BMJ Open

Contribution of hospitals and clinical services to global warming: protocol for a scoping review

Waldo Merino-Urrutia ,[1] Claudio Cárcamo-Fuentes,[2] Mauricio Peña,[3] María José Martinez-Zapata [4,5]

To cite: Merino-Urrutia W, Cárcamo-Fuentes C, Peña M, *et al*. Contribution of hospitals and clinical services to global warming: protocol for a scoping review. *BMJ Open* 2023;**13**:e072227. doi:10.1136/bmjopen-2023-072227

► Prepublication history for this paper is available online. To view these files, please visit the journal online (http://dx.doi.org/10.1136/bmjopen-2023-072227).

Received 10 February 2023
Accepted 21 July 2023

[1]Cirugía, Traumatología y Anestesia. Capacitación, investigación y gestión para la salud basada en la evidencia (CIGES), Universidad de la Frontera, Facultad de Medicina, Temuco, Araucanía, Chile
[2]Departamento de enfermería, Universidad de la Frontera Facultad de Medicina, Temuco, Araucanía, Chile
[3]Hospital Hernán Henríquez Aravena, Centro de responsabilidad Cardiovascular, Temuco, Araucanía, Chile
[4]Iberoamerican Cochrane Center, Institut de Recerca Sant Pau, Barcelona, Spain
[5]CIBERESP, Madrid, Spain

Correspondence to
Dr Waldo Merino-Urrutia; waldo.merino@ufrontera.cl

ABSTRACT

Introduction Climate change is one of the greatest threats to public health today, placing considerable pressure on the healthcare sector. During patient care processes, hospital facilities contribute to greenhouse gas emissions through the use of greater resources and higher energy consumption. Consequently, there is growing interest among researchers, universities, organisations and governments to study the impact of the healthcare sector on the environment and to develop strategies to mitigate its effects. The aim of this scoping review is to determine the extent and nature of current literature on global warming from hospitals and clinical services, and ways in which they contribute to its effect. Planning and execution of future research are possible once those areas with existing gaps are identified.

Methods and analysis A broad literature search will be carried out to illustrate the ways in which hospitals and clinical services, processes and activities contribute to climate change. Our protocol was drafted using the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews. The final protocol was registered prospectively with the Open Science Framework. All identified studies indexed in Medline, Scopus and Embase will be examined.

Ethics and dissemination This project is literature-based research; therefore, it does not require ethical approval. The results will be presented to researchers as well as policymakers in this particular area, via conferences, webinars, podcasts and online events. A peer-reviewed publication will be submitted to specific journals of interest.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ One of the strengths of this protocol is that it does not intend to assess the greenhouse gas emissions of the healthcare system in general, but rather aims to specifically describe the spectrum of publications regarding hospital/clinical services emissions. Undoubtedly, it is an important aspect for clinicians who are interested in mitigating the environmental impact of their professional activities.
⇒ The studies published in this regard and that synthesise the evidence must be updated.
⇒ This scoping review will accomplish the best standard for reporting, such as the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.
⇒ This scoping review will examine and summarise the findings related to the contribution of hospitals and clinical services to global warming. Still, they are expected to be heterogeneous regarding methods and results and with gaps in the literature.

INTRODUCTION

Climate change is one of the greatest threats to public health worldwide, with demonstrated territorial displacement and relocation due to climate stressors. People affected by climate change are at greater risk of infectious and respiratory diseases and increased mortality which are directly related to higher temperatures and heat episodes. Furthermore, the rise of foodborne, vectorborne and waterborne diseases places additional strain and pressure on the already strained healthcare systems.[1]

In medical care, hospital facilities contribute to greenhouse gas emissions through their operations. Patient healthcare and the practice of rendering health services require, among others, the use of therapeutic supplies, drugs and equipment, as well as sterilisation processes, some technologies and life support systems, all of which consume significant resources and result in substantial waste and proven higher energy consumption. Therefore, every healthcare action becomes an important source of emissions,[2] and these emissions have harmful effects on human health.

A number of studies address the issue of greenhouse gas emissions in the health sector, indicating that these reach between 4% and 10% of total emissions in different countries.[3 4] In 2018, the USA alone was responsible for generating 1692 kg per capita and the loss of up to 388 000 disability-adjusted years of life.[5]

As a result, universities, organisations and government agencies globally have expressed growing interest in ongoing research, to study the impact of the healthcare sector on the environment and develop strategies that might mitigate such impact.[6] The Declaration of Helsinki emphasises the urgency of acting to protect human and planetary health.[7] Existing studies are generally descriptive or narrative reviews on the impact of emissions on the environment from the healthcare sector; these include, but are not limited to, therapeutic procedures, intensive care unit admissions, surgeries, anaesthetic supplies and the use of some devices.[6 8 9] We found studies that, even while mentioning hospitals, mainly evaluated the global effect of greenhouse emissions on the healthcare system in different countries.[3–5] Other studies that synthesise the related evidence of this subject must either be updated[8 10 11] or focus on a specific hospital activity, such as surgery.[9]

In general, scoping reviews are commonly used to clarify the limits of what has been published thus far and are especially useful when a body of literature has not yet been comprehensively reviewed, or is of a large, complex or heterogeneous nature that is not amenable to a more precise systematic review.[12] The scoping reviews can examine the extent (ie, size), range (variety) and nature (characteristics) of the evidence on a topic or question, summarise the findings of a body of knowledge that is heterogeneous in terms of methods and identify gaps in the literature.[13]

Consequently, a scoping review will be carried out to enable an updated and comprehensive search of the scope and nature of existing studies, and the degree to which hospitals and clinical services contribute to global warming.

METHODS AND ANALYSIS

An extensive bibliographical search will be carried out indicating how hospitals and clinical services, through various processes, activities and diagnostic or therapeutic strategies, contribute to climate change, which in turn exerts pressure on global public health.

This study will be carried out with the objective of understanding and internalising the areas of the existing literature on the activities of hospitals and clinical services and their contribution to global warming. A search for studies examining how hospitals and their clinical services contribute to climate change will be considered in this analysis, allowing us to identify gaps for future research.

To meet this objective, two authors will independently search the following databases: Medline, Scopus and Embase.

The search strategy is exhaustive and broad in scope and began in the year 2000, since as of that date, the production of scientific evidence accelerated. The following filters will be applied: articles published from 2000 to June 2023, all languages and any type of design.

Each of the three authors will select articles according to the objectives of the study, by title and abstract. In cases where publications are selected by two authors, the article will be automatically incorporated. If only one of the authors selects a particular publication, the differences will be resolved through discussion. If there is no consensus, a third author will resolve the differences.

We will use the following search strategy:

Medline: (((((((carbon footprint) OR (greenhouse effect)) OR (greenhouse gas**)) OR (global warming)) OR (climate change)) OR (life cycle assessment)) AND (((hospitals) OR (hospital units)) OR (laboratories, hospital))) AND ((((((((((environment** medicine) OR (gases)) OR (anesthesia and analgesia)) OR (Anesthetics)) OR (Anesthesiology)) OR (Anesthesiologist)) OR (Waste Products)) OR (Sanitary engineering)) OR (Health care)) OR (Health care activities)) OR (Health process)) OR (Medicine)).

Embase: (((((((carbon footprint) OR (greenhouse effect)) OR (greenhouse gas)) OR (global warming potential)) OR (climate change)) OR (life cycle assessment)) AND (((hospital) OR (hospital subdivisions and components)) OR (hospital laboratory))) AND ((((((((((environmental medicine) OR (gas)) OR (anesthesia procedure)) OR (anesthetics agent)) OR (anesthesiology)) OR (anesthesiologist)) OR (waste)) OR (sanitation)) OR (health care)) OR (health care activities)) OR (health process)) OR (medicine)).

Scopus: (((((((carbon footprint) OR (greenhouse effect)) OR (greenhouse gases)) OR (global warming)) OR (climate change)) OR (life cycle assessment)) AND (((hospitals) OR (hospital units)) OR (laboratories, hospital))) AND ((((((((((environment medicine) OR (gases)) OR (anesthesia and analgesia)) OR (Anesthetics)) OR (Anesthesiology)) OR (Anesthesiologist)) OR (Waste Products)) OR (Sanitary engineering)) OR (Health care)) OR (Health care activities)) OR (Health process)) OR (Medicine)).

Our protocol was drafted using the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.[10] The final protocol was registered prospectively with the Open Science Framework (registration DOI:10.17605/OSF.IO/VWNHZ).

The eligibility criteria for including the studies in this scoping review are studies published in peer-reviewed journals between 2000 and June 2023, written in all languages, and articles with all types of methods: original research articles, reviews, editorials, case studies and conference papers.

Studies are excluded if they are conference proceedings or dissertations.

Data extraction process

Once studies are selected through the scoping review, data extraction will include the following: title, author, publication date, journal, type of study/design, objectives, methodology, characteristic of the health services/hospital, keywords, concept used (carbon footprint,

greenhouse effect, greenhouse gases, global warming, climate change, life cycle assessment), study population, context and important results. The research team will discuss these factors to ensure standardisation and comprehensiveness of the data extraction process. The results will be presented using tabulated data, and new themes will be included as necessary. If an appraisal of the methodological quality is found in the original studies, we will include this information.

Patient and public involvement

None.

ETHICS AND DISSEMINATION

This project is literature-based research, thus does not require ethical approval. The results will be submitted for publication in a relevant scientific journal.

Results will be introduced to other researchers and policymakers in this area through conferences, and a peer-reviewed publication will be submitted to a specific journal of interest.

Twitter María José Martinez-Zapata @mmartinezz2

Acknowledgements Merino W is PhD candidate in the "Metodología de la Investigación Biomédica y Salud Pública"program of the Universidad Autónoma de Barcelona.

Contributors WM prepared the draft and revised the manuscript. CC, MP and MJM-Z advised on the rationale and search strategy. WM and MJM-Z provided input on the study methodology, registration and correction processes.

Funding Funded by the University of La Frontera, Project DI20-0047.

Disclaimer The opinions expressed in the article reflect only the authors' view and do not reflect the official position of Universidad de La Frontera.

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not required.

Provenance and peer review Not commissioned; externally peer reviewed.

ORCID iDs

Waldo Merino-Urrutia http://orcid.org/0000-0002-4956-8444

María José Martinez-Zapata http://orcid.org/0000-0002-5836-1138

REFERENCES

1 Haines A, Ebi K. The imperative for climate action to protect health. *N Engl J Med* 2019;380:263–73.
2 Eckelman MJ, Sherman JD, MacNeill AJ. Life cycle environmental emissions and health damages from the Canadian Healthcare system: an economic-environmental-Epidemiological analysis. *PLoS Med* 2018;15:e1002623.
3 Lenzen M, Malik A, Li M, *et al*. The environmental footprint of health care: a global assessment. *Lancet Planet Health* 2020;4:e271–9.
4 Pichler P-P, Jaccard IS, Weisz U, *et al*. International comparison of health care carbon footprints. *Environ Res Lett* 2019;14:064004.
5 Eckelman MJ, Huang K, Lagasse R, *et al*. Health care pollution and public health damage in the United States: an update. *Health Affairs* 2020;39:2071–9.
6 Sherman JD, Thiel C, MacNeill A, *et al*. The green print: advancement of environmental sustainability in healthcare. *Resources, Conservation and Recycling* 2020;161:104882.
7 Halonen JI, Erhola M, Furman E, *et al*. A call for urgent action to safeguard our planet and our health in line with the helsinki declaration. *Environmental Research* 2021;193:110600.
8 Seifert C, Koep L, Wolf P, *et al*. Life cycle assessment as decision support tool for environmental management in hospitals: A literature review. *Health Care Manage Rev* 2021;46:12–24.
9 Drew J, Christie SD, Tyedmers P, *et al*. Operating in a climate crisis: A state-of-the-science review of life cycle assessment within surgical and anesthetic care. *Environ Health Perspect* 2021;129:76001.
10 Cimprich A, Santillán-Saldivar J, Thiel CL, *et al*. Potential for industrial Ecology to support Healthcare Sustainability: Scoping review of a fragmented literature and conceptual framework for future research. *J of Industrial Ecology* 2019;23:1344–52. 10.1111/jiec.12921 Available: https://onlinelibrary.wiley.com/toc/15309290/23/6
11 Alshqaqeeq F, Amin Esmaeili M, Overcash M, *et al*. Quantifying hospital services by carbon footprint: A systematic literature review of patient care alternatives. *Resources, Conservation and Recycling* 2020;154:104560.
12 Peters MDJ, Godfrey CM, Khalil H, *et al*. Guidance for conducting systematic Scoping reviews. *Int J Evid Based Healthc* 2015;13:141–6.
13 Tricco AC, Lillie E, Zarin W, *et al*. PRISMA extension for scoping reviews (prisma-scr): checklist and explanation. *Ann Intern Med* 2018;169:467–73.