

Bridget Pratt et al.

Funding climate and health research

**This online first version has been peer-reviewed, accepted and edited,
but not formatted and finalized with corrections from authors and proofreaders**

WHO's ethical criteria for health research priority-setting in the context of climate change

Bridget Pratt,^a Rieke van der Graaf^b & Gabrielle Samuel^c

^a Queensland Bioethics Centre, Australian Catholic University, 1100 Nudgee Road, Banyo, Brisbane, Queensland 4014, Australia.

^b Department of Bioethics and Health Humanities, University Medical Center Utrecht, Utrecht, Kingdom of the Netherlands.

^c Department of Global Health & Social Medicine, King's College London, London, England.

Correspondence to Bridget Pratt (email: bridget.pratt@acu.edu.au).

(Submitted: 11 May 2025 – Revised version received: 22 September 2025 – Accepted: 30 October 2025 – Published online: 14 January 2026)

Abstract

Health research on climate change has increased substantially in recognition of the impact of climate change on human health. This research raises new ethical questions for health research priority-setting, including how to prioritize research on climate change and health versus other types of health research unrelated to climate change, and how to prioritize among different health research projects focused on climate change. In this paper, we focus on the latter. We consider whether the ethical criteria for health research priority-setting recently proposed by the World Health Organization (WHO) should be used by funders when allocating resources among health research projects focused on climate change. The WHO criteria were developed in response to imbalances around who controls and sets health research agendas and who benefits from them. The four criteria for ethical research priority-setting are optimizing social value, following fair procedures, respecting special obligations and assessing risks. We first show that these criteria are relevant to priority-setting for research on climate change and health because evidence suggests that the above-mentioned imbalances may exist when priority-setting for allocation of resources for climate change and health research. We next assess whether the four criteria can help reduce imbalances in who controls and who benefits from resource allocation to research on climate change and health. Our analyses indicate that the WHO criteria can help if further specifications are included for research on climate change and health. We provide recommendations for how to further specify the criteria.

Introduction

Climate change is the greatest health threat of our time. As temperatures worldwide continue to rise, we are seeing more frequent heatwaves and bushfires, greater frequency and intensity of heavy precipitation events, increased risk of drought and reduced water availability, sea level rise, and further increases in ocean temperatures and acidification.¹ Recognition of the

impact on human health of these hazards has led to more research on climate change and its relationship to health. For example, in 2022, the United States National Institutes of Health provided an estimated 281 million United States dollars (US\$) to research projects on climate change and health,² and steps were taken in 2023 to increase the funding.³ While this funding is currently under threat due to the United States government's recent attacks on climate science,⁴ 15 963 studies on climate change and health are estimated to have been published between 2013 and 2019.⁵

Despite the increase in research on climate change and health, resources available for health research are generally low, making choices about which research proposals to fund unavoidable. Health research priority-setting is a process through which decisions or recommendations are made about which health research questions or areas should be prioritized.⁶ In relation to research on climate change and health, priority-setting occurs between research on climate change and health and other types of health research unrelated to climate change. Priority-setting also occurs among health research projects on climate change. In this paper, we focus on priority-setting among research projects on climate change and health, and specifically, we focus on the allocation of resources at the level of research funding.

Within research on climate change and health, several types of studies are allocated resources. Health impact studies refer to research that aims to gain insights on how the hazards, exposures and impacts of climate change are worsening human health and health equity. Adaptation studies refer to research on adaptations to protect human health from the impacts of climate change. Mitigation studies refer to research on how health-related sectors can lessen their climate change impact and on the effect of mitigation (across all sectors) on health.

As affirmed by recent the World Health Organization (WHO) publication *Guidance on the ethics of health research priority-setting*⁶ and previously by ethicists,^{7,8} decisions about what health research priorities to set and how to allocate resources are a matter of ethical concern. As the guidance states,

Health research has brought humanity tremendous benefits. But those benefits have not been evenly distributed. Enormous disparities remain built into the global research agenda. Control over what research is done remains in a small number of hands, often in high-income countries, with for-profit, non-profit and government supported research all still

disproportionately focused on conditions that affect populations that are better off... In the face of these concerns, there is an urgent need for those involved in health research to set priorities for that research in an ethical way.⁶

The WHO guidance was thus developed in response to imbalances around who controls and sets health research agendas, and who benefits from them. The guidance affirms an obligation to engage in ethically informed health research priority-setting that is grounded in considerations of justice.⁶ The guidance provides ethical criteria to guide the various actors who set health research priorities, including funders.⁶

In this paper, we consider the research question: should the ethical criteria for health research priority-setting recently proposed by WHO⁶ be used by funders when allocating resources to health research projects that are focused on climate change? To answer this question, we first show how WHO's ethical criteria are relevant to priority-setting for research on climate change and health. We next assess whether applying those criteria can help reduce the trends of concern in research on climate change and health. Finally, we demonstrate that it is possible to apply WHO's criteria if further specifications are included for research on climate change and health.

Funding trends of ethical concern

Limited evidence exists on funding flows to research on climate change and health, and more broadly to climate change research. However, available data on resource allocation trends in these areas suggest the same patterns as in international health research and global health research generally,^{9–15} with control over the research and its benefits lying largely with high-income countries. In Box 1, we take evidence from the literature and offer our assessment of what trends of ethical concern are beginning to emerge in the allocation of funding to climate change and health research.

Some of those trends, namely, resource allocation primarily to recipients in high-income countries or to research promoting technology-based solutions, may reinforce unfair power dynamics of subordination and colonialism,^{20,21} that is, control of decision-making and of political, economic and cultural systems.^{22,23} Even if researchers in high-income countries focus on matters of relevance to low- and middle-income countries, they may still decide what health research questions or topics should be prioritized in research projects. In other words, researchers from high-income countries control the agenda. Furthermore, where funding favours high-technology research, it reinforces economic and cultural models of

high-income countries, namely, knowledge-based economic models that support increased investment in science and technology²⁴ and product-driven solutions to health problems.²⁵

Where resource allocation favours studies on health impact, less knowledge on effective mitigation and adaptation options is generated. Such knowledge is urgently needed for the benefit of populations in low- and middle-income countries because they are most affected by climate change. The lack of knowledge may hinder the design of evidence-based pathways to mitigate the health impacts of climate change⁵ and thereby reinforce distributive injustices, that is, the unequal risk of climate change affecting people's health in low- and middle-income countries versus high-income countries.

Resource allocation to health research conducted in and relevant to high-income countries is another trend, and can further generate or worsen distributive injustices by ensuring that people in high-income countries disproportionately benefit from the results of health research projects focused on climate change. When research on climate change and health is largely conducted in high-income countries on topics of relevance to them, this research is less likely to generate knowledge that will benefit populations in low- and middle-income countries. As a result, global disparities in the health impacts of climate change will widen (Box 1).

WHO criteria

WHO's ethical criteria for health research priority-setting are intended to help address imbalances in who controls and who benefits from health research. Therefore, we consider whether these criteria can reduce any of the trends of concern in Box 1. The WHO guidance proposes four ethical principles, or criteria, to underpin research priorities, including at the funding level: (i) optimize social value; (ii) follow fair procedures; (iii) respect special obligations; and (iv) assess risks⁶ (details available in data repository).²⁶ The environment is considered by two criteria: optimize social value and assess risks (data repository).²⁶

Social value

According to the WHO guidance, social value has three components: (i) the likelihood that the research will produce knowledge that will ultimately benefit human health and well-being; (ii) the magnitude of the benefits; and (iii) the extent to which providing the benefits will reduce inequities. The last two components are most relevant when allocating funding to research on climate change and health.

Magnitude of benefit

Assessing and comparing the magnitude of the benefits of health research requires knowing which benefits and beneficiaries should count and the extent to which they should count relative to one another. Research ethics scholars have considered what benefits should count in terms of health and/or well-being. They have explored whether both or only health benefits should count and whether direct and indirect health benefits or only direct health benefits should count. Scholars have also considered their relative value (that is, health benefits versus other well-being benefits, and direct health benefits versus indirect non-health benefits).²⁷

Beneficiaries who count generally include people now and in the near future. However, research on climate change and health raises new questions about what benefits (that is, environmental benefits) and beneficiaries (that is, people in the distant future) should count and their relative value (that is, also including health benefits versus environmental benefits; direct health benefits versus indirect health benefits; present and near future beneficiaries versus distant future beneficiaries). So far, these questions have not been considered. They arise because mitigation studies generate environmental benefits and indirect human health benefits, including for people in the distant future, whereas health impact studies and adaptation studies generate direct human health impacts for people now and in the near future. Thus, the magnitude of benefits of research projects on climate change and health will vary depending on what benefits (that is, health, environmental, direct and indirect) and which beneficiaries (that is, people now, in the near future or in the distant future) should count and how much they should count.

The WHO guidance answers some of the new questions raised by research on climate change and health but not all. Indirect human health and well-being benefits and environmental benefits (possibly just to sentient non-human animals) should be considered, but the guidance does not specify how these benefits should be valued relative to direct human health benefits. Lack of guidance in this area is problematic because assignment of certain relative values can bias resource allocation in favour of health impact studies and adaptation studies over mitigation studies, or vice versa. If environmental benefits to ecosystems do not count at all and/or environmental benefits and indirect human health benefits count much less, then assessments of magnitude of benefits will be biased in favour of research on climate change and health with direct human health benefits (that is, health impact and adaptation studies). An alternative, that the distant future is given the same weight as the present and near future, is also problematic because then mitigation studies will have a

much greater number of beneficiaries than health impact and adaptation studies. In effect, the bias against either mitigation studies or adaptation studies seen in Box 1 would be reinforced. To reduce this bias, environmental benefits must be given substantial (but perhaps not equal) weight relative to health benefits, as must people in the distant future relative to people in the present and near future. Such a perspective on relative value is consistent with some non-anthropocentric positions and conceptions of environmental justice.²⁸

Reducing inequities

The WHO guidance defines equity as, “the absence of unfair, avoidable, or remediable difference among groups of people” in relation to well-being (including health status) but notes that, “how equity is best specified will depend on the scope – geographical, topical and so on – of the priority-setting exercise.”⁶ For research on climate change and health, equity could be understood in terms of climate equity, that is, in terms of ensuring the absence of unfair, avoidable or remediable differences in risk of the impact of climate change on well-being among groups of people, including current, near future and distant future generations. Research on climate change and health would then promote climate equity by helping generate knowledge on how and why the different risks of the impact of climate change on health exist and how to eliminate them. The focus of such research would primarily need to be on the people most vulnerable to the negative health impacts of climate change. As such, understanding equity as climate equity would help reduce (to some extent) funding being allocated mostly to research projects on climate change and health conducted in high-income countries and focused on their needs. This approach would also help increase resource allocation to mitigation and adaptation studies because mitigation and adaptation are both essential to reduce the unequal impact of climate change.^{29,30}

Yet understanding climate inequity does not help counter trends against funding research on structural solutions or call for funding mitigation studies in high-income countries specifically. For these reasons, reducing injustice in general, and climate injustice in particular, is a better option as the third component of social value for research on climate change and health. As with climate equity, climate justice is understood in terms of well-being. Theories of justice in philosophy increasingly, but not always, define justice as ensuring a threshold level of well-being for individuals, groups and communities. Some priority is given to bringing disadvantaged groups up to that level of well-being.³¹⁻³³ Addressing structural causes is especially important to alleviating disadvantage.³³ Structural causes are unfair power relations, social norms, and social, economic and political institutions

that create an unequal playing field where some people have to have to work much harder than others to achieve a good life.²²

Climate justice then not only calls for reducing the unequal risk of climate change impacts on health and well-being,^{29,30} but also for giving some priority to tackling its structural or root causes.^{34–36} As with reducing climate inequity, reducing climate injustices would, therefore, give more value to projects in low- and middle-income countries, where vulnerability to climate change is higher.²⁹ Reducing climate inequity would also prioritize research on climate change and health focused on how the structural causes of climate change affect human health. An example of such research would be studies on how current models of culture and development driven by fossil fuels harm our health.³⁷ As a matter of climate justice, it has also been extensively argued that the burden of mitigation should not fall on the countries with the greatest health needs who are least responsible for climate change.^{29,38,39} Climate justice would then value mitigation studies in high-income countries higher than mitigation studies in low- and middle-income countries because they place the burden of mitigation on high-income countries. In contrast, understanding climate inequity could equally support increasing mitigation studies in high-income countries and low- and middle-income countries.

Fair procedures

As we focus on resource allocation specifically, we have only considered the process of grant proposal evaluation by funders. The WHO guidance indicates that a fair process of grant proposal evaluation requires consideration of who should be panel members and in what numbers. From a climate change and health perspective, for epistemic reasons, people from low- and middle-income countries should be included on panels evaluating impact and adaptation studies. Equally, people from both high-income countries and low- and middle-income countries should be included in panels evaluating mitigation studies. For intrinsic reasons, those populations most affected by climate change should be included in all panels, that is, people from low- and middle-income countries and future generations. Including future generations can take the form of thought models, procedural approaches or relational approaches.^{40–43}

The WHO guidance also stipulates that meaningful inclusion occurs when participants, in this case, panel members in the evaluation process of grant proposals, are able to raise their voices and be heard. However, panel members' level of participation, namely,

who is part of the actual decision-making, is left open to funders to assign. In the context of research in climate change and health, we think the literature on procedural justice and climate change offers relevant guidance on this matter. In particular, it has been suggested that climate change decision-making processes should give vulnerable populations the power to shape adaptation decisions and the decision rules through which they are made. Granting this authority can also safeguard against exploitation by requiring conditions that ensure vulnerable populations are free from overt forms of domination or oppression.”⁴⁴

Ensuring that representatives from low- and middle-income countries participate as decision-makers on grants’ panels and when selecting the rules for such panels could help counter certain trends in research on climate change and health that raise ethical concerns. This approach could help ensure resources are allocated to studies with a focus on low- and middle-income countries and their needs. This approach may also reduce the allocation of funds to researchers in high-income countries by diversifying which research projects are selected by the evaluation panel. At the same time, this approach will not address structural injustices that give applicants from high-income countries an advantage in preparing high-quality grant proposals. There is also a potential that a fair process, where decision-making is shared with representatives from low- and middle-income countries, could generate priorities inconsistent with the social value criterion and/or that reinforce trends in Box 1. Where ethical criteria conflict, the WHO guidance says trade-offs should always be made for justifiable reasons.⁶ Where the WHO criteria conflict and one criterion supports priorities that reinforce a trend of ethical concern, we suggest that could be a reason to favour priorities consistent with the other criterion.

Special obligations

The WHO guidance states that special obligations are, “ethical duties that one party owes to another in virtue of their role, relationship, or history” but provides little additional detail on different types of special obligations.⁶ An analysis that was conducted on the special obligations of research funders is useful here.⁴⁵ The authors categorize special obligations as constitutive or acquired duties. Constitutive duties derive from and align with a funder’s role in society. They exist for all types of funders. Acquired duties include duties of commitment, reciprocity and culpability.⁴⁵ Duties of culpability are especially relevant in the context of climate change because they arise by virtue of past harmful interactions. In the following paragraphs, we discuss what constitutive and culpability duties arise for different types of funders with regard to priority-setting for research on climate change and health.

For governments, their constitutive duties are shaped by global justice,^{6,45} with governments having some obligations beyond their borders. Global justice thus supports government funders of high-income countries allocating resources to research on climate change and health in (and relevant to) high-income countries and low- and middle-income countries. Beyond constitutive duties, it can be argued that if a government has harmed a population, then it has a duty of culpability to compensate, which can include conducting health research.⁴⁵ Most governments of high-income countries would then have an acquired duty to fund research on climate change and health relevant to those populations most vulnerable to climate change because their countries are most responsible for climate change. If high-income countries fulfilled that duty, the trend we see favouring research in and relevant to high-income countries would be reduced.

Multilateral institutions, such as the Organisation for Economic Co-operation and Development, WHO and World Trade Organization, also have constitutive duties to fund research on climate change and health in, and relevant to low- and middle-income countries. These duties include funding research for populations whose research needs cannot or will not be met by states or other actors. In general, vulnerable populations will benefit the most from this research.⁴⁵ If the mission of nonprofit organizations is health-based and emphasizes the health of the people most in need worldwide, they arguably would have a constitutive duty to fund research on climate change and health in (and relevant to) low- and middle-income countries. The constitutive duties of private companies are not relevant to research on climate change and health because their duties are to their shareholders.

Duties of culpability may also be relevant to multilateral institutions, non-profit organizations and private companies, if they are considered to be complicit in incentivizing and perpetuating carbon intensive economic activities driven by capitalism. Such complicity is arguably evidenced by private companies. A study estimated the aggregate global emissions of the pharmaceutical sector to be about 52 million tonnes.⁴⁶ For that reason, pharmaceutical companies have an acquired duty to compensate populations most vulnerable to climate change and its effects and hence to support research on climate change and health in, and relevant to low- and middle-income countries.

Assess risks

The WHO guidance requires consideration of whether health research projects pose a risk of third party harms to humans, animals or the environment and whether those harms are

justified.⁶ One aspect of particular relevance to research on climate change and health is that if the research leads to environmental (and consequently human health) harms, then low-technology intervention studies, such as providing free drinking water to avoid heat stress, may be preferred over high-technology intervention studies that use more resources.

Applying this criterion could help reverse the ethically problematic trend of focusing on high-technology research. The WHO guidance states “[o]n the other hand, new health technologies may have substantial and potentially deleterious effects if they are energy and resource intensive.”⁶

Conclusions

Applying the WHO ethical criteria for health research priority-setting as we outline in Table 1 can help reduce certain trends of concern in allocation of funding for research on climate change and health. However, avoiding or further reducing these trends requires broader structural changes to the health research system and how grants programmes are designed. For example, to avoid allocation of disproportionately more funds to researchers in high-income countries for research on climate change and health, a fairer grant proposal evaluation processes is needed. Programmes need to be designed that are epistemically fair⁴⁷ and have eligibility requirements or leadership requirements⁴⁸ that favour applicants from low- and middle-income countries. Furthermore, structural injustices that give applicants from high-income studies an advantage in grant writing and management should be eliminated.

Funding:

GS was supported by a Wellcome Trust grant (222180/Z/20/Z). BP was supported by Mater Misericordiae Limited.

Competing interests:

BP was a member of the expert writing group of WHO's *Guidance on the ethics of health research priority-setting*.

References

1. Intergovernmental Panel on Climate Change. Climate change 2022: impacts, adaptation and vulnerability. Contribution of Working Group II to the sixth assessment report of the Intergovernmental Panel on Climate Change. Cambridge: Cambridge University Press; 2022.
2. Sovacool BK, Clifford H, Pearl-Martinez R, Gause E, Braun D, Kamareddine L, et al. Critically examining research funding patterns for climate change and human health. *Npj Clim Action*. 2024;3(1):64. <https://doi.org/10.1038/s44168-024-00142-0>
3. NIH Climate Change and Health Initiative 2023 annual report. Bethesda: National Institutes of Health; 2023.
4. Milman O. Outcry as Trump withdraws support for research that mentions “climate”. *The Guardian*. 2025 Feb 21. Available from: https://www.theguardian.com/environment/2025/feb/21/trump-scientific-research-climate?CMP=share_btn_url [cited 2024 April 15].
5. Berrang-Ford L, Sietsma AJ, Callaghan M, Minx JC, Scheelbeek PFD, Haddaway NR, et al. Systematic mapping of global research on climate and health: a machine learning review. *Lancet Planet Health*. 2021 Aug;5(8):e514–25. [https://doi.org/10.1016/S2542-5196\(21\)00179-0](https://doi.org/10.1016/S2542-5196(21)00179-0) PMID:34270917
6. Guidance on the ethics of health research priority-setting. Geneva: World Health Organization; 2025. Available from: <https://iris.who.int/handle/10665/381711> [cited 2025 Dec 14].
7. Pratt B, Sheehan M, Barsdorf N, Hyder AA. Exploring the ethics of global health research priority-setting. *BMC Med Ethics*. 2018 Dec 6;19(1):94. <https://doi.org/10.1186/s12910-018-0333-y> PMID:30522485
8. Saenz C, Carracedo S, Caballero C, Hurtado C, Leite Ribeiro A, Luna F, et al. Research priority-setting is an ethics exercise: lessons from the Global Forum on Bioethics in Research for the Region of the Americas. *Rev Panam Salud Publica*. 2024 Mar 8;48:e32. <https://doi.org/10.26633/RPSP.2024.32> PMID:38464877
9. G-FINDER 2019: neglected disease research and development: uneven progress. Sydney: Policy Cures Research; 2020.
10. Moran M, Guzman J, Ropars AL, Illmer A. The role of Product Development Partnerships in research and development for neglected diseases. *Int Health*. 2010 Jun;2(2):114–22. <https://doi.org/10.1016/j.inhe.2010.04.002> PMID:24037470
11. Costello A, Zumla A. Moving to research partnerships in developing countries. *BMJ*. 2000 Sep 30;321(7264):827–9. <https://doi.org/10.1136/bmj.321.7264.827> PMID:11009530
12. Edejer TT. North-South research partnerships: the ethics of carrying out research in developing countries. *BMJ*. 1999 Aug 14;319(7207):438–41. <https://doi.org/10.1136/bmj.319.7207.438> PMID:10445930

13. Jentsch B, Pilley C. Research relationships between the South and the North: Cinderella and the ugly sisters? *Soc Sci Med.* 2003 Nov;57(10):1957–67. [https://doi.org/10.1016/S0277-9536\(03\)00060-1](https://doi.org/10.1016/S0277-9536(03)00060-1) PMID:14499518
14. Lyons M. The colonial disease. A social history of sleeping sickness in northern Zaire, 1900–1940. Cambridge: Cambridge University Press; 1992. <https://doi.org/10.1017/CBO9780511583704>
15. Birn A-E, Solórzano A. Public health policy paradoxes: science and politics in the Rockefeller Foundation's hookworm campaign in Mexico in the 1920s. *Soc Sci Med.* 1999 Nov;49(9):1197–213. [https://doi.org/10.1016/S0277-9536\(99\)00160-4](https://doi.org/10.1016/S0277-9536(99)00160-4) PMID:10501641
16. Climate change and health research: current trends, gaps and perspectives for the future. Geneva: World Health Organization; 2021. Available from: <https://iris.who.int/handle/10665/353062> [cited 2025 Dec 14].
17. Timmermann C, Wild V. Sustainability transitions in university hospitals: contextualising research incentives and ethical responsibilities. *Gaia* (Heidelb). 2024;33(4):351–6. <https://doi.org/10.14512/gaia.33.4.5>
18. Sovacool BK, Daniels C, AbdulRafiu A. Science for whom? examining the data quality, themes, and trends in 30 years of public funding for global climate change and energy research. *Energy Res Soc Sci.* 2022;89:102645. <https://doi.org/10.1016/j.erss.2022.102645>
19. Overland I, Fossum Sagbakken H, Isataeva A, Kolodzinskaia G, Simpson NP, Trisos C, et al. Funding flows for climate change research on Africa: where do they come from and where do they go? *Clim Dev.* 2022;14(8):705–24. <https://doi.org/10.1080/17565529.2021.1976609>
20. Kumar R, Khosla R, McCoy D. Decolonising global health research: Shifting power for transformative change. *PLOS Glob Public Health.* 2024 Apr 24;4(4):e0003141. <https://doi.org/10.1371/journal.pgph.0003141> PMID:38656955
21. Abimbola S, Asthana S, Montenegro C, Guinto RR, Jumbam DT, Louskieter L, et al. Addressing power asymmetries in global health: Imperatives in the wake of the COVID-19 pandemic. *PLoS Med.* 2021 Apr 22;18(4):e1003604. <https://doi.org/10.1371/journal.pmed.1003604> PMID:33886540
22. Powers M, Faden R. Structural injustice: power, advantage, and human rights. Oxford: Oxford University Press; 2019. <https://doi.org/10.1093/oso/9780190053987.001.0001>
23. Whyte KP. Is it colonial déjà vu? Indigenous peoples and climate injustice. In: Adamson J, Davis M, editors. *Humanities for the environment: integrating knowledge, forging new constellations of practice.* New York: Routledge; 2016. pp. 88–104.
24. Pratt B, Loff B. Health research systems: promoting health equity or economic competitiveness? *Bull World Health Organ.* 2012 Jan 1;90(1):55–62. <https://doi.org/10.2471/BLT.11.092007> PMID:22271965
25. Kim H, Novakovic U, Muntaner C, Hawkes MT. A critical assessment of the ideological underpinnings of current practice in global health and their

historical origins. *Glob Health Action*. 2019;12(1):1651017.
<https://doi.org/10.1080/16549716.2019.1651017> PMID:31431145

26. Pratt B. Supplemental file 1. Amsterdam: Mendeley Data; 2025.
<https://doi.org/10.17632/c3xffz33st.1>
27. Rid A. Judging the social value of health-related research: current debate and open questions. *Perspect Biol Med*. 2020;63(2):293–312.
<https://doi.org/10.1353/pbm.2020.0020> PMID:33416654
28. De-Shalit A. Why posterity matters: environmental policies and future generations. New York: Routledge; 1995.
29. Moellendorf D. Climate change justice. *Philos Compass*. 2015;10(3):173–86.
<https://doi.org/10.1111/phc3.12201>
30. Schlosberg D, Collins LB. From environmental to climate justice: climate change and the discourse of environmental justice. *Wiley Interdiscip Rev Clim Change*. 2014;5(3):359–74. <https://doi.org/10.1002/wcc.275>
31. Nussbaum M. Women and human development: the capabilities approach. Cambridge: Cambridge University Press; 2000.
<https://doi.org/10.1017/CBO9780511841286>
32. Venkatapuram S. Health justice: an argument from the capabilities approach. Cambridge: Polity Press; 2011.
33. Powers M, Faden R. Social justice: the moral foundations of public health and health policy. New York: Oxford University Press; 2006.
34. Whyte K. Settler colonialism, ecology, and environmental injustice. *Environ Soc*. 2018;9(1):125–44. <https://doi.org/10.3167/ares.2018.090109>
35. Rodríguez I. Latin American decolonial environmental justice. In: Coolsaet B, editor. *Environmental justice*. London: Routledge; 2020. pp. 78–93.
<https://doi.org/10.4324/9780429029585-8>
36. McGregor D. Indigenous environmental justice, knowledge, and law. *Kalfou*. 2018;5(2): <https://doi.org/10.15367/kf.v5i2.213>
37. Romanello M, Di Napoli C, Drummond P, Green C, Kennard H, Lampard P, et al. The 2022 report of the Lancet Countdown on health and climate change: health at the mercy of fossil fuels. *Lancet*. 2022 Nov 5;400(10363):1619–54.
[https://doi.org/10.1016/S0140-6736\(22\)01540-9](https://doi.org/10.1016/S0140-6736(22)01540-9) PMID:36306815
38. Jamieson D. Adaptation, mitigation, and justice. In: Sinnott-Armstrong W, Howarth RB, editors. *Perspectives on climate change: science, economics, politics, ethics. Advances in the economics of environmental resources*. Volume 5. Leeds: Emerald Publishing Limited; 2005. pp. 217–48.
39. Shue H. Subsistence emissions and luxury emissions. *Law Policy*. 1993;15(1):39–60. <https://doi.org/10.1111/j.1467-9930.1993.tb00093.x>
40. Hara K, Yoshioka R, Kuroda M, Kurimoto S, Saijo T. Reconciling intergenerational conflicts with imaginary future generations: evidence from a participatory deliberation practice in a municipality in Japan. *Sustain Sci*. 2019;14(6):1605–19. <https://doi.org/10.1007/s11625-019-00684-x>

41. Baumann T. Representing future generations in the political process. Center for Reducing Suffering; 2020. Available from: <https://centerforreducingsuffering.org/research/representing-future-generations-in-the-political-process/> [cited 2024 April 15]
42. Gosseries A. Introduction: representing future generations? Jurisprudence. 2015;6(3):492–5. <https://doi.org/10.1080/20403313.2015.1065648>
43. Gonzalez-Ricoy I, Rey F. Enfranchising the future: climate justice and the representation of future generations. Wiley Interdiscip Rev Clim Change. 2019;10(5):e598. <https://doi.org/10.1002/wcc.598>
44. Holland B. Procedural justice in local climate adaptation: political capabilities and transformational change. Env Polit. 2017;26(3):391–412. <https://doi.org/10.1080/09644016.2017.1287625>
45. Pierson L, Millum J. Health research priority setting: the duties of individual funders. Am J Bioeth. 2018 Nov;18(11):6–17. <https://doi.org/10.1080/15265161.2018.1523490> PMID:30475176
46. Belkhir L, Elmeligi A. Carbon footprint of the global pharmaceutical industry and relative impact of its major players. J Clean Prod. 2019;214:185–94. <https://doi.org/10.1016/j.jclepro.2018.11.204>
47. Koum Besson ES. How to identify epistemic injustice in global health research funding practices: a decolonial guide. BMJ Glob Health. 2022 Apr;7(4):e008950. <https://doi.org/10.1136/bmjgh-2022-008950> PMID:35470130
48. Pratt B, Hyder AA. Designing research funding schemes to promote global health equity: An exploration of current practice in health systems research. Dev World Bioeth. 2018 Jun;18(2):76–90. <https://doi.org/10.1111/dewb.12136> PMID:27878976

Box 1. Trends of concern regarding funding of research on climate change and health

1. Trend: funders mostly allocate their budget to research on climate change and health conducted in high-income countries, with little research performed in the countries most vulnerable to climate change. That is because the geographical distribution of country-specific research is very uneven according to the evidence below.
Evidence: from 2008 to 2019, high-income countries were the focus of 51.9% (1035/2034) of climate change and health research studies. Much less research was conducted in low- and middle-income countries in the Pacific, Africa and Latin America (all < 10%).¹⁶ From 2013 to 2019, 79.4% (12 629/15 914) of studies on climate change and health focused on high-income and upper middle-income nations, such as China.⁵ The number of publications on climate change and health with study location names in high-income countries was two times more than the number with study location names in lower middle-income countries, and almost 10 times more than the number with study location names in low-income countries.⁵ In addition, a so-called inverse research law appears to exist whereby communities where the impact of climate change is predicted to be most severe attract the least amount of research on climate change and health.¹⁶
2. Trend: the focus of most of the research on climate change and health awarded funding may not align strongly with the health needs and priorities of low- and middle-income countries. Evidence: the research on climate change and health from high-income countries shows an increasing emphasis on chronic diseases, respiratory health and health-system demand.⁵ In contrast, such literature from low-income countries shows a decreasing emphasis on those areas and increasing emphasis on infectious diseases, food and nutrition, water, sanitation and hygiene, and maternal and child health.⁵
3. Trend: funding may favour health impact studies over mitigation studies and adaptation studies.
Evidence: climate–health research between 2013 and 2019 was dominated by impact studies (9172 studies), with only a minority of studies focusing on mitigation (1198) or adaptation (741).⁵ The same pattern was found in a WHO scoping review of health research focused on climate change published between 2008 and 2019.¹⁶
4. Trend: funding may favour health research on high-technology solutions over low-technology or structural solutions.
Evidence: sustainability transitions are complicated by incentives that favour scientific or technological breakthroughs at the expense of low-technology (or nontechnological) solutions without prior systematic assessment of their social value.¹⁷ Additionally, the social determinants of the impact of climate change on health and modifiable entry points for intervention are underrepresented among the topics in the literature on climate change and health.⁵
5. Trend: funding from high-income countries is mostly allocated to climate and health research institutions based in high-income countries or their former colonies.
Evidence: based on a sample of 1000 research projects granted funding between 1990 and 2020 of more than US\$ 2.2 billion, funding for climate research projects has been largely allocated to the European Union (40.1%), United Kingdom of Great Britain and Northern Ireland (36.2%) and United States of America (9.8%).¹⁸ For Africa-focused research projects on climate change, for example, research institutions based in western Europe and the United States received 78.0% (US\$ 480.25 million) of the funding from 1990 to 2020 compared with only 14.5% (US\$ 89.15 million) for institutions based in Africa. Thus, much of the funding for research on climate issues in Africa originates outside Africa and goes to research institutions outside Africa.¹⁹ The six African countries with institutions that received the most funding for Africa-related research on climate change over the period 1990–2020 were all former British colonies.¹⁹

US\$: United States dollars; WHO: World Health Organization.

Table 1. Recommendations for further specification of WHO criteria for research on climate change and health

WHO criterion⁶	Proposed further specification for research on climate change and health	Funding trend in research on climate change and health reduced by the proposed specification
Social value (magnitude of benefits, likelihood of benefits and equity)	In assessing the magnitude of benefits and the relative value of benefits and beneficiaries, give environmental benefits similar (but perhaps not equal) weight relative to health benefits and give some (but not equal) weight to people in the distant future relative to people now and in the near future	Trend 3: resource allocation bias against mitigation studies and adaptation studies
	Rather than assessing the extent to which providing the benefits will reduce inequities, assess the extent to which providing the benefits will reduce climate injustice, that is, the unequal risk of climate change impacts on health and well-being	Trend 1: resource allocation to research done in high-income countries Trend 2: resource allocation to research relevant to high-income countries
	In assessing reduction of climate injustice, give some priority to studies that tackle structural or root causes of unequal risk of climate change impacts on health and well-being	Trend 4: resource allocation to research on high-technology solutions
Fair process (inclusion, transparency and accountability)	In achieving inclusion, representatives from low- and middle-income countries and future generations participate as decision-makers	Trend 1: resource allocation to research done in high-income countries Trend 2: resource allocation to research relevant to high-income countries Trend 5: resource allocation to researchers in high-income countries
Special obligations	In identifying special obligations, give specific consideration of constitutive duties and duties of culpability for governments of high-income countries, multilateral institutions, pharmaceutical companies and, where relevant, nonprofit organizations	Trend 1: resource allocation to research done in high-income countries Trend 2: resource allocation to research relevant to high-income countries

WHO: World Health Organization.