

Research on the health impact of climate must consider distributive justice and environmental sustainability

Richie, Cristina; Garcia-Gomez, Pilar ; Thio , Hok Bing; Rwei, A.Y.; Joo, C.; Staufer, U.; Muratore, D.G.; Mastrangeli, Massimo; Dedoussi, I.C.; More Authors

DOI

[10.1371/journal.pclm.0000431](https://doi.org/10.1371/journal.pclm.0000431)

Publication date

2024

Document Version

Final published version

Published in

PLOS Climate

Citation (APA)

Richie, C., Garcia-Gomez, P., Thio, H. B., Rwei, A. Y., Joo, C., Staufer, U., Muratore, D. G., Mastrangeli, M., Dedoussi, I. C., & More Authors (2024). Research on the health impact of climate must consider distributive justice and environmental sustainability. *PLOS Climate*, 3(6), 1-4. Article e0000431. <https://doi.org/10.1371/journal.pclm.0000431>

Important note

To cite this publication, please use the final published version (if applicable). Please check the document version above.

Copyright

Other than for strictly personal use, it is not permitted to download, forward or distribute the text or part of it, without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license such as Creative Commons.

Takedown policy

Please contact us and provide details if you believe this document breaches copyrights. We will remove access to the work immediately and investigate your claim.

OPINION

Research on the health impact of climate must consider distributive justice and environmental sustainability

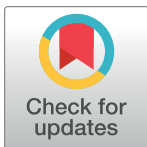
Cristina Richie^{1*}, Pilar Garcia-Gomez², Hok Bing Thio³, Alina Rwei⁴, Chirlmin Joo⁴, Urs Stauer⁴, Dante Muratore⁴, Massimo Mastrangeli⁴, Irene Dedoussi⁴, Job van Exel², Tom van Ourti², Igna Bonfrer², Alberto Gianoli², Alexander Los², Gijsbertus T. J. van der Horst⁵, Martin van Hagen⁵, Lex Burdorf⁵, Jasper V. Been³, Maud Hermans³, Ralph Stadhouders³, Robbert J. Rottier⁶, Anna Bornioli², Ines Chaves³, Willem A. Dik³

1 University of Edinburgh, Edinburgh, Scotland, **2** Erasmus University Rotterdam, Rotterdam, Netherlands, **3** Erasmus MC, Rotterdam, Netherlands, **4** Delft University of Technology, Delft, Netherlands, **5** Erasmus University Medical Center, Rotterdam, Netherlands, **6** Erasmus MC-Sophia Children's Hospital, Rotterdam, Netherlands

* cristina.richie@ed.ac.uk

Abstract

Climate and justice are interconnected. However, simply raising ethical issues associated with the links between climate change, technology, and health is insufficient. Rather, policies and practices need to consider ethics ahead of time. If it is only added “after the fact,” policy will be less efficient and opportunities for carbon minimization will be lost. This will require the cooperation of people at many levels and can be guided by two essential ethical principles: distributive justice and environmental sustainability.



OPEN ACCESS

Citation: Richie C, Garcia-Gomez P, Thio HB, Rwei A, Joo C, Stauer U, et al. (2024) Research on the health impact of climate must consider distributive justice and environmental sustainability. *PLOS Clim* 3(6): e0000431. <https://doi.org/10.1371/journal.pclm.0000431>

Editor: Jamie Males, PLOS Climate, UNITED KINGDOM

Published: June 17, 2024

Copyright: © 2024 Richie et al. This is an open access article distributed under the terms of the [Creative Commons Attribution License](https://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Funding: The authors received no specific funding for this work.

Competing interests: The authors have declared that no competing interests exist.

A 2022 article from *PLOS Global Public Health* noted that climate and justice are interconnected [1]. Through pollution, carbon dioxide emissions, and the deposition of nitrogen, environmental changes have massive effects on health, which more dramatically impact the vulnerable. The World Bank estimates that 6.4 million people died prematurely in 2019 due to exposure to air pollution alone and the health costs were equivalent to 6.9 percent of global GDP worldwide, or 2.8 percent in high income OECD countries [2]. Moreover, the health impacts of environmental changes are often linked to environmental racism [3] and health inequalities through the increase in climate-change related health hazards [4] which disproportionately burden those who lack the money, resources, or political power to recover from climate disasters and access health care when affected by climate health effects [5].

While attempts to reverse climate change and meet individual and population health are a priority in many countries, there are gaps in research and in action. For instance, current studies linking environmental stressors and health are often limited to after-the-fact large-scale statistics and long-term trends, thereby restricting the ability of clinicians to provide timely, cost-effective prevention and treatment strategies to people. Outside of health care delivery, this information is often too outdated to offer impactful strategies for humans to adapt behavior.

At the same time, technological interventions into climate change, studies into the effects of climate on health, and medical treatment for climate-related health complications all have a carbon footprint which further contributes to climate change and climate change health hazards. Thus, humankind finds itself caught in cycle: The health care industry contributes 4–5% of global carbon emissions already [6]. While simply eliminating research and development of health-based technological solutions to climate impacts have no short-term carbon footprint, ethically, that is not an option. Technologically, that is reckless. Scientifically, that is unsatisfying.

Simply raising these ethical issues associated with the links between climate change, technology, and health, is insufficient. Rather, policies and practices need to consider ethics ahead of time. If it is only added “after the fact,” policy will be less efficient and opportunities for carbon minimization will be lost. This will require the cooperation of people at many levels and can be guided by two essential ethical principles: distributive justice and environmental sustainability [7]. Distributive justice argues that benefits and burdens of social life—from technologies to health care—should be equally distributed [8]. Environmental sustainability ensures that basic human needs are met within the boundaries of the ecosystem which sustains us [9].

Distributive justice

Prevention and early diagnostics are essential to proactively maintaining individual health in the face of climate change, therefore, on account of the principle of justice, there is a corresponding obligation to ensure facilitating structures. These may include technological availability and health care access, as well as addressing social determinates of health.

Considering the vast gaps between, and within, countries in access to medical technologies, any climate innovation, like wearable cytokine aptasensors for real-time analysis of environmental impact, [10] should be widely available. To achieve this, these, and other technologies, need to be cost-effective and widely available, which likely requires sharing the financial burden between (and within) countries based on ability to contribute and (past and current) responsibility for climate change. Information about individual health gathered from people using personalized climate technologies can benefit populations who must wait for access and roll-out periods. Thus, structures of justice benefit all.

Additionally, ensuring that public health research is more robustly funded is an ethical requirement, particularly because the burdens of climate change fall disproportionality along the social determinants of health (SDH) [11]. SDH include factors largely outside of one’s control, like quality education, income, vocation, race, and ethnicity. These SDH place people living in the global South, and some minorities within populations, more at risk for particular noncommunicable diseases—including those related to climate—while also making positive health outcomes less likely.

Policies must be created to prevent health deterioration due to pollution and climate change through both personalized interventions on health and broad environmental health policies. Gaps in health—which include access to medical technologies and healthy environments—violate distributive justice and place the poor at a double disadvantage of being less able to prevent and treat climate change health problems. This is not only a threat to their biological health but also to individual and community well-being—their capacity to prosper and flourish.

Environmental sustainability

Environmental sustainability must cut across all nations and sectors. Global decarbonization requires effective and united policies. Initiatives, like those agreed at COP27, are a start, but

commitment and action of the biggest environmental polluters is pivotal for rapid and substantial change. More political pressure on highly polluting nations ought to be considered and climate sanctions and compensation mechanisms could be established. Climate change imperils all and simply relying on the good will of nations and organisations is a present threat to the wellbeing of people globally.

Moreover, sector emissions need to be evaluated. It is counter-productive to use and produce high-carbon technologies to address climate, since these also contribute to climate change throughout their lifecycle, from development, to deployment, to dissemination, to disposal [12]. Climate-tech and health care tech also consume resources through their digital infrastructure [13].

Therefore, while technology offers powerful tools to improve longevity and quality of life in the face of climate change, they themselves must be developed and implemented sustainably. Carbon emissions of technologies must be addressed in the engineering pipeline, from conceptual design, to prototype development, to mass manufacturing [14]. Engineering companies may need incentives to make devices sustainable, but cannot be a substitute for a rigorous change in attitudes towards pro-environmental behaviors [15].

While lifecycle carbon assessments are becoming increasingly available and are useful for understanding the environmental impact of technologies, intuitively and empirically, humankind must simply live more parsimoniously, which is primarily a responsibility for people in the global North.

Effective policies to reduce the impacts of climate on health must be implemented on a global scale, promoting distributive justice and environmental sustainability. Ethics must be *proactive* rather than *reactive*. Ethical policies have the ability to relieve citizens around the globe from economic, societal, and personal burdens of climate-related health problems if all stakeholders collaborate to unite justice, sustainability, and health for all.

Author Contributions

Conceptualization: Cristina Richie, Pilar Garcia-Gomez, Hok Bing Thio, Alina Rwei, Chirlmin Joo, Urs Staufer, Dante Muratore, Massimo Mastrangeli, Irene Dedoussi, Job van Exel, Tom van Ourti, Igna Bonfrer, Alberto Gianoli, Alexander Los, Gijsbertus T. J. van der Horst, Martin van Hagen, Lex Burdorf, Jasper V. Been, Maud Hermans, Ralph Stadhouders, Robbert J. Rottier, Anna Bornioli, Ines Chaves, Willem A. Dik.

Funding acquisition: Cristina Richie, Pilar Garcia-Gomez, Hok Bing Thio, Alina Rwei, Chirlmin Joo, Urs Staufer, Dante Muratore, Massimo Mastrangeli, Irene Dedoussi, Job van Exel, Tom van Ourti, Igna Bonfrer, Alberto Gianoli, Alexander Los, Gijsbertus T. J. van der Horst, Martin van Hagen, Lex Burdorf, Jasper V. Been, Maud Hermans, Ralph Stadhouders, Robbert J. Rottier, Anna Bornioli, Ines Chaves, Willem A. Dik.

Investigation: Cristina Richie, Pilar Garcia-Gomez, Hok Bing Thio, Alina Rwei, Chirlmin Joo, Urs Staufer, Dante Muratore, Massimo Mastrangeli, Irene Dedoussi, Job van Exel, Tom van Ourti, Igna Bonfrer, Alberto Gianoli, Alexander Los, Gijsbertus T. J. van der Horst, Martin van Hagen, Lex Burdorf, Jasper V. Been, Maud Hermans, Ralph Stadhouders, Robbert J. Rottier, Anna Bornioli, Ines Chaves, Willem A. Dik.

Methodology: Cristina Richie, Pilar Garcia-Gomez, Hok Bing Thio, Alina Rwei, Chirlmin Joo, Urs Staufer, Dante Muratore, Massimo Mastrangeli, Irene Dedoussi, Job van Exel, Tom van Ourti, Igna Bonfrer, Alberto Gianoli, Alexander Los, Gijsbertus T. J. van der Horst, Martin van Hagen, Lex Burdorf, Jasper V. Been, Maud Hermans, Ralph Stadhouders, Robbert J. Rottier, Anna Bornioli, Ines Chaves, Willem A. Dik.

Project administration: Cristina Richie.

Writing – original draft: Cristina Richie, Pilar Garcia-Gomez, Hok Bing Thio, Alina Rwei, Chirlmin Joo, Urs Staufer, Dante Muratore, Massimo Mastrangeli, Irene Dedoussi, Job van Exel, Tom van Ourti, Igna Bonfrer, Alberto Gianoli, Alexander Los, Gijsbertus T. J. van der Horst, Martin van Hagen, Lex Burdorf, Jasper V. Been, Maud Hermans, Ralph Stadhouders, Robbert J. Rottier, Anna Bornioli, Ines Chaves, Willem A. Dik.

Writing – review & editing: Cristina Richie, Pilar Garcia-Gomez, Hok Bing Thio, Alina Rwei, Chirlmin Joo, Urs Staufer, Dante Muratore, Massimo Mastrangeli, Irene Dedoussi, Job van Exel, Tom van Ourti, Igna Bonfrer, Alberto Gianoli, Alexander Los, Gijsbertus T. J. van der Horst, Martin van Hagen, Lex Burdorf, Jasper V. Been, Maud Hermans, Ralph Stadhouders, Robbert J. Rottier, Anna Bornioli, Ines Chaves, Willem A. Dik.

References

1. Guinto RR, Deivanayagam TA, Chuji PT, Hossan A, Jensen A, Jung L, et al. Achieving climate justice, safeguarding planetary health: Diagnosis and demands from next generation leaders for COP27 and beyond. *PLOS Glob Public Health*. 2022; 2: e0001304. <https://doi.org/10.1371/journal.pgph.0001304> PMID: 36962659
2. World Bank. The global health cost of pm2.5 air pollution: A case for action beyond 2021. Washington, DC; 2022.
3. Zimring C. Clean and white: A history of environmental racism in the United States. NYU Press; 2017.
4. World Health Organization, Public health and environment. 2022. <https://www.who.int/data/gho/data/themes/public-health-and-environment>.
5. Smith G, Anjum E, Francis C, Deanes L, and Acey C. Climate change, environmental disasters, and health inequities: the underlying role of structural inequalities. *Curr Environ Health Rep*. 2022;: 80–89.
6. Karliner J, Slotterback S, Boyd R, Ashby B and Steele K. Health care's climate footprint. *Health Care Without Harm and ARUP*; 2019.
7. Richie C. Principles of green bioethics: sustainability in health care. MSU Press; 2019.
8. Rawls J. A theory of justice. Cambridge U Press; 1971.
9. Raworth K. A Doughnut for the anthropocene: humanity's compass in the 21st century. *Lancet Planetary Health*. 2017; 1: e48–e49. [https://doi.org/10.1016/S2542-5196\(17\)30028-1](https://doi.org/10.1016/S2542-5196(17)30028-1) PMID: 29851576
10. Kim J, Noh S, Park J, Park S, Park SJ, Lee J-H et al. Recent advances in aptasensor for cytokine detection: A review. *Sensors*. 2021; 21: 8491. <https://doi.org/10.3390/s21248491> PMID: 34960590
11. Bahrami G, Rafiey H, Shakiba A, Noroozi M, and Sajjadi H. A review of studies on climate change and social variables from the perspective of social. *Journal of Community Health Research*. 2020; 9: <https://doi.org/10.18502/jchr.v9i3.4263>
12. Malmodin J and Lundén D. The energy and carbon footprint of the global ICT and E&M sectors 2010–2015. *Sustainability*. 2018; 10: 3027.
13. Zhang W, Fan H, and Zhao Q. Seeing green: how does digital infrastructure affect carbon emission intensity?. *Energy Econ*. 2023; 127: 107085.
14. McCradden M, Anderson J, and Shaul R. Accountability in the machine learning pipeline: The critical role of research ethics oversight. *Am J Bioeth*. 2020; 20: 40–42. PMID: 33103980
15. van Valkengoed A, Abrahamse W and Steg L. To select effective interventions for pro-environmental behaviour change, we need to consider determinants of behaviour. *Nat Hum Behav*. 2022; 6: 1482–1492. <https://doi.org/10.1038/s41562-022-01473-w> PMID: 36385176