

BMJ Open Climate change and human health: what are the research trends? A scoping review protocol

Niamh Herlihy,¹ Avner Bar-Hen,^{1,2} Glenn Verner,^{1,3} Helen Fischer,⁴ Rainer Sauerborn,⁵ Anneliese Depoux,^{1,6} Antoine Flahault,^{1,7} Stefanie Schütte¹

To cite: Herlihy N, Bar-Hen A, Verner G, *et al.* Climate change and human health: what are the research trends? A scoping review protocol. *BMJ Open* 2016;**6**: e012022. doi:10.1136/bmjopen-2016-012022

► Prepublication history for this paper is available online. To view these files please visit the journal online (<http://dx.doi.org/10.1136/bmjopen-2016-012022>).

Received 23 March 2016
Accepted 11 August 2016

ABSTRACT

Introduction: For 28 years, the Intergovernmental Panel on Climate Change (IPCC) has been assessing the potential risks associated with anthropogenic climate change. Although interest in climate change and health is growing, the implications arising from their interaction remain understudied. Generating a greater understanding of the health impacts of climate change could be key step in inciting some of the changes necessary to decelerate global warming. A long-term and broad overview of the existing scientific literature in the field of climate change and health is currently missing in order to ensure that all priority areas are being adequately addressed. In this paper we outline our methods to conduct a scoping review of the published peer-reviewed literature on climate change and health between 1990 and 2015.

Methods and analysis: A detailed search strategy will be used to search the PubMed and Web of Science databases. Specific inclusion and exclusion criteria will be applied in order to capture the most relevant literature in the time frame chosen. Data will be extracted, categorised and coded to allow for statistical analysis of the results.

Ethics and dissemination: No ethical approval was required for this study. A searchable database of climate change and health publications will be developed and a manuscript will be compiled for publication and dissemination of the findings. We anticipate that this study will allow us to map the trends observed in publications over the 25-year time period in climate change and health research. It will also identify the research areas with the highest volume of publications as well as highlight the research trends in climate change and health.

Strengths and limitations of this study

- The review will cover a comprehensive time frame of 25 years.
- Publications not restricted to any particular study type, geographical region or human health issue.
- The review will cover two databases focusing on English language results.
- Grey literature will not be included in the literature search but will include comments or opinion views published in peer-reviewed journals.
- The quality of publications captured will not be assessed.

There is growing evidence to support the scientific theories indicating that climate change is adversely affecting human health. However, the impact of climate change on health is quite complex and the same factor may sometimes act as a cause and other times as an effect. The consequences of climate change are likely to lead to an increased demand on health services, which will require adaptation to the growing incidence of climate-related health issues. The need to identify and prevent adverse health impacts is rising to the forefront of climate change policy debates and is becoming a growing priority of the public health community.¹

INTRODUCTION

For more than 28 years, the IPCC has been assessing the potential health risks associated with climate change.² In the 6 years between 2009 and 2015, climate change has gone from being ‘the biggest global health threat of the 21st century’³ to potentially ‘the greatest global health opportunity of the 21st century’.⁴ To date, projections of the direction and scope of health consequences induced by climate change involve a degree of uncertainty, which makes it difficult to communicate scientific facts to policymakers



CrossMark

For numbered affiliations see end of article.

Correspondence to
Dr Stefanie Schütte;
stefanie.schutte@parisdescartes.fr

BACKGROUND

The phenomenon of climate change is a reality that is now universally acknowledged and better understood than it was in 1988 when the Intergovernmental Panel on Climate Change (IPCC) was formed by the World Meteorological Organization (WMO) and the United Nations Environmental Programme (UNEP).

or even to the general public.^{5 6} Clear information and communication about the health consequences are a critical factor to remove some of this uncertainty. This may also assist in elevating the importance of climate change to ensure that it is a high priority which receives sufficient commitment financially and politically. Climate change presents an enormous governance challenge, with a need for greater new integrated governance structures at national and international levels.⁷

Climate change and health is a growing area of research. There are direct and indirect mechanisms by which climate change affects our health resulting in numerous health outcomes. The 2014 IPCC report outlines the direct impact from extreme weather and indirect impacts through ecosystem-mediated effects and human system-mediated effects.⁸ Generating a greater understanding of these health impacts resulting from climate change could be a key step in inciting some of the changes necessary to decelerate global warming. There is a wide range of publications addressing various aspects of climate change and health. We have identified a number of systematic literature reviews which summarise the evidence of specific health impact related to climate change including nutrition, infectious diseases, etc.^{9–14} A scoping review by Hosking *et al* provides insights into how the published literature on climate change and health addresses the World Health Assembly (WHA) priority research areas for climate change and health as specified in 2008 and expanded on in 2009.¹⁵ This review is highly relevant in identifying the research relevant to the WHA priority areas; however, the results cover a brief 2-year of period 2008–2010. Each iteration of the IPCC report presents evidence from the scientific literature covering the 6–7 years prior to the year of publication with each report covering a different time period. The current literature is lacking a long-term overview of existing scientific literature which addresses all health outcomes in the field of climate change. We are seeking to fill this void through this scoping review covering 25 years of publications which address the extensive health issues affected by climate change. We will examine the historical trends and identify the research areas which are being addressed in scientific publications. This study will provide a more extensive and inclusive overview in comparison with previously published reports and reviews of the research areas.

Objectives and hypotheses

With this scoping literature review we aim to collate published academic literature on climate change and health. We will map the findings by categorising papers according to various indicators and to provide a thematic analysis of their content. *The specific objectives are:*

- ▶ To provide an overview of existing scientific articles over time regarding climate change and human health;

Table 1 Research questions for 'climate change and health' scoping review

Research questions	
1. Which health effects are being studied?	▶ Direct effects ▶ Indirect effects
2. What is the geographical focus of the publications?	▶ Africa ▶ North America ▶ South America ▶ Antarctica ▶ Asia ▶ Australasia ▶ Europe
3. What types of articles are published on the topic?	▶ Original research ▶ Review ▶ Commentary/opinion
4. To whom is the corresponding author affiliated with?	▶ Country ▶ Institution

- ▶ To build a database of existing scientific papers that explore climate change and health from 1990 to 2015 and to categorise them according to specified criteria;
- ▶ To make recommendations based on the research trends observed and prospective areas for future research.

This work may also be a useful resource for future funding projects underlining the need for research in certain areas. [Table 1](#) outlines the research questions to be addressed in undertaking this review.

METHOD

Scoping review methodology

Scoping reviews are a relatively recent method of reviewing evidence-based research, particularly in health and also in other disciplines.¹⁶ There is no single definition of what a scoping review consists of. A frequently applied definition is that from Arksey and O'Malley,¹⁷ which states that the aim of a scoping review is to 'map rapidly the key concepts underpinning a research area and the main sources and types of evidence available'. This scoping review framework developed by Arksey and O'Malley in 2005 will be applied for this study. There have been a number of studies since 2005, which enhance the initial framework and have advanced our understanding of this methodology and how to produce a more efficient and effective study.^{16 18 19}

The key strength of the scoping review method as applied to our study is that it allows for the analysis of a broad research question. Climate change and health is a vast area of research and our intention is to map the breadth of the literature on this topic. The quality of the literature will not be assessed, which is a limitation of scoping reviews. Systematic reviews which have more refined research questions and narrower study parameters, generally result in fewer, more homogeneous citations which can be more efficiently assessed for

Table 2 Search terms for 'climate change and health' scoping review

Climate change-related terms	Health-related terms	Date of publication
Climate change	Health	1990–2015
Global warming	Disease	
Climate variability	► Non-communicable	
Greenhouse effect	► NCD	
GHGE	► Communicable	
	Epidemiology	
	Lifestyle	
	Co-benefits	
	Mortality	
	Morbidity	
	Nutrition	
	Malnutrition	
	Dehydration	
	Migration	
	Mental disorders	

GHGE, greenhouse gas emissions; NCD, non-communicable disease.

quality. The large volume of diverse citations anticipated from our literature search will be compiled into a catalogued database. Reflecting on the experience of others and in the absence of official guidelines for scoping reviews, we will proceed with implementing the initial framework by Arksey and O'Malley and glean insights into the proceeding studies aimed at enhancing this methodology to guide us in developing this study.

Databases

The databases chosen for this review are PubMed and Web of Science. Through PubMed we access primarily

publications in the field of medicine and life sciences. Web of Science is a multidisciplinary database, which will capture the non-clinical health aspects of the effects of climate change across a broad range of research areas.

Search strategy

The search strategy will include broad terms to cover all areas of climate change exposure and health outcomes affected by climate change. The search terms will be used to identify the literature that documents the human health impact of climate change. The keywords that will be used for building the search strategy are outlined in [table 2](#) as well as the range of publication dates. This range dates back to the first report from the IPCC in 1990 to the end of 2015, just after the last Conference of Parties (COP21) to capture as much relevant literature as possible. The search strategy will consist of free text and Medical Subject Headings (MeSH) terms.

Search terms

The key search terms will be adapted according to the database. [Table 3](#) below outlines the detailed search syntaxes that will be used to search each database.

Criteria for inclusion and exclusion

[Table 4](#) below outlines the inclusion and exclusion criteria that will be used to conduct the literature review.

Literature selection

First, two reviewers will independently screen titles and abstracts of identified papers for relevance to the topic. Those articles considered not to be relevant on the grounds of topic will be excluded. Second, full text/papers will be sought for all studies appearing to meet the inclusion criteria and a final selection will be made.

Table 3 Search strategy syntax for databases

Database	Search strategy syntax
PubMed	('climate change' [Title/Abstract] OR 'global warming' [Title/Abstract] OR 'climate variability' [Title/Abstract] OR 'greenhouse effect' [Title/Abstract] OR 'GHGE' [Title/Abstract]) AND (('health' [MeSH Terms] OR 'health' [All Fields]) OR ('disease' [MeSH Terms] OR 'disease' [All Fields]) OR ('Communicable' [All Fields]) OR ('Non-Communicable Disease' [All Fields]) OR ('NCD' [All Fields]) OR ('Lifestyle' [All Fields]) OR ('Co-Benefits' [All Fields]) OR ('epidemiology' [Subheading] OR 'epidemiology' [All Fields] OR 'morbidity' [All Fields] OR 'morbidity' [MeSH Terms]) OR ('mortality' [Subheading] OR 'mortality' [All Fields] OR 'mortality' [MeSH Terms]) OR ('nutritional status' [MeSH Terms] OR ('nutritional' [All Fields] AND 'status' [All Fields]) OR 'nutritional status' [All Fields] OR 'nutrition' [All Fields] OR 'nutritional sciences' [MeSH Terms] OR ('nutritional' [All Fields] AND 'sciences' [All Fields]) OR 'nutritional sciences' [All Fields]) OR ('malnutrition' [MeSH Terms] OR 'malnutrition' [All Fields]) OR ('dehydration' [MeSH Terms] OR 'dehydration' [All Fields]) OR 'emigration and immigration' [All Fields] OR 'mental disorder' [All Fields]) AND ('1990/01/01' [PDAT]: '2015/12/31' [PDAT])
Web of Science	TI=((('climate change' OR 'global warming' OR 'climate variability' OR 'greenhouse effect' OR 'GHGE')) AND TS= (('health' OR 'disease' OR 'Communicable' OR 'Non-Communicable Disease' OR 'NCD' OR 'Lifestyle' OR 'Co-Benefits' OR 'epidemiology' OR 'morbidity' OR 'nutritional status' OR ('nutritional' AND 'status') OR 'nutritional status' OR 'nutrit*' OR 'nutritional sciences' OR ('nutritional' AND 'sciences') OR 'malnutrition' OR 'dehydration' OR ('emigration AND immigration') OR 'mental disorder'))

MeSH, Medical Subject Headings.

Table 4 Inclusion and exclusion criteria for scoping review

Inclusion criteria	Exclusion criteria
<ul style="list-style-type: none"> ▶ Peer-reviewed articles (including original quantitative and qualitative studies, systematic reviews, editorials, viewpoints) ▶ Indexed in PubMed and/or Web of Science databases ▶ Published between 1990 and 2015 ▶ Focus on climate change and human health ▶ Publications in English only ▶ No restriction to country or population 	<ul style="list-style-type: none"> ▶ Book chapters and grey literature (dissertations, conference proceedings, reports, etc).

If the two reviewers cannot reach an agreement, a third reviewer will be involved. A flow chart will be produced to report the selection process.

Data collection and extraction

Screening of studies for eligibility

Results will be merged using citation software EndNote and duplicates will be removed. Data will be extracted from the studies identified using the software R. The data will then be transferred into an Excel file and coded to facilitate analytics and the development of infographics. A second researcher will independently check the data for accuracy and detail. Disagreements will be resolved by consensus or by consulting a third reviewer. A flow chart of the study selection procedure at each stage of the review will be prepared, detailing when exclusion occurred and the reasons for exclusion.

ETHICS AND DISSEMINATION

No ethical approval was required for this literature-based study.

The extraction and categorisation of publications for climate change and health will provide a long-term overview of the published literature in this area. This may be, to the best of our knowledge and if no other group undertakes the same work simultaneously, the first study of its kind to provide such an overview. We will build an open searchable database of our findings, which will be updated over time and serve as a useful source of information for researchers working in this field. The coding of our results will allow for analysis of publications in the various categories. We intend to write a manuscript for the publication of our analysis to disseminate our findings. This study will map the trends observed in publications over a 25-year time period. It will also identify the research areas with the highest volume of publications as

well as highlight the research trends in climate change and health.

The database will be part of a Climate Change and Health Resource that will be available on the Centre Virchow-Villermé's (CVV) website. This study of the academic literature is one axis of a larger overall study on the communication of climate change and health. Other axes include reviews of national legislation and print media to better understand the role of the health argument in the climate change discourse. The Climate Change and Health Resource will also contain links to Massive Open Online Courses (MOOCs) that have been produced by the CVV on the topic and other related MOOCs produced elsewhere. The database will therefore serve to complement the other information resources across different disciplines addressing climate change and health.

Author affiliations

¹Centre Virchow-Villermé for Public Health Paris-Berlin, Université Sorbonne Paris Cité, Paris, France

²Laboratoire MAP5, Université Paris Descartes, Paris, France

³French School of Public Health, Paris-Rennes, France

⁴Institute of Psychology, University of Heidelberg, Heidelberg, Germany

⁵Institute of Public Health, University of Heidelberg, Heidelberg, Germany

⁶Groupe de Recherches Interdisciplinaires sur les Processus d'information et de Communication (EA 1498), Université Paris Sorbonne-Celsa, Paris, France

⁷Institute of Global Health, University of Geneva, Geneva, Switzerland

Twitter Follow Stefanie Schutte @steschutte

Contributors NH wrote the first draft of the paper and initiated data collection. AB-H advised on study methods and conducted preliminary analysis. GV contributed to the initial study methods. HF revised the draft paper. RS initiated the project, advised on study methods and revised the draft paper. AD revised the draft paper. AF advised on study methods and revised the draft paper. SS designed the study design, initiated data collection and contributed to the first draft of the paper. All authors approved the final version of the paper.

Competing interests None declared.

Provenance and peer review Not commissioned; externally peer reviewed.

Open Access This is an Open Access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>

REFERENCES

1. Keim ME. Building human resilience: the role of public health preparedness and response as an adaptation to climate change. *Am J Prev Med* 2008;35:508–16.
2. Woodward A, Smith KR, Campbell-Lendrum D, *et al*. Climate change and health: on the latest IPCC report. *Lancet* 2014;383:1185–9.
3. Costello A, Abbas M, Allen A, *et al*. Managing the health effects of climate change: Lancet and University College London Institute for Global Health Commission. *Lancet* 2009;373:1693–733.
4. Watts N, Adger WN, Agnolucci P, *et al*. Health and climate change: policy responses to protect public health. *Lancet* 2015;386:1861–914.
5. Moser SC. Communicating climate change: history, challenges, process and future directions. *Wiley Interdisciplinary Reviews: Climate Change* 2010;1:31–53.
6. Cardwell FS, Elliott SJ. Making the links: do we connect climate change with health? A qualitative case study from Canada. *BMC Public Health* 2013;13:1–12.

7. Myers TA, Maibach E, Peters E, *et al.* Simple messages help set the record straight about scientific agreement on human-caused climate change: the results of two experiments. *PLoS ONE* 2015;10:e0120985.
8. Smith KR, Woodward A. Human health impacts, adaptation, and co-benefits. Intergovernmental Panel on Climate Change 2014. Report No.:5.
9. Nichols A, Maynard V, Goodman B, *et al.* Health, climate change and sustainability: a systematic review and thematic analysis of the literature. *Environ Health Insights* 2009;3:63–88.
10. Phalkey RK, Aranda-Jan C, Marx S, *et al.* Systematic review of current efforts to quantify the impacts of climate change on undernutrition. *Proc Natl Acad Sci U S A* 2015;112:E4522–9.
11. Brown L, Murray V. Examining the relationship between infectious diseases and flooding in Europe: a systematic literature review and summary of possible public health interventions. *Disaster Health* 2013;1:117–27.
12. Patz JA, Frumkin H, Holloway T, *et al.* Climate change: challenges and opportunities for global health. *JAMA* 2014;312:1565–80.
13. Huang C, Barnett AG, Wang X, *et al.* Projecting future heat-related mortality under climate change scenarios: a systematic review. *Environ Health Perspect* 2011;119:1681–90.
14. Naish S, Dale P, Mackenzie JS, *et al.* Climate change and dengue: a critical and systematic review of quantitative modelling approaches. *BMC Infect Dis* 2014;14:167.
15. Hosking J, Campbell-Lendrum D. How well does climate change and human health research match the demands of policymakers? A scoping review. *Environ Health Perspect* 2012;120:1076–82.
16. Pham MT, Rajić A, Greig JD, *et al.* A scoping review of scoping reviews: advancing the approach and enhancing the consistency. *Res Synth Methods* 2014;5:371–85.
17. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. *Int J Soc Res Methodol Theory Pract* 2005;8:19–32.
18. Daudt HM, van Mossel C, Scott SJ. Enhancing the scoping study methodology: a large, inter-professional team's experience with Arksey and O'Malley's framework. *BMC Med Res Methodol* 2013;13:48.
19. Levac D, Colquhoun H, O'Brien KK, *et al.* Scoping studies: advancing the methodology. *Implement Sci* 2010;5:69.