broader public health outcomes in relation to climate change
Studies that explore the relationship between climate change impacts and the spread, transmission, and management of infectious diseases within the public health domain	Studies that do not explore the relationship between climate change impacts and the spread, transmission, and management of infectious diseases within the public health domain
	Exclude studies that do not examine how climate change impacts influence the spread and transmission of infectious diseases
	Exclude research that fails to investigate the role of climate change in the management strategies for infectious diseases within the public health sector
	Exclude studies that do not analyze the transmission dynamics of infectious diseases in the context of climate change effects
Studies that evaluate the interconnectedness of climate change, pandemics, and public health, emphasizing the importance of integrated approaches to address these complex challenges	Studies that do not evaluate the interconnectedness of climate change, pandemics, and public health, emphasizing the importance of integrated approaches to address these complex challenges
	Exclude studies that do not evaluate how climate change and pandemics are interconnected within the public health framework
	Exclude research that fails to emphasize the necessity of integrated approaches in addressing the challenges posed by climate change and pandemics in public health
	Exclude studies that do not consider the complexity of challenges arising from the interactions between climate change and public health in relation to pandemics

phenomena. Further screening revealed 43 studies that specifically investigate the direct and indirect impacts of climate change on public health outcomes, encompassing a range of issues from infectious diseases to health resilience and overall health outcomes. In addition, 36 studies were found that explore the relationship between climate change impacts and the spread, transmission, and management of infectious diseases within the public health domain, underscoring the critical role of environmental factors in disease dynamics. Finally, 27 studies evaluated the interconnectedness of climate change, pandemics, and public health, emphasizing the necessity for integrated approaches to effectively address these complex challenges.

Characteristics of the studies

Identification and screening of articles for this systematic literature review revealed significant trends

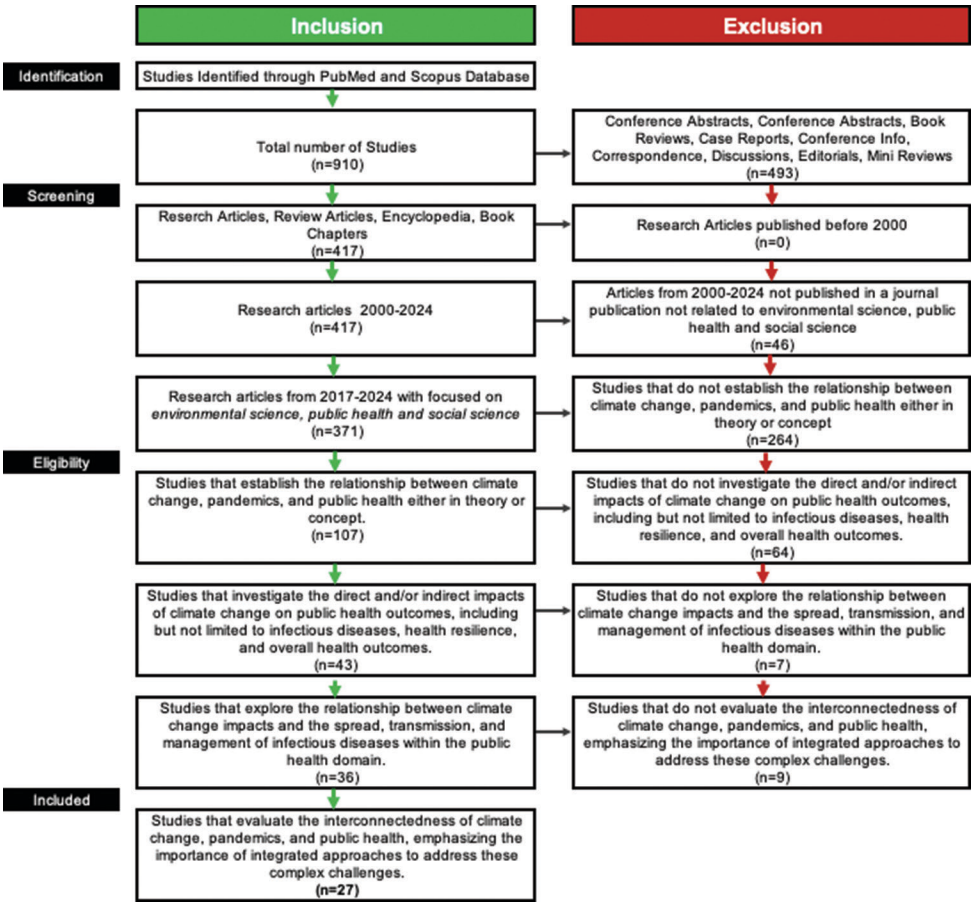

Figure 1: Preferred Reporting Items for Systematic Reviews and Meta-Analyses framework for the inclusion and exclusion of the studies

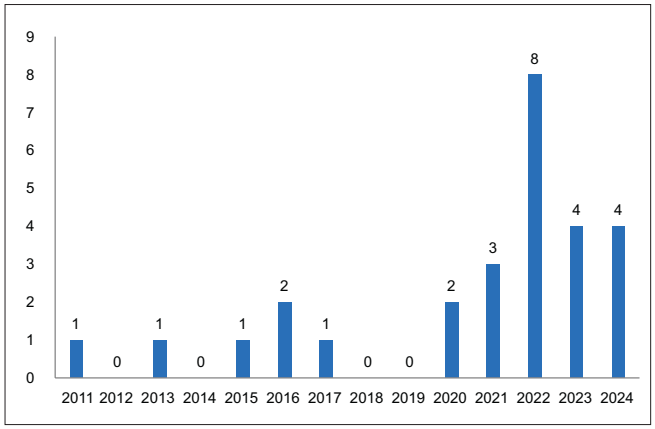

Figure 2: Number of publications from 2011 to 2024

and insights regarding the intersection of climate change, pandemics, and public health. Notably, the initial screening indicated that the first study addressing these interconnected issues was published in 2006, coinciding with the potential emergence of the severe acute respiratory syndrome pandemic, which highlighted the urgent need to understand how environmental factors could influence public health crises. This early research laid the groundwork for subsequent investigations; however, it was not until the onset of the COVID-19 pandemic in 2020 that a marked increase in scholarly attention was observed. The data illustrate a clear upward trend in relevant studies, with a notable spike in publications from 2020 to the present, reflecting the heightened awareness and urgency surrounding the impacts of climate change on public health and infectious disease management. Specifically, the number of studies surged from just 2 in 2021 to 8 in 2022, followed by 4 in both 2023 and 2024, indicating a sustained interest in this critical area of research.

The identification and screening of articles within the theme of climate change, pandemics, and public health yielded a total of 27 relevant studies, revealing a significant emphasis on public health perspectives in this research area. Notably, 87% of the articles were categorized under public health, whereas only 13% fell within the realm of environmental science. This distribution highlights the critical role that public health research plays in understanding and addressing the implications of climate change and pandemics, as it focuses on health outcomes, disease management, and resilience strategies. The predominance of

public health studies suggests a growing recognition among researchers of the urgent need to explore how climate-related factors influence health systems and population well-being, particularly in the context of emerging infectious diseases. This analysis indicates that while environmental science provides essential insights into the ecological aspects of climate change, the overwhelming focus on public health underscores the necessity for interdisciplinary approaches that integrate environmental and health perspectives to effectively tackle the complex challenges posed by climate change and pandemics.

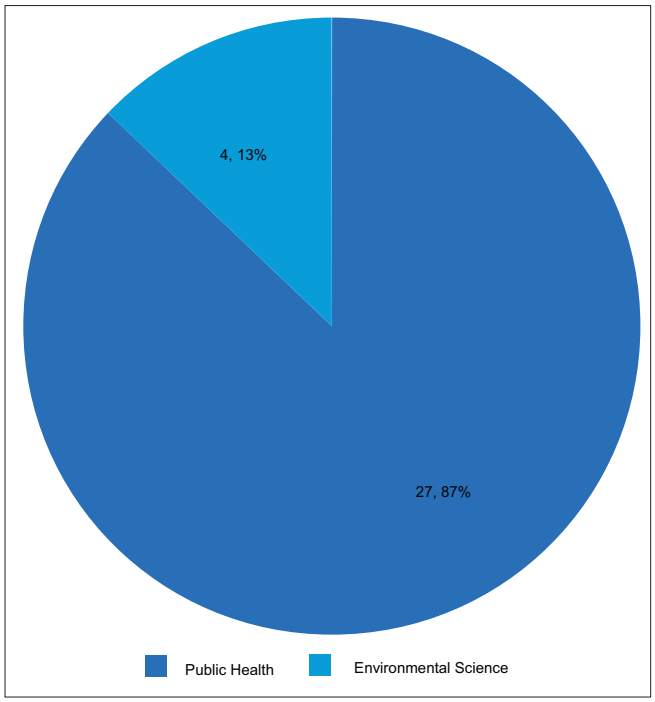

Figure 3: Number of publications per scientific domain of journal

The identification and screening of articles related to the theme of climate change, pandemics, and public health revealed a diverse array of journal publications, totaling 27 studies across various reputable platforms. Notably, the distribution of articles spans a wide range of journals, including prominent biomedical publications such as the *New England Journal of Medicine* and *The Lancet Global Health*, as well as specialized journals such as *Journal of Climate Change and Health* and *Infectious Diseases of Poverty*. Each journal contributes unique perspectives, with some focusing on the intersection of environmental changes and health outcomes, whereas others emphasize the implications of climate change on the emergence and management of infectious diseases and public health preparedness. For instance, *The Lancet Planetary Health* and *Global Public Health* highlight the global implications of health challenges linked to climate change, while journals such as *Emergency Medicine Australasia* and *Disaster Medicine and Public Health Preparedness* address the urgent need for effective responses to health crises that are exacerbated by climate-related factors. The presence of articles in both general and specialized journals underscores the interdisciplinary nature of this research area, reflecting

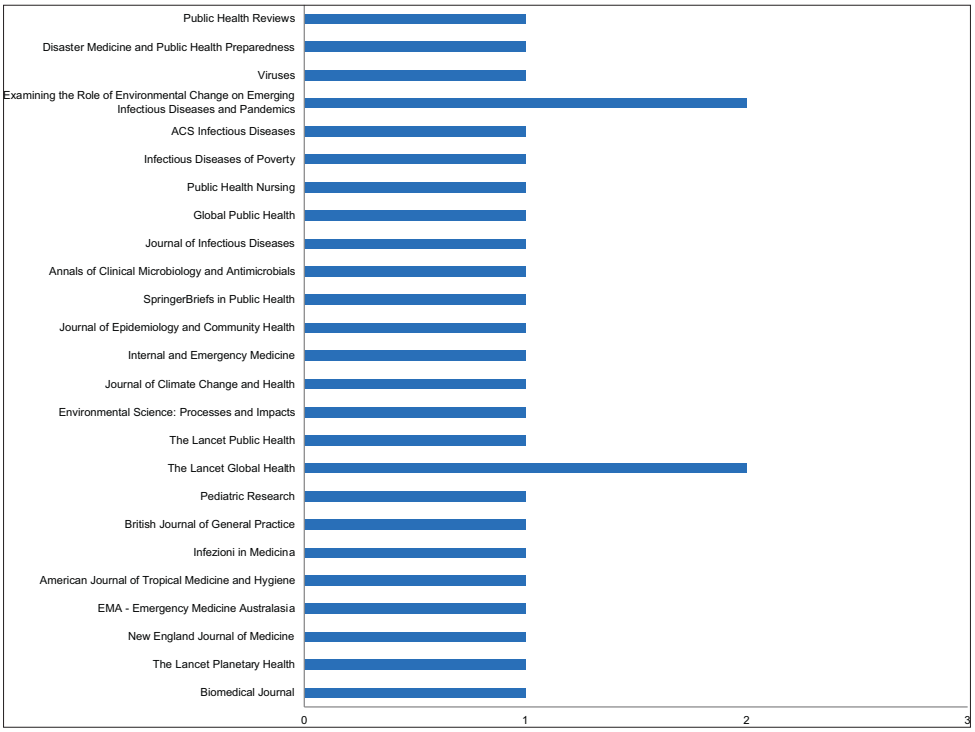

Figure 4: Number of publications per journal

a growing recognition of the critical connections between climate change, public health, and the management of pandemics.

Theories and concepts linking climate change and pandemics

The one health framework

The One Health paradigm is a fundamental framework that emphasizes the interdependence of human, animal, and environmental health, especially in relation to climate change and pandemics.[1,6,7,11-13] This perspective argues that the well-being of people is closely connected to the well-being of animals and environmental systems so that disturbances in one area might trigger health emergencies in another.[3,4,6,14] This connection is worsened by climate change through the modification of ecosystems, the amplification of human–wildlife interactions, and the facilitation of the introduction of zoonotic illnesses. In particular, the COVID-19 pandemic has been associated with a rise in the intrusion into wildlife habitats, therefore, increasing the likelihood of disease transmission from animals to people pandemics.[1,6,7,11-13,15] Researches suggest that as climate change modifies ecosystems, it might cause changes in the distributions and behavioral patterns of species, thereby raising the probability of zoonotic transmission.[9,10,16-18]

Planetary health: An integrated approach to health and environment

The Planetary Health paradigm provides a thorough framework for comprehending the complex correlation between climate change and health consequences, especially in the setting of a pandemic.[1,3,5-7,19] This notion asserts that the well-being of humans is inherently interconnected with the well-being of the Earth, underscoring that the deterioration of the environment and the phenomenon of climate change present substantial risks to the health of the general population. The COVID-19 pandemic has been characterized as a "Anthropocene disease," which signifies the profound effects of human actions on ecosystems and the resulting repercussions on human health.[1,7] Extensive researches have demonstrated that environmental changes, such as deforestation and pollution, can worsen health crises by heightening the likelihood of the introduction of infectious diseases. Specifically, the decline in biodiversity can disturb the equilibrium of ecological systems, resulting in heightened contact between humans and animals and the possibility of zoonotic transmission.[1,20-22]

Syndemic theory: The interaction of concurrent health emergencies

Through the lens of syndemic theory, the relationship between climate change and pandemics has examined critically, revealing how various health crises can work synergistically to worsen health outcomes.[8,12,13,23] This word denotes the simultaneous presence of two or more illnesses that interact and exacerbate one other, frequently affected by social and environmental factors. Individuals with preexisting noncommunicable illnesses, such as diabetes and cardiovascular disorders, have been disproportionately impacted by the COVID-19 pandemic.[5,14,19,20,24] These problems are known to be worsened by climate-related variables such as air pollution and extreme weather events.[2,25] Two research articles suggest that disadvantaged populations, who are particularly susceptible to both climate change and infectious illnesses, have poorer health outcomes during pandemics.[3,21]

The ecological models of disease emergence: An examination of climate change and vector dynamics

Ecological models of disease emergence offered significant insights into the impact of climate change on the pathogenesis of infectious illnesses, especially those spread by vectors. These models propose that climatic changes can modify the geographical range and physical characteristics of disease vectors, such as mosquitoes and ticks, therefore affecting the spread of infectious illnesses.[11,13,21,26] For example, the increase in temperatures and the alteration in precipitation patterns have broadened the range of environments susceptible to vectors, resulting in higher occurrences of illnesses such as malaria and dengue fever in formerly unaffected areas.[6,7,27,28] Empirical evidence has shown that climate change has already had a role in the revival of vector-borne illnesses in some regions, underscoring the necessity for public health measures that are guided by climatic considerations.[6,29,30]

Environmental justice: Mitigating disparities in health results

An essential aspect in comprehending the disproportionate impact of climate change on vulnerable groups and its subsequent influence on pandemic outcomes is the notion of environmental justice.[1,12,16] Socially disadvantaged populations frequently experience the most severe impact of environmental deterioration and are more vulnerable to both health hazards associated with climate change and infectious illnesses.[3,7,30] For example, economically disadvantaged communities have limited availability of uncontaminated water, sufficient healthcare services, and areas of natural vegetation, rendering them more susceptible to pandemic during climate-related phenomena.[12,13,29] These gaps have been emphasized by the COVID-19 pandemic, which has disproportionately impacted communities of minority and low-income individuals, therefore, exposing the interconnectedness of environmental and health imbalances.[31,32] Extensive

research suggests that it is crucial to tackle these disparities in order to enhance health results and develop resilience in response to climate change and pandemic.[33,34]

Health outcomes and vulnerabilities related to climate change

The impact of climate change on the development of zoonotic diseases

Climate change has a substantial impact on the development and dissemination of zoonotic illnesses, which are infections that may be transmitted from animals to people. With the increase in global temperatures and the growing unpredictability of weather patterns, the natural habitats of many animal species are altered, resulting in changes in their numbers and habits.[18,22,30,35] These modifications frequently lead to heightened human–wildlife encounters, as animals are compelled to travel in pursuit of sustenance, water, and an appropriate habitat environment.[16,21,36-38] This occurrence is especially concerning within the framework of pandemics, as some recent pandemic, such as COVID-19, have been attributed to zoonotic spillover incidents, in which infections are transmitted from animals to people.[3,18,22] The interdependence of ecosystems implies that disruptions in one ecological region might trigger a series of consequences, hence increasing the likelihood of disease spread among other species.[10,20,36,39]

Climate change and human activities, including agriculture and urbanization, frequently contribute to deforestation and habitat damage, which in turn increase the vulnerability to zoonotic illnesses.[7,21,31] The clearance of natural habitats leads to the displacement of animals into greater contact with human populations, therefore facilitating the transfer of viruses across species boundaries. For instance, the expansion of agricultural land into wooded regions can result in heightened interaction between humans and animals, therefore enabling the spread of viruses and bacteria that were previously confined mostly within animal populations.[22,23] This emphasizes that areas experiencing substantial environmental changes, such as deforestation and urbanization, are becoming focal points for the spread of infectious illnesses.[3,7,30]

Furthermore, the consequences of climate change on zoonotic infections go beyond acute health issues; they also provide substantial obstacles for worldwide health systems and readiness preparation.[1,8,12,16] Given the escalating frequency and severity of climate-related disasters, multiple studies recommended that public health authorities need to modify their approaches to effectively tackle the changing scope of infectious illnesses.[6,12] This involves improving surveillance systems to systematically track wildlife populations and their contacts with humans and with allocating resources to research in order to get a deeper understanding of the mechanisms behind zoonotic spillover incidents.[3,33,38] Furthermore, researches argue that it is crucial to implement public health initiatives that focus on teaching populations about the hazards linked to wildlife encounters and advocating for behaviors that mitigate these hazards.[28,40]

The influence of climate change on diseases transmitted by vectors

The impacts of climate change on vector-borne illnesses, such as malaria, dengue fever, and West Nile virus, are significant since it modifies the geographical range and behavior of the vectors, namely mosquitoes and ticks, that are responsible for spreading these diseases.[16-18,20] As the global temperatures increase and the patterns of precipitation change, the climatic circumstances become more and more conducive for these vectors to flourish.[1,21,23] According to the studies, increasing temperatures can augment the survival rates and reproductive cycles of mosquitoes, therefore extending the period during which illnesses such as dengue fever can be transmitted. Specifically, studies suggest that higher temperatures might reduce the lifespan of mosquitoes, enabling them to breed at a faster rate and thereby enhancing the probability of disease transmission.[40] This phenomenon gives rise to a worrisome situation, in which areas that were previously less impacted by illnesses transmitted by vectors may encounter pandemic, as the vectors extend their geographical distribution.[11,33,41]

An exemplary case study conducted in the United States demonstrates the influence of climate change on the geographic range of the *Aedes aegypti* mosquito, which serves as a major carrier for the dengue and Zika viruses.[40] With the increasing suitability of climatic conditions for this mosquito species, its distribution has extended into regions that were previously deemed low-risk for certain illnesses. This extension has led to a rise in dengue and Zika virus infections in previously untouched areas, underscoring the clear link between climate change and the rise of illnesses transmitted by vectors.[7,13,33] The ramifications of this pattern are very concerning for public health, as susceptible communities, particularly in economically disadvantaged areas, may lack the essential resources and infrastructure to execute efficient vector control strategies.[13,14,27] The present scenario intensifies health inequalities and imposes further burden on public health services.[3,30]

Climate change and its impact on waterborne diseases

The impact of climate change on the quality and accessibility of water are crucial elements that might result in a higher occurrence of waterborne illnesses, therefore presenting substantial threats to public health, particularly during emergencies and widespread outbreaks.[17,21,37] Severe weather phenomena, such as intense precipitation and inundation, have the potential to damage sewage infrastructure, resulting in the discharge of untreated effluent into potable water sources.[35] The introduction of microorganisms into the water by this pollution leads to the occurrence of several illnesses, including cholera,[13,21,23] giardiasis,[6,21,41] and cryptosporidiosis.[25] For instance, the cholera epidemic in Haiti in 2010 was greatly intensified by intense rainfall and subsequent floods that occurred after the catastrophic earthquake, demonstrating how climate-related occurrences can increase the susceptibility of communities to waterborne illnesses.[21]

According to studies, escalating temperatures, an additional outcome of climate change, can exacerbate the degradation of water quality by facilitating the proliferation of detrimental algal blooms in lakes, rivers, and coastal waterways. Blooms of this nature have the potential to generate poisons that might pollute drinking water sources and recreational bodies, therefore posing significant health risks for anybody who comes into contact with them.[25,28] The widespread propagation of detrimental algal blooms is frequently associated with the discharge of nutrients from agricultural activities, which can be exacerbated by severe weather phenomena. The anticipated increase in temperatures is projected to enhance both the frequency and severity of these blooms, therefore presenting more obstacles to public health and water safety. Communities dependent on surface water supplies for drinking and sanitation are especially vulnerable, as the existence of these pollutants can result in gastrointestinal diseases and other health hazards.[21,25,28]

Transmission dynamics of infectious diseases in a changing climate

Influence of temperature on vector-borne diseases

As it directly impacts the life cycles, activity, and dispersion of disease vectors such as mosquitoes and ticks, temperature is a crucial determinant of the transmission dynamics of vector-borne illnesses.[11,22] Elevated temperatures can expedite the growth and reproductive rates of these vectors, resulting in augmented numbers and prolonged periods of transmission.[22] For example, studies have demonstrated that the *A. aegypti* mosquito, which is accountable for spreading illnesses such as dengue fever and Zika virus,[25] flourishes in regions with higher temperatures.[21] Consequently, there has been a notable increase in the occurrence of dengue fever in regions that were previously regarded as low-risk. Furthermore, variations in temperature might also impact the diseases transported by vectors.[21,37] For instance, the rate at which the malaria parasite, *Plasmodium*, replicates is acutely responsive to fluctuations in temperature. Empirical evidence suggests that elevated temperatures can augment the capacity of malaria to spread in some areas, including in sub-Saharan Africa, where climate change is projected to substantially raise temperatures.[11,38]

The impact of rising global temperatures on the melting of permafrost is now widely acknowledged as a major determinant of vector-borne disease dynamics, which may have considerable consequences for future pandemics.[33] According to the United States Environmental Protection Agency, the process of permafrost thawing not only generates fresh environments for vectors like mosquitoes and ticks but also enables the resurgence of disease-causing agents that have been inactive for extended periods, ranging from decades to entire centuries. For example, the process of ancient permafrost melting in Siberia has been associated with events of disease pandemic such as anthrax, which have the potential to affect both people and cattle.[7,28] Furthermore, the consequences of thawing permafrost go beyond localized epidemics; they provide a wider risk to global health security. The migration of vectors to novel regions might facilitate the introduction of infections to populations that are immunologically vulnerable, therefore establishing favorable circumstances for extensive transmission.[28] The heightened activity and geographic distribution of these vectors, together with the possible liberation of latent diseases, intensify the vulnerability to epidemics or pandemics that may progress into pandemics, particularly in a world already contending with the consequences of global health emergencies.[11,22,28,40]

Precipitation patterns and transmission of waterborne diseases

Alterations in precipitation patterns caused by climate change have a substantial impact on the transmission dynamics of aquatic illnesses.[19] Elevated precipitation and subsequent inundation can overpower sanitary infrastructure, resulting in the pollution of drinking water sources with pathogenic microorganisms.[40] For instance, the cholera epidemic in Haiti after the 2010 earthquake was worsened by intense rainfall that undermined the quality of water and the infrastructure that provided sanitation.[21,40] Furthermore, modified precipitation patterns might generate ideal circumstances for the

rapid growth of detrimental algal blooms,[21] which generate toxins that contribute to the further degradation of water quality. These blooms are frequently initiated by the uncontrolled flow of nutrients from agricultural operations, which can be further accelerated by periods of intense rainfall. Contamination of water sources with these pollutants can result in epidemics of gastrointestinal diseases and other health problems.[4,40]

Public health preparedness for extreme weather events

Severe weather conditions might undermine the implementation of sanitation and hygiene measures, therefore heightening the likelihood of epidemics.[4,19,32] For instance, inundation can overpower sewage systems, resulting in the pollution of potable water sources and the proliferation of waterborne illnesses. Based on studies, it is recommended that it is important to customize public health interventions to effectively tackle these issues, with a focus on the need for prompt illness monitoring and the allocation of sufficient healthcare resources to impacted communities.[16,20] The implementation of a proactive strategy encompassing predisaster preparation, community education, and resource allocation can effectively reduce the health consequences of severe weather phenomena.[4,33,39,40] Understanding the correlation between climate-related catastrophes and disease transmission enables health officials to devise more efficient measures to safeguard public health in the context of climate change.[16,39]

Furthermore, studies argue that with prompt reaction measures, it is crucial to develop long-term initiatives to enhance resilience against the health consequences of severe weather phenomena. This encompasses allocating resources toward infrastructure enhancements, such as the construction of flood-resistant healthcare buildings and the establishment of improved emergency response systems, in order to guarantee the continued accessibility of public health services both during and after catastrophes.[3,28,42] Moreover, studies strongly recommend that including climate change factors into public health planning and policy might facilitate the identification of susceptible groups and guide the prioritization of treatments.[20,23,35]

Integrated approaches to address climate change and pandemic preparedness

Collaborative efforts across sectors to enhance preparedness

According to studies, effective resolution of the difficulties posed by climate change and pandemic preparation requires coordination among several industries.[9,18,22,39] Effective collaboration across public health, environmental science, agriculture, and emergency management is essential to develop holistic approaches that strengthen the ability to withstand health emergencies.[19,32,39] An exemplary form of this collaboration is the One Health program, which promotes interdisciplinary alliances to study and address zoonotic illnesses and pandemics.[6,5,19,28,30,35,38] During the COVID-19 pandemic, some nations employed One Health frameworks to monitor the spread of the virus from animals to people, therefore enabling prompt interventions and coordinated public health measures.[1,13,38]

Furthermore, studies argue that it is essential to involve local communities in these cooperative endeavors to establish confidence and guarantee that treatments are culturally suitable and highly efficient.[24,34] The dissemination of knowledge on the health consequences of climate change and the significance of pandemic preparedness can be significantly facilitated by community-based groups. In locations susceptible to climate-related catastrophes, studies recommend that local health personnel can provide education to people about the hazards of infectious illnesses and the precautions they might adopt to safeguard themselves.[4,8,32] Based on researches, it is important to develop a more resilient and adaptable health system, but it is necessary to cultivate collaborations among public health authorities, environmental groups, and community stakeholders to make the initiative successful.[6,13,21]

Implications of climate change on health systems and policies

Given the significant impact of climate change on health systems, studies argue that it is imperative to reassess public health policies to ensure they are adequately prepared to address the difficulties presented by both climate change and pandemics.[6,7,11,13,21] According to multiple accounts in the study, severe weather phenomena, such as hurricanes, floods, and heatwaves, have the potential to significantly strain healthcare infrastructure, interrupt services, and worsen health inequalities among susceptible communities.[8,9,17,24]

To tackle these limitations, researches argue that public health policy should give priority to climate adaptation measures that strengthen the ability of health systems to effectively respond to both health consequences linked to climate change and pandemic.[21,33] This entails allocating resources toward infrastructure enhancements, such as constructing healthcare facilities that are resilient to flooding and improving emergency response systems.[13,25,40]

Furthermore, multiple recommendations from studies suggest that it is imperative for governments to

prioritize the training of healthcare professionals to effectively identify and address the health consequences of climate change.[12] This will guarantee their readiness to tackle the distinct obstacles presented by severe weather phenomena. Moreover, studies recommend the incorporation of climate change into public health strategies might facilitate the identification and prioritization of treatments for susceptible communities that have a disproportionate impact from both climate change and pandemics.[5,15,32] Specifically, disadvantaged groups frequently have heightened health hazards because of insufficient healthcare accessibility, substandard living circumstances, and restricted resources for disaster readiness.[25]

Resilience and adaptation strategies in public health

Enhancing health infrastructure for resilience

The establishment of robust health infrastructure is essential for efficiently addressing the intersecting issues of climate change and pandemics.[24,39] According to studies, health systems should be engineered to endure and adjust to the growing occurrence and severity of climate-related phenomena, such as floods, heatwaves, and storms, which have the potential to interrupt healthcare provision and worsen health inequalities.[11,21,25] The allocation of resources toward infrastructure should give priority to the construction of facilities that possess both resilience and adaptability to effectively handle increases in patient volume during health emergencies.[29,38] For example, modular healthcare facilities may be quickly created in reaction to catastrophes, therefore guaranteeing the availability of access to treatment even during catastrophic events.[11,22]

In addition, studies recommend that the incorporation of technology into health infrastructure may substantially enhance resilience. Telehealth services have been enormously beneficial during the COVID-19 pandemic, enabling healthcare practitioners to maintain the delivery of treatment while reducing the likelihood of viral transmission. Further enhancing telehealth capabilities can guarantee the continuous availability of healthcare services during disturbances caused by climate change.[2,26,32,42] Crucially, studies strongly recommend that the cooperation of public health authorities, urban planners, and environmental groups is important in order to establish a robust health infrastructure.[13,19,35] Implementing this multidisciplinary strategy can result in the establishment of health facilities strategically positioned in regions that are less susceptible to climatic effects, such as floods or excessive heat.[22,30,37]

Community engagement in resilience building

Establishing community involvement is an essential element in developing resilience within public health systems, especially in relation to climate change and pandemic.[23,36,39] Active involvement of communities in health planning and decision-making processes guarantees that treatments are culturally appropriate and customized to meet the requirements of the community.[22,25] Community people have profound expertise regarding local health hazards and resources, which may guide the formulation of efficient public health policies.[38] Utilizing participatory methods that include community people in determining health priorities might result in more efficient and well-received interventions, hence strengthening resilience against health risks.[14,21]

Moreover, the promotion of community resilience through educational initiatives and awareness campaigns might enable individuals to adopt proactive strategies in safeguarding their health.[1,11,13] The provision of training on disaster preparation, climate adaptation methods, and disease prevention by public health organizations serves to provide community members with the necessary skills and information to effectively respond to health crises.[17,21,27,38] For example, studies argue that actions initiated by the community that advocate for vaccination, implementation of good hygiene practices, and provision of mental health assistance can greatly mitigate the consequences of infectious disease outbreaks and health problems associated with climate change.[2,43] Moreover, the establishment of robust networks of community groups can augment resilience by enabling cooperation and the exchange of resources.[30] Local groups frequently possess a well-established level of trust within their communities, which enables them to effectively distribute information and gather resources during health crises.[35]

Policy frameworks supporting adaptive responses

Robust policy frameworks are crucial for facilitating adaptive solutions to the health issues presented by climate change and pandemic.[5,34] According to studies, the incorporation of climate issues into public health planning and response processes should be given priority by policymakers.[3,11,13,22,30,33] This entails formulating regulations that prioritize sustainable activities, such as the mitigation of greenhouse gas emissions and the improvement of environmental well-being.[18] By implementing policies that provide incentives for the use of renewable energy sources in healthcare facilities, studies argue that it is possible to decrease the carbon footprint of the health sector and enhance energy resilience in the face of climate-related disruptions.[17] The alignment of public health policy with climate objectives enables governments to establish a health system that is both sustainable and resilient.[22,23]

Furthermore, it is imperative that adaptive policies exhibit flexibility and responsiveness toward developing health hazards.[40] Sustained surveillance and assessment of health data are necessary to detect patterns and possible hazards linked to climate change and infectious illnesses.[32,40] Studies recommend that policymakers should implement systems to promptly address health crises, including efficient procedures for allocating money and organizing collaborative efforts across many sectors.[39] For example, the implementation of emergency response frameworks that incorporate public health, environmental, and emergency management organizations can improve the effectiveness and synchronization of efforts during emergencies.[11,22] The promotion of equality in health policy is of utmost importance in order to prevent a disproportionate impact of climate change and health crises on disadvantaged communities.[40,43] Studies strongly emphasized that policymakers should give paramount importance to addressing the needs of disadvantaged populations, who frequently encounter heightened health hazards as a result of socioeconomic determinants of health, including poverty, limited healthcare accessibility, and insufficient housing.[3,11,21,30,40]

Discussion

The objective of this study is to conduct a systematic literature review that serves as a vital resource for synthesizing existing research on the relationship between pandemics and climate change. Specifically, it aims to assess the extent to which climate change is recognized in the discourse surrounding the emergence and spread of pandemics. This examination emphasizes the significance of understanding the complex connections between these two pressing global challenges, particularly in relation to their implications for public health systems. Importantly, the study does not posit a direct causal link between climate change and the emergence of pandemics; instead, it highlights how climate change factors contribute to conditions that may favor the transmission of infectious diseases. Throughout the review, key findings indicate that ecosystems are being altered in ways that can lead to increased biodiversity loss, disrupted habitats, and greater interaction between humans and wildlife.

Based on the results of this systematic review, several important discussion points are raised, which warrant further exploration. First, changing ecosystems and biodiversity loss are acknowledged as significant factors that can influence the emergence of infectious diseases, as they disrupt the natural balance of habitats and result in novel interactions that facilitate pathogen spread. Additionally, habitat disruption is linked to increased human-wildlife interaction, which can elevate the risk of zoonotic diseases entering human populations. The discussion further advocates for the implementation of a One Health system that integrates human, animal, and environmental health, ensuring a holistic approach to managing health risks. Finally, the study underscores the need for coherence in policy and diplomacy concerning pandemic preparedness and climate change responses.

Changing ecosystems and biodiversity loss

The relationship between climate change and the emergence of pandemics is increasingly underscored by the profound changes occurring in ecosystems and the alarming rates of biodiversity loss.[21,30,42] As climate change alters habitats and disrupts ecological balances, it creates conditions that facilitate the spillover of pathogens from wildlife to humans.[8,18,36] This phenomenon, known as zoonotic transmission, is exacerbated by habitat destruction, which forces wildlife into closer contact with human populations. The encroachment of human activities into natural habitats not only increases the likelihood of disease transmission but also diminishes the resilience of ecosystems that might otherwise buffer against such outbreaks.[13,21] For instance, deforestation and land-use changes can lead to the loss of species that play critical roles in maintaining ecological balance, thereby destabilizing the systems that regulate disease dynamics.[22,28] This interplay highlights the urgent need to address climate change as a fundamental driver of emerging infectious diseases.

Moreover, the loss of biodiversity significantly impacts the ability of ecosystems to function effectively, which in turn affects public health outcomes.[13,23,37,41] Diverse ecosystems are known to provide essential services, such as regulating disease vectors and maintaining soil and water quality. When biodiversity is compromised, these services are diminished, leading to increased vulnerability to infectious diseases.[40] For example, the decline of certain species that control mosquito populations can result in higher incidences of vector-borne diseases, such as malaria and dengue fever. In addition, the homogenization of ecosystems due to climate change can create environments that favor the proliferation of specific pathogens, further heightening the risk of pandemics.[6,13,21,43] This underscores the interconnectedness of climate health, ecosystem integrity, and human health, emphasizing that strategies aimed at conserving biodiversity are not merely environmental concerns but are also critical to safeguarding public health.

Habitat disruption and increased human-wildlife interaction

Habitat disruption, driven largely by climate change, is a critical factor contributing to increased

human-wildlife interactions, which in turn heightens the risk of pandemics.[1,20,23,39] As global temperatures rise and weather patterns become more erratic, natural habitats are altered, leading to the displacement of wildlife populations.[6,29,30] This disruption often forces animals to migrate into urban areas or agricultural lands in search of food and shelter, bringing them into closer contact with human populations.[11,26,30] Such interactions create opportunities for zoonotic diseases – those that jump from animals to humans – to emerge and spread. Multiple cases highlight the direct correlation between habitat loss and the increased likelihood of pandemics.[12,20] This phenomenon underscores the urgent need to address habitat preservation as a key component of public health strategies.

Furthermore, the increased interaction between humans and wildlife due to habitat disruption can lead to a breakdown of the ecological barriers that typically limit disease transmission.[6,21,23,40] As wildlife populations are forced into closer proximity with humans, the risk of pathogen spillover escalates. Climate change exacerbates this issue by altering the distribution of wildlife species and their associated pathogens, creating new reservoirs of disease in areas previously considered low-risk.[17,20] Changing climate conditions can expand the range of certain vector species, such as mosquitoes, which are known carriers of diseases like Zika, West Nile, and Dengue virus. This shift not only increases the potential for disease transmission but also complicates public health responses, as traditional methods of disease control may become less effective in the face of changing ecological dynamics.[3,13,18] Thus, understanding the implications of habitat disruption on human–wildlife interactions is essential for developing effective pandemic prevention strategies.

One health system

The One Health System, which recognizes the interconnectedness of human, animal, and environmental health, is increasingly vital in addressing the complex relationship between climate change and pandemics.[3,11,22,23,37] As climate change continues to alter ecosystems and disrupt the delicate balance between species, the risk of zoonotic diseases emerging from wildlife reservoirs escalates.[22,25] The One Health approach emphasizes the need for collaborative efforts across multiple disciplines – such as veterinary medicine, public health, and environmental science – to monitor and mitigate these risks effectively (Benjamin, 2015; Piscitelli and Miani, 2024; Filho *et al*., 2023; and Braithwaite, 2024).[6,13,17,28] Multiple studies recommend that by integrating data and expertise from these fields, stakeholders can better understand how climate change influences disease dynamics, enabling proactive measures to prevent outbreaks before they occur.[13,29,30] This holistic perspective is essential in a world where the boundaries between human and animal habitats are increasingly blurred due to environmental changes.

Moreover, the One Health framework facilitates a comprehensive response to the multifaceted challenges posed by climate change and pandemics.[6,12,13] For instance, as climate change drives shifts in wildlife migration patterns and habitat loss, it becomes crucial to monitor the health of animal populations and their interactions with humans. This monitoring can help identify potential spillover events where pathogens may jump from animals to humans, allowing for timely interventions.[11,22] In addition, the One Health approach promotes the development of sustainable practices that not only protect biodiversity but also enhance food security and public health.[1]

Pandemic vis-a-vis climate change coherence in policy

The coherence of policy responses to pandemics and climate change is crucial for fostering resilience in the face of interconnected global challenges.[11,28,31] As evidenced by the COVID-19 pandemic, the health of human populations is inextricably linked to environmental conditions, which are increasingly influenced by climate change.[6,29,38] Policymakers must recognize that the factors driving climate change – such as deforestation, industrial pollution, and unsustainable agricultural practices – also contribute to the emergence and spread of infectious diseases.[14,29] Therefore, a unified policy framework that addresses both climate change and public health is essential for mitigating the risks associated with future pandemics. This coherence can be achieved by integrating health considerations into climate action plans and ensuring that environmental policies prioritize public health outcomes.

Moreover, the economic implications of pandemics and climate change necessitate a coherent policy approach that promotes sustainable development.[6,17,43] The financial burden of pandemics, as seen with COVID-19, can be exacerbated by climate-related disasters, such as floods and wildfires, which disrupt economies and strain healthcare systems.[14,20] Therefore, if the government aligns pandemic preparedness strategies with climate adaptation and mitigation efforts can create synergies that enhance overall resilience. For example, investing in green infrastructure not only helps combat climate change but also improves public health by reducing air pollution and

promoting active transportation. Policies that support sustainable agriculture can enhance food security while minimizing the environmental impact, thereby reducing the likelihood of zoonotic spillover events. Thus, a coherent policy framework that addresses both climate change and pandemics can lead to more sustainable economic outcomes and healthier communities.

Fostering international cooperation is essential for achieving coherence in policy responses to pandemics and climate change.[11,23] Both issues transcend national borders, requiring collaborative efforts to share knowledge, resources, and best practices. Global initiatives, such as the Paris Agreement and the One Health approach, highlight the importance of integrating health and environmental policies at the international level. Therefore, countries can develop comprehensive strategies that address the root causes of both climate change and pandemics by promoting cross-sectoral partnerships among governments, nongovernmental organizations, and the private sector. This collaborative approach not only enhances the effectiveness of individual policies but also builds a collective capacity to respond to future crises.

Diplomacy and negotiations on the nexus of pandemic and climate change

Diplomacy and negotiations can play a pivotal role in addressing the nexus of pandemics and climate change, as both issues are inherently global challenges that require coordinated international responses.[20,22,43] The COVID-19 pandemic has underscored the interconnectedness of health and environmental policies, revealing how climate change can exacerbate public health crises.[5,7,27] Diplomatic efforts must therefore prioritize the integration of health considerations into climate agreements, ensuring that nations commit to not only reducing greenhouse gas emissions but also enhancing their public health infrastructure.[23,26] International organizations can facilitate the sharing of best practices and resources, ultimately leading to more effective strategies for mitigating the health impacts of climate change by fostering dialogue among countries.[11,22]

Furthermore, the economic implications of pandemics and climate change necessitate a collaborative approach to diplomacy that emphasizes sustainable development.[7,13,29] The financial strain of responding to pandemics can be compounded by climate-related disasters, which disrupt economies and hinder recovery efforts.[4,19] Negotiations must focus on creating financial mechanisms that support both climate adaptation and pandemic preparedness, such as climate finance initiatives that allocate resources for strengthening health systems in vulnerable countries.[11,22] By aligning economic incentives with environmental and health goals, diplomats can promote a holistic approach that addresses the root causes of both crises. For example, investments in green technologies and sustainable agriculture not only contribute to climate resilience but also enhance food security and public health outcomes. Thus, effective diplomacy can create synergies that benefit both the climate and health sectors, fostering a more sustainable and resilient global economy.

Finally, the role of multilateral institutions in facilitating diplomacy and negotiations on the nexus of pandemics and climate change cannot be overstated.[11,22,25] Organizations such as the WHO and the United Nations Framework Convention on Climate Change are essential in coordinating international efforts and ensuring that health and environmental policies are aligned. These institutions can provide platforms for dialog, enabling countries to share knowledge and collaborate on research initiatives that explore the links between climate change and infectious diseases. Additionally, these institutions can help establish global standards and frameworks that guide national policies, ensuring that countries are held accountable for their commitments.

Conclusion

The intricate relationship between pandemics and climate change underscores the urgent need for coherent policies that address both challenges simultaneously. The COVID-19 pandemic has illuminated how environmental degradation and climate change can create conditions conducive to the emergence and spread of infectious diseases, highlighting the critical importance of integrating public health and environmental strategies. Policymakers must adopt a multifaceted approach that not only prioritizes pandemic preparedness but also actively mitigates climate change and protects biodiversity. This includes incorporating pandemic considerations into climate change adaptation and mitigation strategies, ensuring that responses to climate impacts also account for potential health risks. As communities adapt to climate-related challenges such as extreme weather events, they must also be equipped to handle the public health implications that may arise, such as increased vector-borne diseases or respiratory issues linked to air quality deterioration. Sustainable land-use practices, the establishment of protected areas, and the promotion of biodiversity-friendly agricultural methods can

contribute to a healthier planet and, consequently, healthier populations. Furthermore, fostering global cooperation and implementing a One Health framework that emphasizes the interconnectedness of human, animal, and environmental health is essential for building resilience against future pandemics.

Study limitation

The studies reviewed in this systematic literature review expose several significant limitations that must be addressed to strengthen our understanding of the interplay between climate change and pandemics. One critical action is to improve how climate change is contextualized within pandemic discourse, as current research often overlooks or inadequately explores the direct correlations, resulting in contradictions in the literature. To enhance methodological rigor, future studies should aim to incorporate larger sample sizes and longitudinal data, which would significantly bolster the reliability of their findings. Furthermore, to ensure that results hold relevance in real-world contexts, researchers should expand their investigations beyond specific geographic regions and unique conditions, thereby capturing broader global dynamics. It is also essential to standardize definitions and frameworks used to evaluate public health responses, as this uniformity will allow for clearer synthesis of findings.

Authors contribution

- John Nicolas B. Mejia: Conceptualization, Protocol Design, Data Collection, Data Analysis, Writing of the Manuscript
- Antonio P. Contreras; Eduardo F. Roquiño; Maria Victoria O. Espaldon; Decibel V. Faustino-Eslava; Patricia Ann J. Sachez: Guidance on Research Design and Methodology, Review and Feedback on Manuscript Development; Overall consultation and guidance.

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This study employs AI technology, specifically Copilot, solely for grammar checking and syntax improvement. All data analysis and interpretation are conducted by the authors, ensuring the integrity and authenticity of the research findings.

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There are no conflicts of interest.

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