



Climate change and global public health: 2022 Richard and Hinda Rosenthal Symposium



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Executive summary

Climate change, driven primarily by greenhouse gas emissions, will have far-reaching implications for life on Earth. Through a wide range of direct and indirect pathways it is already clear that climate change is having a profound impact on human health. Many of the worst impacts of these changes are being experienced by the most marginalised and disadvantaged communities. Climate change is therefore exacerbating existing health inequalities.

In July 2022, the UK Academy of Medical Sciences and US National Academy of Medicine co-hosted the 2022 Richard and Hinda Rosenthal Symposium, which focused on climate change and global public health. The symposium was a hybrid event at the National Academy of Medicine in Washington, with a limited number of people travelling internationally and many more joining remotely. The Symposium took stock of the current situation, future prospects, scope for decarbonisation of health sectors in the two countries, and the connections between climate change, health and other key sectors, such as agriculture, transportation and energy generation. The two Academies also discussed ways in which they might work together to address this existential threat to human existence.

Among the key issues highlighted were:

Placing health at the heart of the climate change narrative: Health impacts have not received due attention in climate debates. Highlighting the health consequences of rising temperatures and environmental disruption, as well as the health and wellbeing benefits associated with decarbonisation, provides a compelling drive to accelerate action.

Adaptation and mitigation need to be considered together: Mitigation (actions to limit global temperature rises and therefore avert health impacts) and adaptation (changes to manage the impacts associated with higher temperatures, including the impact on health) are typically considered separately. There is a need to adopt a more integrated approach, in particular to assess the synergies and trade-offs associated with particular actions and to avoid unintended consequences and inequitable outcomes.

Climate interventions are health interventions: Emphasising the negative consequences of climate change can lead audiences to disengage. By contrast, many interventions to mitigate climate change have the potential to deliver multiple health benefits, for example by reducing pollution or promoting healthier lifestyles. Stressing the positive is likely to be a more effective way of engaging with public audiences.

Public support is vital but climate change can be a sensitive issue: Public support for mitigation and adaptation measures is essential and encouraging progress has been made in recent years. However, climate change has become a politicised issue, particularly in the US, and presents a communication challenge. Focusing on specific issues, such as drought, extreme heat, wildfires, agricultural yields, and the health co-benefits of addressing these issues, may allow for constructive dialogue when political convictions might be a barrier. Further work is needed to understand public attitudes and how they are influenced.

Health needs to have a stronger voice in global and national policy dialogue: To date, the health community has not had a strong voice in climate conversations, despite the substantial impact of climate change on health. The health sector needs to avoid the risk of silos and increase its engagement with sectors such as energy, transport, industry, urban planning, and agriculture and food supply, to emphasise the public health implications of courses of action and to promote a 'health in all policies' perspective.

Health researchers need to forge stronger relations across disciplines: The impacts of climate change on health are mediated through complex pathways. Understanding these impacts – and how mitigation and adaptation actions could benefit health – will require integrated cross-disciplinary efforts. For the Academies, this could involve working more closely with other national academies that represent other disciplines.

Health researchers should seek to exploit synergies with activities addressing social determinants of health: Significant efforts are already being made to address health inequities by focusing on the social determinants that typically underlie them. There are opportunities to build on and integrate these actions with those driven by the climate imperative to ensure that actions contribute to both goals.

The Academies identified a range of ways in which they might work more closely together to enhance the presence of the health perspective on the global stage, to advance health-informed climate communication, and to promote global innovation in support of climate goals and health.

In conclusion, the Symposium highlighted the profound threat to human health posed by climate change, but also how real actions are beginning to be taken at local, national and global levels – albeit currently too slowly for Paris Agreement targets to be met. The health research communities in the UK and the US have the potential to contribute to decarbonisation within the health sector but can also play a much wider role in stressing the health impacts of climate change – and the benefits to be gained from mitigation and adaptation efforts¹. The collaborative efforts of the two Academies could help to ensure that this influence is fully realised.

1. It is important to note the potential for economic growth through innovation commercialisation and industry for those that develop solutions to tackle climate change amongst the various mitigation and adaptation strategies discussed in the meeting.

Introduction

Increasing greenhouse gas emissions and changing land use are heating the world and causing major environmental disruption. These are already beginning to have significant implications for ecosystems, and also for human health.

In July 2022, the UK Academy of Medical Sciences and the US National Academy of Medicine jointly organised a hybrid event, to take stock of the health consequences of climate change, particularly on vulnerable and disadvantaged populations, and how the Academies could work together to limit its further impact.

Opening the meeting, **Sir Andy Haines**, Professor of Environmental Change and Public Health, London School of Hygiene and Tropical Medicine, UK, provided an overview of the climate emergency. Global average temperatures are rising inexorably, primarily driven by rising levels of greenhouse gases, particularly carbon dioxide and methane, due to human activities – principally the burning of fossil fuels and land use changes such as deforestation². Notably, 10% of the global population is responsible for nearly half of all global carbon dioxide emissions³.

Changes to the climate are having multiple direct or indirect effects on human health and wellbeing⁴. Risks include higher temperatures, more frequent extreme weather events such as floods, droughts and severe storms, wildfires, reduced water quality and availability, compromised food supplies, changes to the distribution of vector-borne, food-borne and water-borne diseases, and multiple psychosocial impacts.

Professor Haines noted that it is now possible to attribute specific numbers of death to specific aspects of climate change, such as higher temperatures. An analysis of data from 43 countries for 1990–2018, for example, suggests that more than 30% of heat-related deaths over this period can be attributed to climate change⁵. However, these are likely to be underestimates as there are many gaps in the data globally, particularly in low-income countries that are likely to bear the brunt of climate change.

There are multiple pathways through which health is affected, not all of them obvious. For example, rising temperatures are associated with an increased risk of preterm birth⁶ and other adverse pregnancy outcomes, which have many consequences for mother and infant. Death rates have been found to jump markedly in the immediate aftermath of wildfires, because of reduced air quality⁷. Melting permafrost is releasing methane, a potent greenhouse gas, but also threatens to release long-frozen pathogens (including smallpox virus), dangerous chemicals and nuclear waste⁸.

The changing climate is likely to have profound impacts on food systems, including crop yields. Although these may increase in some regions, crop productivity globally is projected to decline sharply at higher temperatures⁹. The nutritional quality of crops is also projected to decline as a result of higher CO₂ levels in the atmosphere¹⁰.

2. Intergovernmental Panel on Climate Change (IPCC). *Climate Change 2021: The Physical Science Basis. Summary for Policymakers*. Available at: https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM.pdf
3. <https://wid.world/news-article/climate-change-the-global-inequality-of-carbon-emissions/>
4. Haines A, Ebi K. *The Imperative for Climate Action to Protect Health*. N Engl J Med. 2019;380(3):263-273. doi: 10.1056/NEJMra1807873.
5. Vicedo-Cabrera AM, Scovronick N, Sera F et al. *The burden of heat-related mortality attributable to recent human-induced climate change*. Nat Clim Chang. 2021;11(6):492-500. doi: 10.1038/s41558-021-01058-x.
6. Chersich MF, Pham MD, Areal A et al. *Associations between high temperatures in pregnancy and risk of preterm birth, low birth weight, and stillbirths: systematic review and meta-analysis*. BMJ. 2020;371:m3811. doi: 10.1136/bmj.m3811.
7. Chen G, Guo Y, Yue X et al. *Mortality risk attributable to wildfire-related PM_{2.5} pollution: a global time series study in 749 locations*. Lancet Planet Health. 2021;5(9):e579-e587. doi: 10.1016/S2542-5196(21)00200-X.
8. Miner RK, D'Andrilli J, Mackelprang R et al. *Emergent biogeochemical risks from Arctic permafrost degradation*. Nature Climate Change. 2021;11:809–19.
9. Challinor AJ, Watson J, Lobell DB et al. *A meta-analysis of crop yield under climate change and adaptation*. Nature Climate Change. 2014;4:287–291
10. Kristie L. Ebi and C. Leigh Anderson et al. *Nutritional quality of crops in a high CO₂ world: an agenda for research and technology development*. Environmental Research Letters, May 2021. <https://iopscience.iop.org/article/10.1088/1748-9326/abfca>

These changes will increasingly impact many millions of people, affecting their health, livelihoods, surroundings and food security. Displacement, hardship and the loss of treasured landmarks will have mental health impacts, while the young are already experiencing ‘climate anxiety’.

Broadly speaking, the responses to the climate emergency can be categorised as either **adaptation**, changing behaviour or infrastructure to minimise the impact of climate change, or **mitigation**, preventing rising temperatures by curbing greenhouse gas emissions or for example accelerating the uptake of carbon dioxide by natural systems e.g., by reforestation.

Mitigation actions may include clean renewable energy, more sustainable active transportation and changing diets which can also be considered to be adaptation strategies. Adaptation can encompass improved flood protection, upgrading infrastructure, creating more climate-resilient health systems, and better disaster management and Continuity of Operations planning by government and businesses.

Notably, many mitigation actions also deliver health benefits. Phasing out fossil fuels, for example, would avert millions of premature deaths annually from air pollution¹¹. Methane generated in agriculture and from gas leakages creates tropospheric ozone, which reduces crop yields and damages the lungs. If the population of the UK were to adopt diets conforming to WHO nutritional guidelines, this would cut GHG emissions by about 17% and save 7 million lives over 30 years¹². Other calculations suggest that, in nine countries for which good data are available, meeting Paris climate change agreements would avoid millions of annual premature deaths¹³.

Creative solutions are being developed to support mitigation and adaptation. Multiple new foodstuffs are being developed with lower carbon footprints. Through nature-based solutions, natural systems can be harnessed to protect environments and sequester more carbon¹⁵.

Professor Haines also noted the importance of considering trade-offs. Closing coal mines leads to unemployment and economic decline in mining communities, so healthy net-zero job creation must also be a priority. Mining for lithium or cobalt for batteries includes ‘artisanal’ mining operations in low-income countries, some of which employ children.

While individuals can adjust their behaviour to reduce their carbon footprint (particularly by focusing on high-impact activities such as air travel and car use), systemic changes are required to decarbonise economies. Psychological models such as the COM-B framework highlight the factors affecting behaviour and the policy options available for shifting them¹⁶.

Professor Haines concluded by noting that a wealth of information is now available on the human impacts of climate change. With the crisis so urgent, he argued that there was a need to move beyond descriptions and modelling and to begin acting and evaluating impacts.

11. *Effects of fossil fuel and total anthropogenic emission removal on public health and climate.* Lelieveld J, Klingmüller K, Pozzer A, Burnett RT, Haines A, Ramanathan V. *Proc Natl Acad Sci U S A.* 2019;116(15):7192-7197. doi: 10.1073/pnas.1819989116.
12. Milner J, Green R, Dangour AD *et al.* *Health effects of adopting low greenhouse gas emission diets in the UK.* *BMJ Open.* 2015;5(4):e007364. doi: 10.1136/bmjopen-2014-007364.
13. Hamilton I, Kennard H, McGushin A *et al.* *The public health implications of the Paris Agreement: a modelling study.* *Lancet Planet Health.* 2021;5(2):e74-e83. doi: 10.1016/S2542-5196(20)30249-7.
14. Parodi A, Leip A, De Boer IJM *et al.* *The potential of future foods for sustainable and healthy diets.* *Nat Sustain.* 2018; 1:782–789. doi.org/10.1038/s41893-018-0189-7
15. Griscom BW, Adams J, Ellis PW *et al.* *Natural climate solutions.* *Proc Natl Acad Sci USA.* 2017;114(44):11645-11650. doi: 10.1073/pnas.1710465114.
16. Michie S, van Stralen MM, West R. *The behaviour change wheel: a new method for characterising and designing behaviour change interventions.* *Implement Sci.* 2011;6:42. doi: 10.1186/1748-5908-6-42

Decarbonising health systems

Nick Watts, Chief Sustainability Office for the UK National Health Service (NHS), described some of the actions being taken by the NHS to achieve its net-zero target by 2045. Due to the devolved nature of the NHS, this strategy has three headings – autonomy, capability and capacity, and relatedness.

Autonomy reflects the fact that the NHS is composed of multiple administrative subunits, each of which now has a publicly available net-zero strategy. All subunits have calculated annual emissions targets and appointed Board-level leads to ensure accountability. The net-zero vision is enshrined within legislation, the Health and Care Act 2022, the first piece of legislation anywhere in the world directly addressing the health profession's response to climate change.

Capability and capacity recognises that it is the 1.4 million people employed by the NHS who will deliver on the net-zero agenda. New funding has been secured (£660m a year) to support pathfinder projects, testing innovations on a small scale, such as two zero-emission ambulances.

Procurement from third-party suppliers' accounts for 62% of NHS emissions and is an important target for action. From 1 April 2027, new qualifying criteria will be introduced for everything the NHS purchases. In advance, from 1 April, a 10% weighting has been introduced, sending a message to suppliers about the seriousness of the NHS's intentions.

Relatedness reflects the fact that the NHS has been slow to share good ideas and learn from others. Through a greener NHS delivery fund, small sums are available to individual clinicians to 'borrow' an idea that improves patient care and tackles climate change, the proviso being that they must share their experience.

In addition, a new partnership is being set up with the World Health Organisation, with £1.5m funding a year over ten years, to ensure that success stories can be shared globally. One of the advantages of joint approaches is that collective action can create economies of scale and achieve greater leverage on suppliers.

As noted by **John Balbus**, Acting (Deputy) Director at the Office of Climate Change and Health Equity, US Department of Health and Human Services, the US system differs significantly from the UK's, representing a healthcare sector dominated by private sector enterprises. Decarbonisation is therefore more complex, requiring coordinated action across many stakeholders.

A strong political statement has been made by the Biden administration, which in 2021 established a new **Office of Climate Change and Health Equity**. It has three priority areas: protecting the health of the people from climate-related impacts; addressing the unequal burden faced by disadvantaged populations; and health sector resilience and decarbonisation.

The US has a broader **federal decarbonisation goal**, with all agencies required to cut emissions by roughly 50% by 2030 and to be net zero by 2050. Federal health agencies have established a learning network to share ideas on how these targets can be achieved. Conversations across the public-private divide are being taken forward through the National Academy of Medicine **Action Collaborative** (see below).

Conversations with stakeholders have revealed a widespread recognition of the need for urgent action, although there is more interest in resilience than in mitigation. Agreed metrics and reporting systems are seen as critical. The COVID-19 pandemic is a complicating factor but is not viewed as reason to delay action, while the need for additional financial resourcing was also stressed. It was also noted that health sector policy emphasises care quality, equity and costs, and without evidence of impacts in these areas, it will be difficult to shift policy.

Dr Balbus also highlighted the need to align climate-driven actions with work addressing the root causes of health inequities. As many climate impacts operate through **social determinants of health**, there are opportunities to coordinate activities to maximise climate and health benefits.

Recent activities have included a White House event for signatories of COP26 health sector climate pledge. A webinar series has been launched¹⁷, and a major learning network on climate change and cardiovascular disease is being created¹⁸.

George Barrett, Chairman of the Healthcare Leadership Council, provided additional background on the National Academy of Medicine's **Action Collaborative**. Its focus is on **decarbonisation of the health sector**, which will require collaboration across a diverse range of public and private stakeholders. The Action Collaborative has established a steering committee and four working groups focusing on healthcare delivery, the healthcare supply chain, professional education, and policy, financing and metrics as a cross-cutting theme.

A short-term objective for the delivery workstream will be reducing activity, as the US system creates some incentives for unnecessary procedures. As in the UK, the supply chain is a major contributor of carbon emissions. Concerted efforts will be needed to drive down this footprint while also building greater resilience, underpinned by an emphasis on sustainable innovation.

The professional education stream will help to ensure that climate impacts are routinely considered by all healthcare professionals. The cross-cutting policy, financing and metrics workstream reflects the need for thoughtful, evidence-based policies and incentives, underpinned by an agreed set of metrics. Ultimately, there is no single path to net zero, but agreed metrics will ensure that all are aware of how far they have to travel.

An extension of the collaborative covers a much wider network of organisations. These have the opportunity to learn from the best practices identified by the collaborative, while also feeding additional insights into the collaborative's work.

Mr Barrett concluded by emphasising the interconnectedness of the sector, and how coordinated action will be essential. For example, manufacturers cannot independently introduce innovations if they are not acceptable to the deliverers of care. Collaboration must therefore be the keyword going forward, and new mechanisms and relationships will be needed to make it happen.

In discussions, it was noted that **changing medical school curricula** could be challenging. However, the Association of American Medical Colleges is a committed member of the Action Collaborative. In the UK, the General Medical Council works with the Royal Colleges to set curricula, providing a potential route of influence. One goal could be to develop a set of core competencies that the future health workforce will require in an urbanising and heating world.

It was also noted that young people are typically highly engaged with climate issues. Medical students are pushing their institutions to be more active. In the US, a group of students have created an influential **planetary health report card** for medical schools.

The prospect of a 'circular economy' for the healthcare supply chain was raised. It was noted that many of the processes that go into pharmaceutical manufacturing are 'dirty'; however, changes to processes have to be approved by regulatory authorities, which may take years to achieve. Nevertheless, in the UK, key regulators are often more flexible than their reputations suggest, as illustrated by their responsiveness during the COVID-19 pandemic.

It was also noted that there is close alignment between climate-driven action and the **health promotion and disease prevention** measures being promoted to address health inequities. More generally, it was suggested that a fundamental shift in framing may be required, to create health systems that focus on health rather disease, underpinned by policies that aim to improve and sustain health. However, this would require a groundswell of public support and political will.

17. <https://www.hhs.gov/climate-change-health-equity-environmental-justice/climate-change-health-equity/actions/health-care-sector-pledge/webinar-series/index.html>

18. <https://millionhearts.hhs.gov/about-million-hearts/building-communities/particle-pollution.html>

Integrating mitigation and adaptation

Professor Lea Berrang Ford, Priestly Chair in Climate and Health, University of Leeds, UK, noted that, although decarbonisation strategies hold the potential to enhance health, there are also potential downsides or trade-offs. She highlighted that the ideal options are those that are good for health and decarbonisation, and also do not compromise development goals.

This requires careful consideration of the options available and their potential positive and negative implications for different demographic groups/populations. Differing perspectives may need to be considered, as different groups may not necessarily share the same priorities.

Professor Berrang Ford also argued that mitigation and adaptation, often considered separately, need to be assessed together, so that potential trade-offs can be assessed. Currently, most publications focus on either mitigation and adaptation independently (and are outnumbered hugely by those discussing impacts). Hence only limited evidence is available to support systematic efforts to maximise benefits and minimise trade-offs during decision-making.

She therefore suggested that the research community needs to do more to synthesise existing evidence, to close key evidence gaps, and to present the evidence to policymakers. In particular, this can highlight 'red flags' – where options could have significant trade-offs for the climate and/or health. Use of air-conditioning, for example, is an effective adaptation mechanism but also drives up greenhouse gas emissions. Conversely, 'green light' or win-win interventions can be identified, where options deliver both climate and health benefits, such as shifts in dietary behaviour and more active transportation.

Elizabeth Finkelman, Senior Program Officer, National Academy of Medicine Grand Challenge on Climate Change, Human Health, and Equity, discussed some of the US National Academies' work in this area. The Grand Challenge on Climate Change, Human Health, and Equity¹⁹ was launched in recognition of the fact that the health risks of climate change are not equally distributed but concentrated on the most vulnerable and disadvantaged populations, often due to historic and/or current systemic inequities. Such populations are less able to prepare for and respond to climate change, which therefore has the potential to exacerbate existing social and health inequities.

The Global Challenge is a multiyear National Academy of Medicine initiative launched in 2021 that seeks to protect and improve human health by transforming the systems that contribute to and are impacted by climate change. It has four strategic objectives:

- To communicate the climate crisis as a public health and equity crisis.
- To catalyse health sector decarbonisation (through the Action Collaborative, see above).
- To develop a roadmap for systems transformation – a report outlining how critical systems, such as agriculture, transportation and energy, can be redesigned to promote more sustainable and equitable health.
- To accelerate research and innovation at the interface between climate change and health inequity.

To support these goals, a platform for bidirectional sharing of information and dialogue has been established, the **climate communities network**. In the past, underserved and marginalised communities have rarely had a voice in policy discussions, research funding policy and funding decisions. The network will provide an opportunity for stakeholders to hear directly from communities bearing the brunt of climate change, on the challenges and possible solutions.

Later this year, a network of around 30 community-based organisations and leaders representing affected communities will begin to work together to address common challenges, co-design solutions and identify opportunities for research to improve health in the context of the climate emergency. It will provide a neutral space where all groups can openly share and discuss challenges, innovative new practices and solutions. It will ensure that community knowledge and wisdom guides the direction and output of these programmes.

The group plans to produce a document summarising how US populations, particularly marginalised and disadvantaged ones, have been disproportionately affected by climate change. It will also highlight examples where communities are collaborating across sectors on successful mitigation and adaptation activities.

19. <https://nam.edu/programs/climate-change-and-human-health/>

Efforts will also be made to coordinate activities across the US Academies of Science, Engineering and Medicine, including a quarterly staff meeting series, whereby staff from across the US Academies can come together to share learnings, challenges and best practice around community engagement.

Rachel Stancliffe, Founder and Director of the Centre for Sustainable Healthcare, a non-profit based in Oxford, UK, argued that there is a need to engage as many people as possible in understanding the problem and finding solutions. As well as implementation of strategic plans, each individual healthcare professional can play a role in decarbonising health systems.

Given the gravity of the situation, there is an urgent need to identify successful solutions and to share them for wider take up. The key challenge is to combine the drive towards improved care with reductions in greenhouse gas emissions. A greater emphasis on upstream prevention, to reduce disease and the need for treatment, would be one way to benefit both people and the climate.

To promote this agenda, the Centre for Sustainable Healthcare has partnered with a range of UK NHS bodies on sustainability initiatives, including the 'NHS Forest' project to create more green space around hospitals and other NHS sites²⁰. It also works to promote sustainability in the medical curriculum and runs short courses for healthcare professionals. It is also establishing speciality networks, facilitating the exchange of green ideas between professionals in different medical disciplines.

Dr Alexandra Adams, Center for American Indian and Rural Health Equity, Montana State University, USA, experienced the impacts of climate change first hand when wildfires affected large parts of Montana in 2017. She and a group of public health colleagues were prompted to audit the human health impact of climate change in the state²¹.

The findings provided the first systematic account of the impacts of climate change on rural farming and Native American communities. Farming communities are generally economically disadvantaged and at significant risk of climate-driven changes that affect agricultural productivity. The same is true of Native American communities, who face multiple vulnerabilities and have a life expectancy 10-15 years lower than that of their white counterparts in the state.

Notably, during the work, the team experienced significant pushback against use of the term 'climate change'. Drought, smoke and fire were seen as important concerns, but climate change has become a loaded and politicised term. This was less so for Native American communities.

Notably, three tribes living on reservations in -Montana had already carried out their own climate change and adaptation planning. As the communities are remote, heavily reliant on local food production, and with growing seasons short, food security is already a key issue. Among the solutions being tried were identification of the most resilient seeds and reintroduction of bison – the animals being more heat-resistant than cattle.

Dr Adams also noted that, although the situation is a crisis, too much doom and gloom can be counterproductive when engaging with communities, leading to defeatism and shutting down conversation. Focusing on solutions can open up new ways of engaging. As well as nailing down arguments at an intellectual level, she suggested that it was also important to engage with people's hearts and their spirit – or "engaging people's whole selves". Providing positive examples where local communities had made changes, without economic pain and benefiting as a result, can be particularly persuasive.

In discussions chaired by Professor Tom Solomon CBE FRCP FMedSci, Vice President (International), UK Academy of Medical Sciences, **how best to communicate with public audiences** was repeatedly raised. Scientists have been battling disinformation campaigns and need to identify the most effective approaches, for example by framing climate change in terms of its impacts on people's health and wellbeing.

20. <https://sustainablehealthcare.org.uk/what-we-do/green-space/nhs-forest>

21. Adams A, Byron R, Maxwell B, Higgins S, Eggers M, Byron L, Whitlock C. 2021. *Climate change and human health in Montana: a special report of the Montana Climate Assessment*. Bozeman MT: Montana State University, Institute on Ecosystems, Center for American Indian and Rural Health Equity. 216 p. <https://doi.org/10.15788/c2h22021>.

It was suggested that attitudes had changed significantly in the last five years, particularly among young people but also among older people who may be experiencing 'climate guilt'. The US and UK may differ to the degree in which climate change has been politicised, and the extent to which a lack of understanding is inhibiting action. Political polarisation, as seen in the US, presents a huge challenge if attitudes become entrenched along party political lines.

The value of **emotional as well as intellectual communication** was also noted. This may be uncomfortable for many scientists, more used to dispassionate communication to fellow researchers. Yet appealing to people's spiritual side, including their religious beliefs, can be powerful drivers of behaviour. The arts and humanities may also offer a way to encourage reflection and trigger new conversations.

It was also noted that those living closest to nature often have a deep understanding of the interconnectedness of natural systems and an awareness of how to work with, rather than against, nature. A key challenge is how to ensure that this wisdom is shared more widely and captured in national discussions. Due to a past history of discrimination, some potentially influential voices may be unwilling to speak; and additionally, sadly, COVID-19 has led to the deaths of many elders and the loss of their accumulated wisdom.

Participants also emphasised the **complex nature of adaptation and mitigation decision-making** and the need to consider possible trade-offs. As many public health or climate interventions can end up benefiting mainly the well-off, it was argued that equity should be a theme that runs through all decision-making. Groups like the Centre for Sustainable Healthcare have developed deliberative frameworks that embed equity considerations in decision-making processes.

Sector actions

Professor Jonathan Patz, Global Health Institute, University of Wisconsin, Madison, USA, noted that air pollution causes an estimated 7 million premature deaths a year²². Cleaner energy generation could dramatically cut such figures, and some gains have already been achieved: wind and solar power deployment in the USA between 2007 and 2015 resulted in US\$29.7–112.8 billion in air quality benefits and prevented 3000–12,700 premature deaths²³.

The economic arguments are also beginning to be won. Professor Patz pointed out that, since 2019, if all subsidies were removed, the cheapest way to generate electricity is from renewables and batteries²⁴.

The evidence suggests that, globally, about 400,000 lives a year are lost because of air pollution from the transportation sector²⁵, emphasising the huge potential health benefits of decarbonising transportation. US cities with the highest levels of walking and biking already show lower rates of obesity and diabetes²⁶. One analysis suggests that cutting air pollution could save 53,000 US lives a year. Benefits vary county by county, depending on local causes of air pollution²⁷.

Professor Patz concluded by arguing that a change of mindset was needed – shifting attention to the benefits to be gained from change rather than the burden of the status quo and stressing that climate solutions double as health interventions²⁸.

The world is rapidly **urbanising** – more than half the world’s population now lives in towns and cities. **Rachel Huxley**, Director of Knowledge and Learning, C40 Cities, described some of the progress towards low-carbon, resilient, equitable and healthy cities.

Through the C40 cities initiative²⁹, nearly 100 cities, representing 700 million citizens and responsible for 25% of global GDP and 6–10% of global greenhouse gas emissions, have committed to achieving the 1.5°C aspiration of the Paris Agreement and to creating resilient and equitable cities. They aim to halve emissions within a decade and achieve net zero by 2050.

The initiative also has an interest in assessing the broader impacts of climate change and the benefits of reduced greenhouse gas emissions. When assessing the potential impact of climate actions, health came out as a huge beneficiary. It was also something that both policymakers and the public could relate to: the benefits feel more tangible and immediate than those traditionally associated with climate change action.

In terms of possible climate actions, many policy options favoured either climate or health but were neutral or negative with respect to the other. However, ‘win-win’ options could be identified when policymakers have access to the appropriate data.

Cities are large, complex and stable systems that can be hard to shift. To effect change, there is a need to be opportunistic and creative. In New York, for example, the Clean Heat Programme has achieved rapid success in reducing air pollution and reducing greenhouse gas emissions.

22. https://www.who.int/health-topics/air-pollution#tab=tab_1

23. Millstein D, Wiser R, Bolinger M, Barbose G. *The climate and air-quality benefits of wind and solar power in the United States*. Nature Energy. 2017;2:17134. DOI: 10.1038/nenergy.2017.134

24. <https://www.irena.org/publications/2019/Jul/Renewable-energy-statistics-2019>

25. Anenberg SC, Achakulwisut P, Brauer M et al. *Particulate matter-attributable mortality and relationships with carbon dioxide in 250 urban areas worldwide*. Sci Rep. 2019;9(1):11552. doi: 10.1038/s41598-019-48057-9.

26. Pucher J, Buehler R, Bassett DR, Dannenberg AL. *Walking and cycling to health: a comparative analysis of city, state, and international data*. Am J Public Health. 2010;100(10):1986-92. doi: 10.2105/AJPH.2009.189324.

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It set up a climate panel and an air quality panel across the whole city, which was technically challenging but provided key data for decision-making.

The city was keen to stop use of the dirtiest heating oil but lacked the powers to ban it outright. However, it did have the power to provide licence permits for boilers, which needed to be renewed every three years. The city was able to use this mechanism to phase out the most polluting heating oils. It also worked with the state of New York on heating oil standards to improve their quality and reduce pollution.

In Oslo, Norway, an alliance between the Lord Mayor and Mayor of the city led to the development of an innovative cycling strategy, which sought to increase the number of journeys made by bike from 30% to a highly ambitious 50%. A new cycling secretariat was created, with resources, a budget and decision-making powers. Having achieved its target, the city innovated again, abolishing the separate secretariat and giving it a cross-cutting coordinating role, the pro-cycling culture having been embedded in the city's governance.

Of particular importance in Oslo was the creation of a carbon budget alongside a financial budget. Just as a finite amount of money has to be allocated each year, so carbon emissions have to be accounted for. In addition, socioeconomic models used to strongly favour road building, leading the cycling team to carry out a similar socioeconomic valuation for cycling, demonstrating equivalent benefits, which influenced city decision-making.

Dr Huxley noted the importance of focusing on issues within the city's control and re-engineering decision-making processes so that a wider range of outcomes are assessed, including those related to health. She also highlighted the need to move away from economic development as the sole measure of success and to integrate wider social, ecological and health perspectives.

Dr Liz Willetts, Senior Policy Advisor on Health-Environment, International Institute for Sustainable Development, focused on **food systems**, particularly the mechanisms of intergovernmental negotiations. She discussed policy analysis examining the alignment between global health agendas and environmental policy agreements, emphasising the need for a common language to support greater engagement across the different domains.

Although the environment is a determinant of health, and climate change is a determinant of health, health is a relatively minor aspect of global environmental discussions. For example, Dr Willetts noted that there are 35 intergovernmental agreements on the environment, most of which discuss agriculture, but they make little or no reference to nutrition – even though 3 billion people globally are affected by malnutrition. At the same time, food systems are responsible for up to 30% of global greenhouse emissions and for 70% of all human water use.

The sector is also a major contributor to the loss of biodiversity and is disrupting long-stable ecosystems. Environmental degradation contributes to around 25% of global mortality. Despite these impacts, access to healthy, sustainable and secure diets is not equitable within or between countries.

Dr Willetts' policy analysis found that intergovernmental negotiations on environmental issues, including climate, include relatively few health experts. For example, at the most recent session of the UN Committee on World Food Security, just 6% of attendees were from departments of health. Dr Willetts argued that greater alignment was needed between environmental and health policymaking, with global environmental agreements implemented through public health strategies.

For the UN Framework Convention on Climate Change (UNFCCC), agriculture was not mentioned until 2017 and nutrition did not feature until 2020. Currently, there is little policy space in which these issues, and their links to health, can be discussed at the global level.

Dr Peninah Murage, Assistant Professor of Environmental Epidemiology, London School of Hygiene and Tropical Medicine, UK, discussed the potential of **nature-based solutions** to address environmental degradation and climate change impacts.

Nature-based solutions are based on working with natural ecosystems to achieve a range of objectives, which can include mitigation and adaptation and can generate health benefits through multiple pathways. The Millennium Ecosystem Assessment Framework identifies four types of ‘services’ provided by ecosystems:

- Provisioning services
- Regulating services
- Cultural services
- Supporting services

Dr Murage described an evidence synthesis initiative examining the greenhouse gas mitigation potential of particular ecosystems, as well as their social, economic and health outcomes³⁰. For example, the 173 million trees in Californian cities have the potential to absorb carbon dioxide and other pollutants but also produce harmful compounds such as volatile organic compounds. Overall, the trees are responsible for net removal of harmful compounds, but it is important to focus on trade-offs as well as benefits.

An example from sub-Saharan Africa examined farmer-managed natural regeneration in Tanzania, in an arid area where land has been degraded by poor agricultural practices. Farmers are being encouraged to plant trees to restore the land and enhance resilience to climate change. Focus group discussions with communities has led to the identification of multiple pathways through which these activities can generate a wealth of social and health benefits, alongside environmental benefits.

In discussions chaired by Carlos del Rio MD, Distinguished Professor of Medicine in the Division of Infectious Diseases at Emory University School of Medicine, it was acknowledged that the medical community tended to operate in its own silo and needed to **work across disciplines**, including with other learned societies. There are multiple opportunities to insert the health voice into national and global discussions, and to promote the ‘health in all policies’ approach. The **planetary health** concept, which recognises the intimate connections between natural systems and human health and wellbeing, is another framing that can support interdisciplinary interactions.

It was also noted that there are opportunities for **action at all levels** – global, national and local. Currently, local activism is an area of vibrant innovation, and there is a need to move beyond the piecemeal to national strategies, drawing on successes. The identification of benefits derived by ‘early adopters’ may help to persuade others of the benefits of action. However, it is important that local action involves and draws upon the knowledge of local communities who are most familiar with their lands.

The Academies’ response

Following a presentation by **Dr Modi Mwatsama** summarizing Wellcome’s climate change strategy (see Annex 1), **Dr Victor Dzau** and **Dame Anne Johnson**, the Presidents of the National Academy of Medicine and the Academy of Medical Sciences, respectively, concluded the meeting by discussing the current work of their respective academies and how the two could work together in this area, building on a newly signed memorandum of understanding.

Dr Dzau briefly summarised the National Academy of Medicine’s Grand Challenge, overseen by Dr Judy Rodin previous president of the Rockefeller Foundation, and Dr Phil Pizzo, the former Dean of Stanford University. As discussed earlier, its four workstreams cover communication, decarbonisation of the health sector, the roadmap for system transformation, and research and innovation, with a cross-cutting communications equity network.

Communication activities will focus on equipping healthcare professionals to communicate around the climate crisis, as well as cross-Academy work on communication outputs, including a digital booklet on climate change and health. The roadmap, due to be published later in 2022, will outline paths towards net zero for key sectors such as agriculture, food, transportation and energy. Work towards decarbonisation of the health sector falls within the Action Collaborative initiative, involving multiple public and private partners

Notably, the Action Collaborative includes industry associations, greatly extending its scope, as well as multiple senior business leaders, demonstrating their high-level commitment. Given the diversity of the system, each organisation will map out its own direction of travel, but within this collaborative framework and using commonly agreed metrics.

30. McPherson EG, van Doorn N, de Goede J. *Structure, function and value of street trees in California, USA*. Urban Forestry and Urban Greening. 2016; 17:104-115. <http://dx.doi.org/10.1016/j.ufug.2016.03.013>

In terms of decarbonisation of the health sector, Dr Dzau noted the potential to cut waste, enhance healthcare and promote prevention, all of which deliver environmental as well as health benefits. The Academy is also looking to expand its grant funding. These include schemes at the intersection between health and other systems, such as food, water and transportation, providing funding to individual healthcare workers to change practice at the grassroots, and a wider initiative to promote investment in sustainable R&D, particularly on supply chain decarbonisation.

Dr Dzau also identified some of the ways in which the National Academy could collaborate with the Academy of Medical Sciences and potentially with similar partners. These included a joint statement on climate change and health, a global competition to support innovations for decarbonising care delivery, based on a model developed for an international health longevity initiative, and a programme to develop emerging research leaders. Other possibilities include interdisciplinary evidence syntheses, with other Academies, and shaping the agenda for COP27.

For the Academy of Medical Sciences, Dame Anne Johnson discussed the Academy's report produced jointly with the Royal Society, on Climate Change and Health³¹. Its first recommendation was that health should be made central to the climate change narrative, stressing the health gains linked to net-zero transitions. This will require greater engagement with policymakers but also a rediscovery of the importance of the environment to human health.

The second recommendation was to integrate adaptation and mitigation policies to benefit health, to assess potential trade-offs and create a more holistic approach to policymaking. The third recommendation was to develop metrics for tracking progress, while the fourth focused on the adoption of transdisciplinary systems approaches to address the complex interaction between climate change, mitigation and health.

Dame Anne also suggested some possible options for collaboration across Academies. These included a joint statement, as well as sharing experience of engaging with a wider range of communities. She also suggested there were opportunities for the two Academies to consider their own net-zero strategies, as well as decarbonisation of the research system. A further potential area for collaboration is in risk communication. Public attitudes and understanding, and the most effective ways to communicate with public audiences, remain key priorities in both countries. The UK's Young Academy could be an important contributor to these activities.

Dame Anne also noted that, during the COVID-19 pandemic, the Academy had been successful engaging with different parts of the UK Government. Similar activities could be undertaken to ensure that health forms a larger part of climate policymaking discussions across all areas of government. Collaborations could also cover preparation for COP27 or future meetings.

In discussions, the potential to harness **entrepreneurial spirit** was highlighted. This could build on the health longevity global competition, through which entrepreneurs could apply for funding of up to US\$50,000 to get bold ideas off the ground. From 15,000 applications, 150 were funded. The most successful had the opportunity to apply for up to US\$2 million commercialisation funding from Johnson & Johnson Innovation and the European Investment Bank. Innovative new supply chain ideas would avoid each manufacturer having to develop their own solutions. The Academy of Medical Sciences' FORUM initiative, which provides a platform for interactions between the academic, healthcare and industry sectors could also take this idea forward.

The emphasis on **transdisciplinary research** was felt to raise questions about the structure of university departments, which tends to emphasise disciplinary differences. Many institutions are attempting to break down barriers between departments or build virtual institutes focused on social challenges. This growing interest in 'convergence science' could lead to physical institutes focused on climate change and health.

In the shorter term, it was noted that the next **US Farm Bill** will be coming up for reauthorisation in 2023. This occurs once every five years and covers annual spending of around US\$100 billion. This could provide an opportunity to engage with policymakers to ensure consideration of climate change in health in these disbursements.

Another opportunity could be the development of the **seventh IPCC Assessment Report (AR7)**. Potentially, the Academies could push for a greater focus on health in AR7 and shape the evidence assessment processes.

31. <https://acmedsci.ac.uk/policy/policy-projects/climate-change-and-health>

Conclusions

Evidence is growing of the health consequences of climate change, and how health will be impacted as global temperatures continue to rise. Often, it is the most disadvantaged and marginalised populations who are most affected, and also have least power to prepare for or adapt to climate change, emphasising the important health equity dimension to climate change.

Conversely, many actions to mitigate the rise in greenhouse gas emissions or adapt to a warming world also have the potential to deliver health benefits; some of these will also have economic benefits. There is still time to avoid the worst effects of climate change, and that the actions taken to mitigate climate change are also likely to benefit health and wellbeing in multiple ways – climate action can deliver ‘win–wins’.

Both the UK Academy of Medical Sciences and the US National Academy of Medicine have recognised that climate change poses an existential threat to health and must be addressed with great urgency. Both Academies have launched initiatives to communicate the threat to health posed by climate change, the opportunities climate action offer to enhance health, and to position health more strongly within national and global climate discussions. Now, building on a recent memorandum of understanding, the two Academies can work together to use their global influence and convening power to ensure that health is at the heart of climate decision-making.

Annex 1: Wellcome and climate change

Climate change and health is one of Wellcome's three priority areas, and Dr Modi Mwatsama described how Wellcome plans to address it.

In September 2021, Wellcome launched a new strategy, its key aim being to use science to solve some of the world's biggest challenges. Over the next decade, it plans to invest £16 billion in its activities. As well as continuing to support discovery research, it is also focusing on three global challenges – one of which is climate change and health.

In this area, it plans to focus on four areas:

- Generating evidence on the impacts of climate change on health
- Generating evidence to spur action on mitigation
- Generating evidence to spur action on adaptation
- Advocating for cooperation and coordination

The fourth aim is a wider 'field-building' goal. This will include development of research capacity, for example through fellowships, but also work on public attitudes and building a global community across researchers, policymakers and communities. Wellcome is currently working through how the new strategy will be applied in practice, although some funding calls have already been made.



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