

Mapping the Intersection of Climate Change and Primary Care: A Bibliometric Analysis

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Abstract

Objective and Aim

Climate change-related health problems are becoming an increasingly prominent research topic. Family physicians are in a unique and advantageous position to manage the impacts of the environment on human health and the effects of human activities on the environment. The aim of this study is to identify research trends, gaps, and future directions in this field and to serve as a reference source.

Materials and Methods

A comprehensive literature search was performed in the Web of Science Core Collection database. Following the application of predefined inclusion and exclusion criteria, a total of 244 publications were included in the study. Bibliometric

analyses were carried out using VOSviewer software, including keyword co-occurrence mapping, international collaboration networks at the country level, citation analysis, and examination of publication trends over time.

Results

The number of publications has shown a significant upward trend, particularly after 2020, highlighting the growing interest in this field. Keyword analysis revealed four main thematic clusters: (1) climate change and health, (2) primary healthcare and sustainability, (3) public and global health perspectives, and (4) adaptation and mitigation strategies. The United States, the United Kingdom, and Australia emerged as the leading contributors, demonstrating strong international collaboration networks. Citation analysis indicated that early foundational studies continue to be highly influential, whereas recent publications increasingly focus on implementation and sustainability within primary healthcare settings.

Conclusion

The data obtained reveal a rapidly evolving research landscape at the intersection of climate change and primary healthcare. While the literature focuses primarily on high-income countries, broader global participation is needed. Future research

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should focus on practical interventions and sustainable primary healthcare practices.

Keywords: Climate Change, Family Medicine, Health Impacts.

1. Introduction

The current century should be recognized as a period in which climate change poses a widespread global health threat. Temperature fluctuations, extreme weather events, and air pollution have significant impacts on both physical and mental health. According to the World Health Organization (WHO), environmental factors affecting human health are responsible for approximately one-quarter of deaths worldwide.(1) This shows that the environmental crisis is also a multifaceted issue threatening public health.(2) Primary healthcare plays a central role in healthcare delivery as the first point of contact for patients. Family physicians, who have a unique connection with their patients through prevention, early diagnosis, patient education, and palliative care, are in a unique position to observe the impacts of climate change on health. With the increasing recognition of this role, the climate crisis has led to research and the implementation of sustainability solutions in primary healthcare practices.(2-5) WONCA, the umbrella organization for family physicians, has established the Planetary Health Working Group, whose vision is summarized as "healthy people, healthy communities, and healthy ecosystems on a healthy planet."(6) Concepts such as sustainable healthcare, carbon footprint reduction, and planetary health have gained importance in the literature. More studies have begun to focus on practical and systemic solutions for managing the harm the environment inflicts on both humans and ecosystems. Although the number of publications in this field has increased, there is still a need for a clearer understanding of the general structure, characteristics, and key contributions of the literature. Bibliometric analysis is a useful method for mapping scientific progress,

identifying influential publications, and analyzing collaboration networks. Therefore, the aim of this study is to conduct a bibliometric analysis of publications on the climate crisis, sustainability, and related issues. This study aims to identify research trends, key contributors, collaboration patterns, and thematic developments in this rapidly growing field.

2. Materials and Methods

Study Design

This study was designed as a bibliometric analysis to evaluate research trends, patterns, and developments in the fields of climate change, environmental sustainability, and primary healthcare.

Data Source and Search Strategy

The literature search was conducted using the Web of Science Core Collection database. The following search query was applied: ("primary care" or "family medicine" or "general practice") and ("climate change" or "global warming" or "environmental sustainability" or "environmental health"). The search is limited to articles published in English. Only original research articles and review articles were included. The time period covered publications between 2000 and 2025. The search was conducted in March 2026.

Inclusion and Exclusion Criteria

Publications were included if they were related to climate change and primary care. Studies not directly related to the topic, non-English publications, conference abstracts, editorials, and letters were excluded.

Data Extraction

All records were downloaded in plain text format with full records and cited references. The extracted data included authors, titles, keywords, publication year, country, and citation information.

Bibliometric Analysis

Bibliometric analyses were performed using VOSviewer. The analyses included keyword co-occurrence, country co-authorship, and citation analysis. For keyword analysis, author keywords were used with a minimum occurrence threshold of 5. For country collaboration analysis, a minimum document threshold of 5 was applied. Citation analysis was conducted based on document-level citations with a minimum citation threshold of 5.

Statistical Analysis and Visualization

Publication trends over time were analyzed descriptively. Visual maps and network analyses were generated using VOSviewer to illustrate relationships between keywords, countries, and cited documents.

3. Results

A total of 244 publications were included in the bibliometric analysis. The annual number of publications demonstrated a gradual increase from the early 2000s, followed by a marked rise after 2016. A significant growth trend was observed after 2020, with the highest number of publications recorded between 2022 and 2025, indicating a rapidly growing interest in climate change and primary care research.(Figure 1)

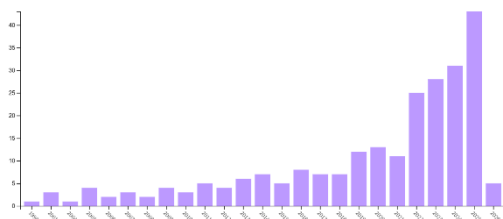


Figure 1: Number of publications by year

Keyword co-occurrence analysis revealed four major thematic clusters. The first cluster focused on climate change, global warming, health, and policy, representing the core research domain. The second cluster highlighted primary care and general practice with a focus on sustainability and

carbon footprint. The third cluster reflected a broader public and global health perspective, including planetary health and family medicine. The fourth cluster emphasized adaptation and mitigation strategies related to human health. (Figure 2)

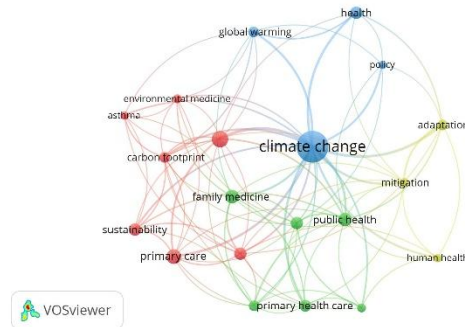


Figure 2: Co-occurrence analysis

The country co-authorship analysis demonstrated that the United States, England, and Australia were the leading contributors in this research field. Strong collaboration networks were observed among European countries, particularly between England, France, Italy, and Spain. The United States emerged as a central hub, maintaining extensive collaborations with multiple countries worldwide. (Figure 3)

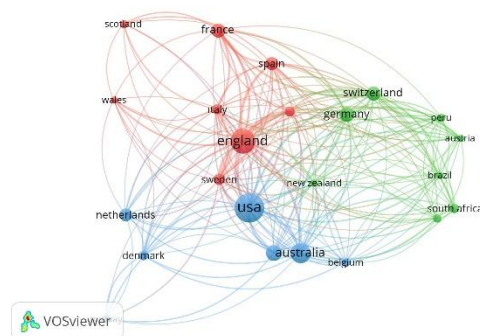


Figure 3: Co-authorship analysis

Citation analysis identified Costello (2009)(7) as the most influential publication in the field, forming the core of the citation network. Other highly cited studies included Watts (2018)(8), which significantly contributed to the global understanding of climate change and health. Recent

publications suggest a growing and evolving research landscape, particularly in sustainability and primary care applications. (Figure 4)

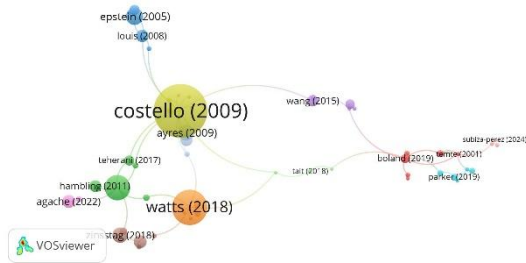


Figure 4: Citation analysis

Discussion

This study provides an overview of the literature on climate change, environmental sustainability, and the impacts of the climate crisis on primary healthcare delivery. The data obtained indicate that research interest in this field has increased, especially in recent years. The Paris Agreement on Climate Change (9), adopted in 2015 and ratified by more than 190 countries, along with the reports of the World Health Organization (2018) (10) and The Lancet Countdown (2017) (11), highlight the growing global awareness of climate-related health problems, while the subsequent COVID-19 pandemic may have further accelerated this interest in resilient and sustainable health systems. It confirms the most important factors explaining the rapid increase in the number of published articles, particularly after 2020. In keyword analysis, climate change is at the center of the literature and is strongly linked to concepts such as health, politics, and primary healthcare. Themes such as sustainability, carbon footprint, and planetary health indicate that an understanding of the effects of climate change has been achieved and that progress is being made toward developing practical and systemic solutions. WHO reports state that known preventable environmental risk factors cause at least 13 million deaths annually and account for approximately one-quarter of the global

disease burden. (10) WHO reports also emphasize that environmental risk factors have now reached an effect size comparable to other well-known risks (tobacco consumption, diet, alcohol consumption, and physical inactivity). (10) These data more clearly demonstrate the central role of climate change in the literature. In the analysis of country collaboration, it has been shown that high-income countries such as the United States, Great Britain, and Australia dominate the research results in this field. The strong collaboration networks among European countries underscore the global importance of this research area. However, the relatively small contribution of low- and middle-income countries indicates a geographical imbalance in knowledge production, even though these regions are generally more affected by climate change. The citation analysis study identified several landmark works that shaped the field, particularly important early publications establishing the connection between climate change and health. Recent studies seem to be focusing on implementation strategies for mitigating the climate crisis and its effects, sustainability practices, and the role of primary healthcare systems. (12–24) Studies suggest that primary care services are inherently more sustainable and accessible, and therefore represent an important solution for reducing the carbon footprint of health systems. Studies emphasizing new target models such as sustainability and green practices highlight how healthcare processes can be made more environmentally friendly. (20–22,25) Overall, the findings highlight the critical role of primary healthcare in addressing the health impacts of climate change. (13–15,17,26) As the first point of contact within health systems, primary healthcare has the potential to make significant contributions to prevention, patient education, and sustainable healthcare delivery. Future research should focus on developing practical interventions, strengthening health system resilience, and increasing participation from underrepresented regions. This study has some limitations. The analysis was limited to publications indexed in the selected databases and English-

language articles, which may have potentially excluded relevant studies. Additionally, bibliometric methods primarily provide quantitative information and may not reflect the full qualitative depth of the literature. Despite these limitations, this study offers valuable insights into the development, structure, and future direction of climate change and primary care health services research.

Conflict of interest

The authors declare no conflict of interest.

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