# The 2024 Report of the Lancet Countdown on Health and Climate Change

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# List of Abbreviations

A&RCC – Adaptation & Resilience to Climate Change

AC – Air conditioning

CDP – Carbon Disclosure Project

CFU – Climate Funds Update

$CO_2$ – Carbon Dioxide

$CO_2e$ – Carbon Dioxide Equivalent

COP – Conference of the Parties

ECMWF – European Centre for Medium-Range Weather Forecasts

EE MRIO – Environmentally-Extended Multi-Region Input-Output

EH – Extreme Heat

EJ – Exajoule

EM-DAT – Emergency Events Database

ERA – European Centre for Medium-Range Weather Forecasts Reanalysis products

ETS – Emissions Trading System

EU – European Union

FAO – Food and Agriculture Organization of the United Nations

GBD – Global Burden of Disease

GDP – Gross Domestic Product

GGA – Global Goal on Adaptation

GHG – Greenhouse Gas

GNI – Gross National Income

GPW – General Programme of Work

GST – Global Stocktake

$GtCO_2$ – Gigatons of Carbon Dioxide

GW – Gigawatt

GWP – Gross World Product

HAP – Household Air Pollution

HDI – Human Development Index

HHA – Heat-Health Alert

HNAP – Health National Adaptation Plan

IEA – International Energy Agency

IHR – International Health Regulations

IK – Indigenous Peoples' Knowledge

IO – International Organisation

IPC – Infection Prevention and Control

IPCC - Intergovernmental Panel on Climate Change

IRENA - International Renewable Energy Agency

LPG – Liquefied Petroleum Gas

LT-LEDS – Long-term Low Emissions and Development Strategies

MODIS – Moderate Resolution Imaging Spectroradiometer

MRIO – Multi-Region Input-Output

Mt – Metric Megaton

$MtCO_2e$ – Metric Megatons of Carbon Dioxide Equivalent

NAP – National Adaptation Plan

NASA – National Aeronautics and Space Administration (US)

NBS – Nature-based solutions

NCDs – non-communicable diseases

NDCs - Nationally Determined Contributions

NDVI – Normalised Difference Vegetation Index

NHS – National Health Service

$NO_x$ – Nitrogen Oxides

OECD – Organisation for Economic Cooperation and Development

O&G – Oil and Gas

$PM_{2.5}$ – Fine Particulate Matter (less than 2.5 micrometres in diameter)

PV – Photovoltaic

SCA – South and Central America

SDG – Sustainable Development Goal

SDU – Sustainable Development Unit

SPEI – Standardised Precipitation Evapotranspiration Index

SSS – Sea Surface Salinity

SST – Sea Surface Temperature

$tCO_2$ – Metric tons of Carbon Dioxide

tCO2/TJ – Metric tons of Carbon Dioxide per Terajoule

TJ – Terajoule

TPES – Total Primary Energy Supply

TWh – Terawatt Hours

UN – United Nations

UNEP – United Nations Environment Programme

UNFCCC – United Nations Framework Convention on Climate Change

UNGA – United Nations General Assembly

UNGD – United Nations General Debate

US$ – 2023 United States Dollars (unless clarified in the text)

WHO – World Health Organization

WMO – World Meteorological Organization

WNV – West Nile Virus

# Executive Summary

Annual mean surface temperature reached a record-high 1.45˚C above the pre-industrial baseline in 2023, and the climatic extremes of 2023 and 2024 exposed the human cost of persistent delays in reducing global greenhouse gas (GHG) emissions. Despite the initial hope inspired by the 2015 Paris Agreement, the world is now dangerously close to breaching its target of limiting global multi-year mean heating to 1.5°C.

The Lancet Countdown: Tracking Progress on Health and Climate Change was established the year the Paris Agreement entered into force, to monitor the health impacts and opportunities of the world's response to its commitments. Today, the collaboration brings together over 300 researchers and health professionals from around the world, annually taking stock of the evolving links between health and climate change at a global, regional, and national level. This report, drawing on the expertise and collaborative efforts of 122 leading researchers from UN agencies and academic institutions worldwide, reveals the most concerning findings in the Lancet Countdown's nine years of monitoring.

## The record-breaking human costs of climate change

People around the world are experiencing the record-breaking impacts of climate change. Of the 16 indicators monitoring health hazards, exposures, and impacts, 11 reached concerning new records in their last year of data.

Heat-related deaths of people over 65 years of age rose to a record 167% above that in the 1990s - 159% higher than would have been expected in the absence of temperature change (indicator 1.1.5). The increasing heat is also limiting the hours available for safe physical activity and is affecting sleep, in turn increasing the risk of adverse physical and mental health outcomes: in 2023, a record-high 27.7% more hours of safe physical activity were lost globally than in the 1990s (indicator 1.1.2), and the hours of sleep lost due to heat were a record 6% higher in 2023 than in 1986-2005 (indicator 1.1.4).

Climate change is also increasing the frequency and intensity of life-threatening extreme weather events. The incidence of extreme precipitation grew in 61% of the global land area between 2014-2023 and 1961-1999, increasing the risk of flooding, infectious disease spread, and water contamination (indicator 1.2.3). Simultaneously, the incidence of extreme drought

has also grown, reaching the second-highest level recorded since 1951 in 2023 (indicator 1.2.2), with multiple adverse effects across the systems that sustain good health. The higher frequency of droughts and heatwaves in 2022, as compared to 1981–2010, was associated with 151 million more people experiencing moderate or severe food insecurity across 124 countries assessed, the highest level on record (Indicator 1.4.2). The hotter and drier weather also contributed to a 4.4% increase in the number of people exposed to dangerously-high concentrations of desert and sand-derived $PM_{10}$ particulate matter air pollution between 2018-2022 and 2003-2007 (indicator 1.2.4). Meanwhile, the changing climate is increasingly favouring the transmission of deadly infectious diseases like dengue, malaria, West Nile virus, and vibriosis across new locations (indicators 1.3.1-1.3.4).

The impacts of climate change are also damaging the socioeconomic conditions upon which health and wellbeing depend. The average annual economic losses from weather-related extreme events increased 23% from 2010-2014 to 2019-2023, to US$ 227 billion (indicator 4.1.1). Extreme weather and climate change-related health impacts are also affecting labour productivity, and heat exposure led to a record-high loss of 512 billion potential labour hours in 2023, associated with potential income losses worth US$ 835 billion (indicators 1.1.3 and 4.1.3). Low and Medium Human Development Index (HDI) countries were most affected by these losses, which amounted to 7.6% and 4.4% of their GDP, respectively.

These growing health risks are compounded by years of delays in adaptation. Only 68% of countries reported high to very high implementation of International Health Regulation capacities for health emergency management in 2023, of which only 11% were Low HDI countries (indicator 2.2.5). Although the implementation of health early warning systems (HEWSs) is associated with a reduced lethality of extreme weather events (indicator 2.3.2), only 35% of countries reported having HEWSs for heat-related illness, and only 10% did so for mental and psychosocial conditions (indicator 2.2.1). Concerningly, with unequal distribution of financial resources and technical capacity, the delay in adaptation is most acute in the world's most underserved countries, leaving their populations largely unprotected in the face of the growing risks. As a result, the impacts of climate change are exacerbating global health inequities.

These findings, while concerning, might only represent the tip of the iceberg. The multiple hazards revealed by individual indicators are likely to have simultaneous, compounding and cascading impacts on complex human systems. Combined with the delays in the implementation of adaptation efforts, these growing climate change-related hazards are

increasingly threatening the basic foundations and societal structures on which human development, health and survival depend.

## Fuelling the fire

Since its establishment in 2016, the Lancet Countdown's reports have revealed a world veering away from the goal of limiting temperature rise to 1.5°C, and increasingly putting people's health and survival at risk. This year's report shows concerning new records reached across indicators monitoring GHG emissions, and the actions that support them.

Global $CO_2$ emissions from the energy system reached an all-time high in 2023 (indicator 3.1.1), and, partly fuelled by high energy prices and windfall profits, many oil and gas (O&G) companies expanded their fossil fuel production plans. As of March 2024, the 114 largest O&G companies were on track to exceed emissions consistent with 1.5°C of heating by 189% in 2040, up from 173% one year before (indicator 4.2.2), pushing the world further off-track from meeting the goals of the Paris Agreement.

The persistent reliance on fossil fuels, coupled with an unjust energy transition, has entrenched global health inequities. Although renewable energy could provide power to remote locations, its adoption is lagging, particularly in energy-poor regions. Globally, 745 million people still lack access to electricity, biomass still accounts for 92% of the energy used in Low HDI country households (indicator 3.1.2), and only 2.3% of electricity in Low HDI countries comes from clean renewables, compared to 10.3% in Very High HDI countries (indicators 3.1.1). The persistent burning of fossil fuel and biomass has come at a high human cost, leading to at least 3.33 million deaths from outdoor $PM_{2.5}$ air pollution globally in 2021 (indicator 3.2.1), while the domestic use of dirty solid fuels caused 2.3 million deaths in 2020 across 65 countries analysed (indicator 3.2.2).

Compounding the growth in energy-related GHG emissions, almost 182 million hectares of forests were lost between 2016 and 2022 (indicator 3.4), reducing the world's capacity to absorb atmospheric $CO_2$. In parallel, mostly driven by the consumption of red meat and dairy products which contributed to the 11.2 million deaths caused by unhealthy diets that in 2021 (indicator 3.3.2), agricultural GHG emissions grew 2.8% since 2016 (indicator 3.3.1).

Health systems themselves, while essential to protect people's health, are also increasingly contributing to the problem. Healthcare-related GHG emissions increased 36% since 2016,

making health systems increasingly unprepared to operate in a net zero-emission future, and pushing healthcare further from its duty to do no harm (indicator 3.5).

## Health-threatening financial flows

Due to the growing impacts of climate change, the world is on track to losing between 11% and 29% of global income by 2050, losses that will grow further if delays in climate change action persist. While tackling climate change requires considerable capital investment, financial resources to support it are available, and the expected economic benefits would vastly outweigh the cost of inaction. This is particularly so when the potential health gains are taken into account, with healthier and more resilient populations enabling more prosperous and sustainable economies. However, delivering these benefits requires investing in people's health and wellbeing, redirecting financial resources away from activities that hinder the just zero-emissions transition.

Indicators in this report reveal the importance of financial support to enable health adaptation. The implementation of International Health Regulation capacities for health emergency management is positively associated with financing for public health emergency responses (indicator 2.2.5), and 50% of the cites that did not plan to undertake a climate change health risk assessment identified scarce finance as a main barrier (indicator 2.1.3). Still, adaptation projects with potential health benefits represented 27% of all the Green Climate Fund's adaptation funding in 2023, despite a 137% increase since 2021 (indicator 2.2.4). With universal health coverage still unattained in most countries, financial support is particularly needed to strengthen health systems, and ensure that they can protect people from growing climate change-related health hazards.

However, while funding for health adaptation remains scarce, substantial financial resources are being allocated to activities that harm health and perpetuate a fossil fuel-based economy. With their energy systems still reliant on fossil fuels, most countries responded to the sharp increase in energy prices that followed Russia's invasion of Ukraine by increasing their explicit fossil fuel subsidies, often for sums comparable to their total health budgets. Consequently, 84% of countries studied still operated net positive carbon prices (net fossil fuel subsidies) in 2022, for a record-high net-total of US$ 1.4 trillion (indicator 4.3.3). In addition, 90% of investment in energy other than electricity was still allocated to fossil fuels in 2021, while energy efficiency, essential for a just transition, accounted for only 15% of all energy investment (indicator 4.3.1).

The resulting expansion of fossil fuel assets is not only costing lives, but also putting economies at risk. Investment in this industry has pushed the economic losses associated from current coal-fired power generation assets that risk becoming stranded in a 1.5°C trajectory to a cumulative total of US$ 164.5 billion between 2025 and 2034 , a value that will increase if coal investments continue(indicator 4.2.3); and fossil fuel employment reached 11.8 million employees in 2022, increasing the size of a workforce whose employment cannot be sustained in a world that avoids the most catastrophic impacts of climate change (indicator 4.2.1). Most countries therefore remain unprepared to face the transition to net zero GHG emissions. But the risk is not equally distributed: all countries with Low HDI, 96% of those with Medium HDI, and 84% of those with High HDI had transition preparedness scores below the global average, compared to just 7% of Very High HDI countries (indicator 4.2.4). The persistent investment in a carbon-intensive economy and an unjust response is therefore putting the social and economic structures on which people's health and wellbeing depend acutely at risk, with lower HDI countries currently worst affected.

## Shaping the health profile of people worldwide

Following decades of delays, avoiding the most severe health impacts of climate change now requires aligned, structural, and sustained changes across most human systems, including energy, transportation, agriculture, food, finance, and healthcare. Integrating and prioritising people's health in this transition can enable sustainable development pathways, reduce health inequities and maximise health gains. Some indicators reveal incipient progress and important opportunities for delivering this transformation.

As of December 2023, 50 countries reported having formally assessed their health vulnerabilities and adaptation needs, up from 11 the prior year; and 43 reported having a Health National Adaptation Plan, up from 4 in 2022 (indicators 2.1.1 and 2.1.2). Crucially, 70% of 279 public health education institutions worldwide reported providing education in climate and health in 2023 (indicator 2.2.6). Some progress was also registered in the energy sector. The global share of electricity from clean modern renewables reached a record-high 10.5% in 2021 (indicator 3.1.1); and zero-GHG energy accounted for 80% of electricity investment that year (indicator 4.3.1). Simultaneously, renewable energy-related employment grew 35.6% since 2016, delivering healthier and more sustainable employment opportunities than those in the fossil fuel industry (indicator 4.2.1). Importantly, mostly as a result of coal phase down in High and Very High HDI countries, deaths attributable to $PM_{2.5}$ from fossil fuel combustion decreased

6.9% between 2016 and 2021 (indicator 3.2.1), revealing the potential for immediate health co-benefits of coal phase-out; as well as the imperative to ensure lower HDI countries are not left behind in the adoption of healthier energy sources.

Following years of leadership from the WHO on climate change and health, its Fourteenth General Programme of Work (GPW14), adopted in May 2024, made responding to climate change a strategic priority for health worldwide. Within climate negotiations themselves, COP28 featured the first health thematic day in 2023, and 149 countries endorsed the COP28 UAE declaration on climate change and health. The Global Goal on Adaptation (GGA) set a specific health target, and the outcome of the first Global Stocktake (GST) of the Paris Agreement recognised the right to health and to a healthy environment, urging parties to take further health adaptation efforts. With the GST informing the updated Nationally Determined Contributions (NDCs) due in 2025, this has opened a new opportunity to ensure that human survival, health, and wellbeing are put at the centre of national climate policies.

Progress was also made at COP28 towards climate change and health finance, with US$ 1 billion committed to this purpose. The pending decision of how the Loss and Damage fund will be governed, and the definition of the New Collective Quantified Goal on Climate Finance, provide further opportunities to secure the financial support critically need for a healthy net-zero transition.

While still insufficient to protect people's health from climate change, these emerging signs of progress help illuminate a path towards a healthy, prosperous future. But much remains to be done.

## Hanging in the balance

With concerning new records once again breached across the indicators in this report, the opportunity to tackle climate change and prevent catastrophic impacts on human development, health and survival is fading. Enabling a healthy future that avoids the most catastrophic impacts of climate change now requires the support and will of most actors in society. However, data suggest that engagement of key actors with health and climate change could be declining: only 35% of governments mentioned health and climate change in their annual UN General Debate statements, compared to 50% in 2022; and only 47% of the 58 NDCs updated as of February 2024 referred to health (indicator 5.4.1). Media engagement also dropped in 2023, with the proportion of newspaper climate change articles mentioning health

falling 10% from the year before (indicator 5.1). The uncertainty of multiple armed conflicts and geopolitical shifts now threatens to further reverse the little progress made to date.

Amidst global turmoil, the powerful and trusted leadership of the health community could hold the key to reversing these concerning trends. Its engagement is crucial to inform a rigorous assessment of the human costs of inaction. Also essential is its collaboration with those organisations working to advance and implement climate change action is essential to support a response that prioritises safeguarding people's survival, maximises health gains, and paves the way to a healthy, prosperous future. As climate change continues to break new records, the wellbeing, health, and survival of individuals in every country may now hang in the balance.

# Introduction

The devastation caused by record-breaking extreme weather events in 2023 and 2024 demonstrates the human costs of a failure to curb greenhouse gas (GHG) emissions and adapt to rapidly growing hazards. In 2023, annual mean surface temperature broke all records, reaching 1.45°C above pre-industrial times, with some estimates suggesting this 12-month record may have been breached again since.[1,2] Rapid attribution studies identified the influence of climate change in deadly events worldwide,[3] including the floods that claimed over 300 lives in the Horn of Africa,[4] the deadly heatwaves affecting much of the northern hemisphere,[5–7] a record-breaking wildfire season in Canada,[8] and many others.[3] At least 43 million child displacements were linked to extreme weather events over the past six years,[9] and climate change-related extreme events are responsible for an estimated US$ 143 billion annual losses.[10] People in every country now face threats to their health and survival as climate hazards increase.

Current policies and actions, if sustained, put the world on track to 2.7°C of heating by 2100,[11 11] The impacts seen to date could therefore be only the beginning of an increasingly dangerous future, with devastating impacts on the natural systems upon which humanity dependsh.[12,13]

The outcome of the first Global Stocktake (GST) of the Paris Agreement, which culminated at the 28th Conference of the Parties (COP28) to the United Nations Framework Convention on Climate Change (UNFCCC), noted with grave concern the growing impacts of climate change and the delays in necessary actions.[14] Calling for a "transition away from fossil fuels in energy systems", it was the first-ever COP text in 30 years of negotiations to even acknowledge the need to address the use of fossil fuels in the energy system, which are the main drivers of climate change. However, the final text reflected an overreliance on carbon capture and storage – technologies which have not been developed, or indeed proven to be safe, at the necessary scale.

COP28 also marked the year in which health was first mainstreamed within global climate change negotiations. With the first-ever health thematic day, and with 149 countries endorsing the COP28 health-climate declaration during the first-ever COP climate and health ministerial meeting, it underscored the imperative for health to be elevated in climate change negotiations.[15,16] The GST recognised the right to health and to a healthy environment; and the Global Goal on Adaptation (GGA) set an overarching target towards the collective well-being of

all people, and a specific target for reducing the health impacts of climate change and promoting climate-resilient health services.[14] Importantly, US$ 1 billion was committed to enable action on climate change and health at COP28. While far from sufficient, this support could be an important enabler of progress. As countries work to update their Nationally Determined Contributions in response to the GST, COP28 laid the grounds for countries to commit to ambitious, health-promoting climate change action, tailored to the possibilities and needs of their people.

Complementing the health focus of climate negotiations, the World Health Organization (WHO)'s Fourteenth General Programme of Work (GPW14) set the strategic objective of promoting health by responding to climate change, and delivering climate-resilient health systems, as well as low-GHG societies and health systems that contribute to better health and wellbeing. In addition, a new Resolution on Climate Change and Health adopted at the 77th World Health Assembly provides a platform for member states and the WHO to develop and advance actions on climate change and health.

These milestones could provide new opportunities that pave the way to deliver a future of reduced life threats, and improved health (panel 1). Nevertheless, 2024 could also see a major geopolitical shift, with multiple armed conflicts and 64 countries — representing nearly half of the global population — holding major elections. Amid this geopolitical uncertainty, and with misinformation rising,[17,18] upholding international agreements and driving evidence-informed action on climate change and health is imperative to protect the future of present and future generations.

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*Panel 1: The opportunities at hand to put health at the centre of the world's response to climate change*

The 2023 report of the Lancet Countdown presented 11 priorities for a healthy future.[19] Since its publication, new opportunities have emerged to put health at the centre of the world's response to climate change. Indicators in this report inform the following seven priorities to leverage near-term opportunities to deliver a healthy future.

1. **Put health at the centre of national commitments to meet the goals of the Paris Agreement**
   *Opportunity: countries are due to update their Nationally Determined Contributions (NDCs) by 2025.*

   As countries work to update their NDCs, laying out their plans to meet the goals of the Paris Agreement in response to the first Global Stocktake, ensuring heatlh is accounted

for and considered within them opens the opportunity to ensure national-level climate change actions promote and protect people's health and survival. With mentions of health dropping in the NDCs submitted as of February 2024 (indicator 5.4.1), increased engagement of health professionals will be critical to ensuring this.

2. **Invest in a healthy future and healthy populations**
*Opportunity: fossil fuel subsidies reached record-high levels in 2022 as energy prices soared, while fossil fuels still dominate non-electricity energy investment. This funding can be re-directed to support a just transition, and healthier, more resilient populations.*

Delivering the actions that protect and promote people's health in the face of climate change requires sufficient, stable, and predictable financial resources. Financial support for action on health and climate change is still scarce (indicator 2.2.4), while financial resources continue to be allocated to activities that hinder the transition to net zero GHG emissions (indicators 4.2.3, 4.2.4, and 4.3.1-4.3.4). There is an opportunity to redirect these resources towards supporting a just transition and investing in healthier populations and thriving economies. This could include increasing funding to support equitable access to, and uptake of, clean energy, protect those vulnerable to the removal of fossil fuel subsidies, and support interventions that improve population health (indicators 3.1.2 and 3.2.2). The associated benefits to human health and wellbeing could help build more resilient populations, and ultimately benefit the whole economy.

3. **Put human health at the centre of climate change finance**
*Opportunity: At COP29, the New Collective Quantified Goal on Climate Finance is due to be adopted, and arrangements for the Loss and Damage (L&D) Fund will be considered and approved*

As the New Collective Quantified Goal on climate finance is defined at COP29, and governing arrangements of theL&D fund are set to be agreed, the engagement of the health sector with these processes will be essential to ensure the funding mechanisms optimise the health gains of climate action, and account for the economic and non-economic losses and damages associated with the health impacts of climate change, as well as on the financial needs for health-centred and just climate change action. This will be key to ensure the funding can fully support the most affected countries, helping address and minimise the inequities of climate change.

4. **Set the protection and promotion of human health and wellbeing as the primary measure of climate action**.

*Opportunity: The metrics to monitor progress against the GGA and GPW14 are being defined in 2024-2025.*

In addition to the health gains of mitigation across sectors, adaptation in water and sanitation systems, food and agriculture, energy generation, health systems, human infrastructure, natural ecosystems, and the economy hold the potential to improve health outcomes. As the indicators to measure progress against the GGA and GPW14 are defined, indicators that monitor climate-sensitive morbidity and mortality can help ensure adaptation efforts are evaluated against their capacity to protect the most fundamental aspect of human wellbeing, while, in the case of the GPW, also quantifying the health co-benefits of mitigation. It can also help identify and avoid potential

unintended health harms of climate action, and guide adaptation actions to reduce health inequities.

5. **Shape societies to promote health, equity and climate justice**
*Opportunity: at COP28, parties have agreed to hold biannual dialogues under the UNFCCC Just Transition Work Programme (JTWP)*

Inadequate and unjust climate change action is leaving the most underserved communities also most exposed to the health impacts of climate change (Indicators 2.2.2, 2.2.4-2.2.6), most unprepared for the transition away from fossil fuels (indicator 4.2.4), and most exposed to the health harms of energy poverty, fossil fuel-derived air pollution, and GHG-intensive diets (indicators 3.1.1, 3.1.2, and 3.2.1-3.3.2). A persistent increase in investment in fossil fuels is increasing the value of assets that will become stranded, and expanding the size of a workforce whose employment opportunities will wane as the world transitions to healthy, renewable energy in line with international agreements (indicator 4.2.1 and 4.2.3 and 4.3.1). Additionally, an unjust transition to renewable energy can perpetuate harmful global power dynamics, leaving the most vulnerable populations, including indigenous peoples, exposed to the health harms of extractive industries (panels 3 and 6). Embedding health considerations in the evolving JTWP offers the opportunity deliver a transition that enables sustainable, equitable and healthy development pathways, and delivering benefits to the helath and wellbeing of people worldwide.

6. **Build future-proofed health systems**
*Opportunities: the WHO's GPW14 and WHA77 resolution on health and climate change established responding to climate change as a core priority, including through low-carbon, and climate-resilient health systems*.
Building climate-resilient health systems is essential to ensure that health systems can deliver quality care in the face of climate change. However, health systems will simultaneously need to remove the 4.6% of GHG emissions they contribute to, in order to meet global climate targets, and avoid generating harm to the health of the populations they serve (indicator 3.5). This represents a substantial challenge. The GPW14 offers a framework to deliver low-carbon, climate-resilient health systems that are fit for the future, an effort for which the WHO's Alliance for Transformative Action on Climate and Health is providing support.[20] Ensuring countries engage with these processes will be essential to deliver health systems that are fit to operate in future climates.

7. **Tackle climate change through public health interventions**
*Opportunities: the WHO's GPW14 and WHA77 resolution established a priority to address health determinants and the root causes of ill health in key policies across sectors, including by tackling air pollution and unhealthy diets*.

Tackling GHG emissions and delivering adaptation to climate change are core priorities of climate change action and help build a safer, healthier future for all. However, public health interventions that address the root causes of ill-health can contribute to these goals too: public health interventions aimed at reducing exposure to air pollution can save millions of deaths annually, while promoting the shift to clean energy sources (indicators 3.2.1 and 3.2.2). Promoting and enabling healthier diets can save millions of deaths each year, while aiding mitigation in the agri-food sector (indicators 3.3.1 and 3.3.2).

In responding to these new opportunities, the health sector can help drive transformative changes to tackle climate change and deliver major improvements to people's health. However, the success of this transformation requires simultaneous and sustained efforts to lay the foundations for a health-centred response to climate change. These include:

- **Building capacity on health and climate change,** by providing formal training in climate change and health. Making climate and health education part of core curriculum within health education programmes would represent an important step to meet this goal (indicator 2.2.6).
- **Engaging Indigenous peoples, frontline communities and minoritised groups** in the design and implementation of health and climate change policies, to ensure that they can protect people's health, and avoid unintended harms. These communities are often most affected by the actions needed to tackle climate change, and in many cases hold the key to their effective implementation (sections 2 and 3, and panel 3).[21,22].
- **Integrating health in all climate change policies** at the international, national, and local levels, through cross-sectoral cooperation, as a key to ensure climate change actions, can protect and promote people's health and survival.

These priorities are, however, not sufficient on their own. To be effective, they rely on the world meeting the mitigation goals laid out in the Paris Agreement, for which other initiatives have provided detailed roadmaps.[23–25] Unless that basic prerequisite is met, these priorities will have little effect, if any, in protecting people's health.

**Advancing science and evidence for health-centred action on climate change**

As the challenges of tackling climate change grow, robust scientific evidence is increasingly necessary to inform effective, health-protecting policies. In response to this need, the Lancet Countdown: Tracking Progress on Health and Climate Change brings together over 300 leading researchers worldwide, to track the evolving links between health and climate change and help inform policies that enable a healthy, prosperous future. This effort, currently supported by the Global Lancet Countdown and its regional centres in Asia,[26] Europe,[27] Latin America,[26] Oceania,[28] Small Island Developing States, will soon be expanded to Africa and South Asia.

The 2024 Global Report of the Lancet Countdown is the result of the expertise and dedication of 122 researchers, health professionals, and practitioners, from 57 UN agencies and academic institutions globally. It provides a comprehensive assessment of the state of health and climate change, building on nine years of experience of indicator development and monitoring of the Lancet Countdown. Following the priorities identified in consultation with global experts and policy makers,[29] the set of indicators presented has been expanded and updated, harnessing

the latest scientific developments. Following the Lancet Countdown's indicator criteria, most indicators in this report feature improved methodologies, or temporal or geographical coverage, while seven new indicators provide an increasingly comprehensive assessment of the global state of health and climate change. As in previous iterations, all new and substantially improved indicators were subjected to a review process, in which independent global experts evaluated their rigour and relevance before inclusion in the present report.

The space constraints intrinsic to any academic publication limit the information that can be presented in this document. However, the 53 indicators in this report (panel 2) can be explored in further detail in the Lancet Countdown's online Data Visualisation Platform. To support country-level decision making, a deeper assessment for specific countries is provided through a series of data sheets and policy briefs shared in the Lancet Countdown's website. Complementing this report, the Appendix provides further findings, methodological details and an in-depth description of indicator caveats, making it an essential document to adequately interpret the findings in this report.

*Panel 2: The indicators of the 2024 report of the Lancet Countdown*

| Section | Indicator | |
|---|---|---|
| **1: Health Hazards, Exposures, and Impacts** | 1.1: Health and Heat | 1.1.1: Exposure of Vulnerable Populations to Heatwaves |
| | | 1.1.2: Heat and Physical Activity |
| | | 1.1.3: Change in Labour Capacity |
| | | 1.1.4: Rising Nighttime Temperatures and Sleep Loss |
| | | 1.1.5: Heat-Related Mortality |
| | 1.2: Health and Extreme Weather-related Events | 1.2.1: Wildfires |
| | | 1.2.2: Drought |
| | | 1.2.3: Extreme Precipitation |
| | | 1.2.4: Sand and Dust Storms |
| | | 1.2.5: Extreme Weather and Sentiment |
| | 1.3: Climate Suitability for Infectious Disease Transmission | 1.3.1: Dengue |
| | | 1.3.2: Malaria |
| | | 1.3.3: Vibrio |
| | | 1.3.4: West Nile Virus |
| | 1.4: Food Security and Undernutrition | |
| **2: Adaptation, Planning, and Resilience for Health** | 2.1: Assessment and Planning of Health Adaptation | 2.1.1: National Assessments of Climate Change Impacts, Vulnerability and Adaptation for Health |
| | | 2.1.2: National Adaptation Plans for Health |
| | | 2.1.3: City-level Climate Change Risk Assessments |
| | 2.2: Enabling Conditions, Adaptation Delivery, and Implementation | 2.2.1: Climate Information for Health |
| | | 2.2.2: Benefits and Harms of Air Conditioning |
| | | 2.2.3: Urban Green Space |
| | | 2.2.4: Global Multilateral Funding for Health Adaptation Programmes |
| | | 2.2.5: Detection, Preparedness, and Response to Health Emergencies |
| | | 2.2.6: Climate and Health Education and Training in Public Health Institutions |
| | 2.3: Vulnerabilities, Health Risk, and Resilience to Climate Change | 2.3.1: Vulnerability to Severe Mosquito-borne Disease |
| | | 2.3.2: Lethality of Extreme Weather Events |
| | | 2.3.3: Rising Sea Levels, Migration, and Displacement |
| **3: Mitigation Actions and Health Co-Benefits** | 3.1: Energy Use, Energy Generation, and Health | 3.1.1: Energy Systems and Health |
| | | 3.1.2: Household Energy Use |
| | | 3.1.3: Sustainable and Healthy Road Transport |
| | 3.2: Air Quality and Health Co-benefits | 3.2.1: Mortality from Ambient Air Pollution by Sector |
| | | 3.2.2: Household Air Pollution |
| | 3.3: Food, Agriculture, and Health Co-benefits | 3.3.1: Emissions from Agricultural Production and Consumption |
| | | 3.3.2: Diet and Health Co-Benefits |
| | 3.4: Tree Cover Loss | |
| | 3.5: Healthcare Sector Emissions and Harms | |
| **4: Economics and Finance** | 4.1: The Economic Impact of Climate Change and its Mitigation | 4.1.1: Economic Losses due to Weather-related Extreme Events |
| | | 4.1.2: Costs of Heat-related Mortality |
| | | 4.1.3: Loss of Earnings from Heat-related Labour Capacity Reduction |
| | | 4.1.4: Costs of the Health Impacts of Air Pollution |
| | 4.2: The Transition to Net Zero-carbon, Health-supporting Economies | 4.2.1: Employment in Low-carbon and High-carbon Industries |
| | | 4.2.2: Compatibility of Fossil Fuel Company Strategies with the Paris Agreement |
| | | 4.2.3: Stranded Coal Assets from the Energy Transition |
| | | 4.2.4: Country Preparedness for the Transition to Net Zero |
| | | 4.2.5: Production-based and Consumption-based Attribution of $CO_2$ and $PM_{2.5}$ Emissions |
| | 4.3: Financial Transitions for a Healthy Future | 4.3.1: Clean Energy Investment |
| | | 4.3.2: Funds Divested from Fossil Fuels |
| | | 4.3.3: Net Value of Fossil Fuel Subsidies and Carbon Prices |
| | | 4.3.4 Fossil Fuel and Green Sector Bank Lending |
| **5: Public and Political Engagement with Health and Climate Change** | 5.1: Media Engagement with Health and Climate Change | |
| | 5.2: Individual Engagement with Health and Climate Change | |
| | 5.3: Scientific Engagement with Health and Climate Change | 5.3.1: Scientific Articles on Health and Climate Change |
| | | 5.3.2: Scientific Engagement on the Health Impacts of Climate Change |
| | 5.4: Political Engagement with Health and Climate Change | 5.4.1: Government Engagement |
| | | 5.4.2: Engagement by International Organisations |
| | 5.5: Corporate Sector Engagement with Health and Climate Change | |

## Rising to the challenge

In response to the escalating health threats of climate change, the Lancet Countdown is entering a new phase of increased ambition, underpinned by a strategic partnership with *The Lancet* and the World Health Organization.

Over the forthcoming five years, efforts will focus on ensuring that the collaboration's rigorous scientific evidence can inform global and national-level progress on health and climate change. Improved metrics will be tailored to enable target-setting and to monitor and evaluate national and international progress towards achieving the GPW14 goals and the Paris Agreement ambitions. The Lancet Countdown's indicator frameworks will be updated accordingly, to better reflect the priorities of all countries, harness the latest scientific developments, and address the needs of critical policy processes.

This new phase will be enabled by an updated governance structure to increase transparency, scrutiny, and representation in the collaboration. A new independent board will provide strategic guidance and oversight for the collaboration's next phase of activities. In addition, the Lancet Countdown will continue to strengthen its regional centres, formally launching its Africa Regional Centre, and expanding to new regions in the near future. This effort will support capacity building on health and climate change in some of the world's most vulnerable regions, fostering international collaboration, supporting local policy makers, and increasing diversity and representation within the Lancet Countdown itself.

Throughout this new phase, the Lancet Countdown will operate an open and iterative process of indicator improvement, welcoming proposals for new indicators through its website, and particularly encouraging the contributions of colleagues from minoritised communities and from the world's most vulnerable countries.

## Closing the data gap for a healthy future

A global scarcity of internationally-standardised data hinders the capacity to optimally monitor the observed health impacts of climate change, and to evaluate the health-protective effect of implemented interventions. It also impedes an accurate assessment of progress against international commitments, hinders knowledge sharing, and undermines evidence-based planning and implementation of potentially life-saving interventions. The available data are rarely disaggregated by relevant groups (e.g., gender, indigeneity, ethnicity, and socioeconomic level), impeding an optimal assessment of vulnerabilities and inequities. Additionally, Indigenous knowledge is often overlooked, and Indigenous populations are seldom taken into

consideration in the production and reporting of evidence and data, increasing their marginalisation and vulnerability (Panel 3).

With increased international commitments on climate change and health, improved data will be essential to evaluate progress and optimise resource allocation.

In support of this effort, the Lancet Countdown will partner with the WHO to bridge the data gap by improving the availability of national-level data and delivering guidance, blueprints, and tools to support countries in standardised data collection and reporting.

Throughout the next five years, the priority for the collaboration will be to deliver rigorous and actionable scientific data and to move from tracking the soaring health threats of climate change to informing policies that enable a healthy future for all.

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*Panel 3: Indigenous Knowledge for a healthy future*

Indigenous Peoples maintain deep connections with the natural environment, including for the social, livelihood, cultural, and spiritual practices that underpin their health and wellbeing.[30] This close relationship makes Indigenous Peoples particularly susceptible to climate change-related hazards, which threatens the natural resources on which they depend for food, medicine, and cultural practices,[31] affecting health seeking behaviours,[32–34] jeopardising livelihoods, and increasing the risk of climate-induced (im)mobility which in itself can affect the sense of identity and physical and mental health.[35,36]

Indigenous People's physical and mental health is often poorer than their non-Indigenous counterparts.[37,38] Although they represent 6% of the global population,[39] Indigenous Peoples are often excluded and minoritised within national and international political systems, with limited recognition of their needs within policy making.[40] Indigenous health systems and cosmogonies are rarely represented within most countries' dominant health systems, making them inadequate to meet their health needs. Additionally, indigenous medicine and worldviews are rarely considered within healthcare or health risk preparedness and response,[41,42] and Indigenous voices are often neglected in government planning for climate policies, health interventions, and government assistance programs.[43,44] The capability of Indigenous peoples and their knowledge in supporting climate change action is also seldom acknowledged within climate adaptation programs at national and international levels.[45–47] The magnitude of current climate change impacts, persistent socioeconomic exclusion and scarce guarantee of Indigenous collective rights, safety, and integrity, jeopardise Indigenous opportunities to respond, adapt to, and protect their health systems and wellbeing from environmental changes.[48,49] This marginalisation often also results in profound negative impacts on physical and mental health.[37,50–52] For example, without accounting for Indigenous systems, climate mitigation policies have created conflict over land ownership, affecting Indigenous People's identity, wellbeing, and health systems.[53–55]

Indigenous Peoples' knowledge (IK) plays an essential role in avoiding, reducing, and managing the climate-related health threats they face, including by informing effective actions to safeguard their food security, natural resources (such as medicinal plants and forest and farm food), and housing.[30,35,48,56–58] To be effective for all peoples, climate change policies must therefore respect Indigenous Peoples' rights and dignity, so that

they can design responses that truly protect and promote their identity, culture, health and wellbeing.[59–62] For example, some Indigenous Peoples in the Amazon mostly drink a fermented casava beverage, which generally contains less coliform bacteria than water directly collected from the environment.[63] This could represent a culturally-adequate adaptation measure to reduced water availability as climate impacts worsen. Some studies have also documented a change in the timing of planting, and in the crops used by Indigenous Peoples.[64] Furthermore, respecting, recognising, and promoting the use and transmission of IK is not only crucial to safeguard their health in the face of climate change, but can also inform further adaptation policies that benefit society as a whole.[65,66] Indigenous practices and IK can also substantially contribute to meeting global mitigation targets: Indigenous Peoples' lands store around 300 billion metric tons of carbon,[67] and Indigenous knowledge of protection of natural environments can inform a transition to more sustainable social systems.[59,68]

However, valuable IK has been jeopardised by the disruption of traditional systems of knowledge transmission, including through colonisation, enforcement of non-Indigenous schooling, land dispossession, and environmental change itself.[58,69–71] The implementation of formal systems to embed and elevate IK in climate change policy making and enable and promote active participation of Indigenous Peoples in the design of global, national and local climate change policies is therefore urgent.[72] In response, international research networks are engaging with Indigenous Peoples to co-create knowledge to respond to the compounding threats of health crises, climate change, and food insecurity, proposing new paradigms for increasing the representation and consideration of IK in planetary health.[66] Climate change and health researchers, policy-makers and practitioners have the opportunity to drive a response to climate change that can create better and fairer conditions for all peoples, including for Indigenous Peoples. This is the only way forward to deliver a just, healthy future for all.

# Section 1: Health Hazards, Exposures, and Impacts

Complex interactions between growing climate-related hazards, exposures, and vulnerability are resulting in the health impacts of climate change. Decades of delay in climate change mitigation and adaptation have intensified these impacts.

Record-breaking extreme weather events were registered worldwide in 2023, with extreme heatwaves, wildfires, storms, floods, and droughts affecting people and the systems and economies on which their health depends.

This section monitors the evolving health hazards, exposures and impacts of climate change, covering the effects of increasing heat, extreme weather, climate-sensitive infectious disease transmission, and food insecurity. Three new indicators offer an increasingly comprehensive picture, measuring the effect of rising nighttime temperatures on sleep loss; exposure to extreme precipitation; and exposure to desert dust.

Throughout the section, the continued scarcity of data stratified by vulnerable population groups limits the capacity to reflect the disproportionate impact of climate change on minoritised groups, including Indigenous Peoples, women, children, ethnic minorities, and underserved communities – a global challenge that hampers an efficient and equitable response to climate change.[73–77]

## 1.1: Heat and health

Global mean surface temperatures reached a record-breaking 1.61°C above pre-industrial times between May 2023 and April 2024,[1] with increasingly frequent and intense extreme heat events globally.[78,79] The following indicators track the risks that heat exposure poses to people's survival, health, and wellbeing.

### Indicator 1.1.1: exposure of vulnerable populations to heatwaves

*Headline finding: in 2023, the number of heatwave days that infants and adults over 65 were exposed to, reached a new record high of an average 13.8 heatwave days per person.*

Heatwaves represent an acute health hazard, especially for the elderly; very young children; and those living with underlying chronic cardiovascular, respiratory, or kidney diseases.[80] They also increase the risk of adverse pregnancy and birth outcomes.[81]

This indicator tracks the exposure of vulnerable age groups (those less than 1 year old and over-65) to heatwave days, using updated demographic data.[82–85] To distinguish the influence of an increase in the number of heatwaves from the influence of demographic changes, a counterfactual scenario was created, keeping heatwave incidence constant at baseline levels.

In 2023, people from vulnerable age groups experienced a record total 13.4 billion person-days of heatwaves (and record average of 13.8 heatwave days per person), exceeding the previous high of 11.1 billion days (2022) by over 20%. If heatwave incidence had remained constant since 1986-2005, vulnerable people would have experienced 4.7 heatwave days per person on average per year in 2004-2023 – 45% less than observed. Each infant experienced, on average, 8.2 more days of heatwaves in 2023 than in 1986-2005, and adults over-65 experienced an extra 9.3 days of heatwaves.

### Indicator 1.1.2: heat and physical activity

*Headline finding: in 2023, people were exposed, on average, to a record 27·7% more hours per year during which ambient heat posed at least moderate heat stress risk if undertaking light outdoor exercise, than in 1990–1999.*

Regular exercise provides physical and mental health benefits,[86,87] and walking and cycling can contribute to decreasing transport-related GHG emissions and air pollution (Indicators 3.1.3 and 3.2.1).[88] However, heat stress can reduce the willingness to engage in physical activity, and increase the health risks for those exercising outdoors.[89] This indicator uses ambient temperature, humidity, and solar radiation to estimate the number of hours during which light outdoor physical activity (for example, walking) presents a risk of heat stress.

In 2023, people were exposed, on average, to a record-high 1,512 hours during which ambient heat posed a at least at moderate risk of heat stress  if undertaking light outdoor exercise– 328 hours (27.7%) above the 1990–1999 annual average. In 2014–2023, the average number of hours per year entailing this same risk was an average of 262 hours (22·1%) more than in 1990–1999. The greatest percentage increase from 1990-1999 to 2014-2023 was observed in Very High HDI countries (150 hours per person; 36·0%), and the largest absolute increase was observed in Medium HDI countries (255 hours per person; 12·7%).

## Indicator 1.1.3: change in labour capacity

*Headline finding: a record-high 512 billion potential work hours were lost in 2023, 48% above the 1991–2000 average.*

Heat exposure outdoors or in non–cooled indoor environments puts workers' health at risk.[90] In addition, heat exposure reduces labour productivity and harms the livelihoods of workers and their dependents, particularly when affecting access to quality nutrition, healthcare, housing, or health-supporting services.[91,92]

This indicator has two distinct parts. The first monitors the number of outdoor workers (a population at risk) with estimates produced by WHO staff. The second part tracks potential work hours lost because of heat exposure, by considering temperature, humidity, solar radiation (via wet–bulb globe temperature), and the typical metabolic rate of workers in specific economic sectors, through well-established epidemiological models.[93,94]

Globally in 2023, an estimated 1·6 billion people, or 25·9% of the working–age population, worked outdoors. The proportion of outdoor workers is highest in Low HDI countries (30.8% of the workforce), followed by Medium HDI (27.7%), High HDI (25.0%), and Very High HDI

countries (22.7%). This reflects the disproportionate impact on workers in the world's most underserved regions.

Heat exposure led to a record-high of 512 billion potential work hours lost in 2023 due to heat exposure, 48% above the 1991–2000 average. Low and Medium HDI countries were worst affected, with an average of 221 and 290 potential work hours lost per worker in 2023, respectively; while High and Very High HDI countries lost on average 89 and 41 potential work hours per worker, respectively. Low and Medium HDI countries bear a growing share of the world's potential work hours lost due to heat, up from 57% in 1990 to 71% in 2023.

Of the global potential work hours lost in 2023, 63% occurred in the agricultural sector. This proportion is even higher for Low (80.5%) and Medium (64.8%) HDI countries, disproportionately affecting the most vulnerable agricultural workers, on whom local food availability often depends.

## Indicator 1.1.4: rising nighttime temperatures and sleep loss

*Headline finding: sleep hours lost due to high temperatures increased by 5% between 1986-2005 and 2019-2023, reaching a record 6% in 2023.*

Sleep of adequate duration and quality is important for good human physical and mental health.[95–98] High ambient temperatures are associated with worse sleep quantity and quality.[99–104] With climate change resulting in nighttime temperatures rising faster than daytime temperatures in many world regions, the risk of adverse health outcomes from poor sleep quality is rising globally.[105]

This indicator –new to this year's report– tracks the impact of suboptimal nighttime temperatures on sleep loss, by combining the global functional sleep response to nighttime temperature identified in a multi-country sleep study,[104] with nighttime temperature data.[106] Findings suggest that high nighttime temperatures led to an average estimated 5% more sleep hours lost in 2019-2023 than in 1986-2005, and reaching a record-high of 6% more sleep hours lost in 2023 (Figure 1).

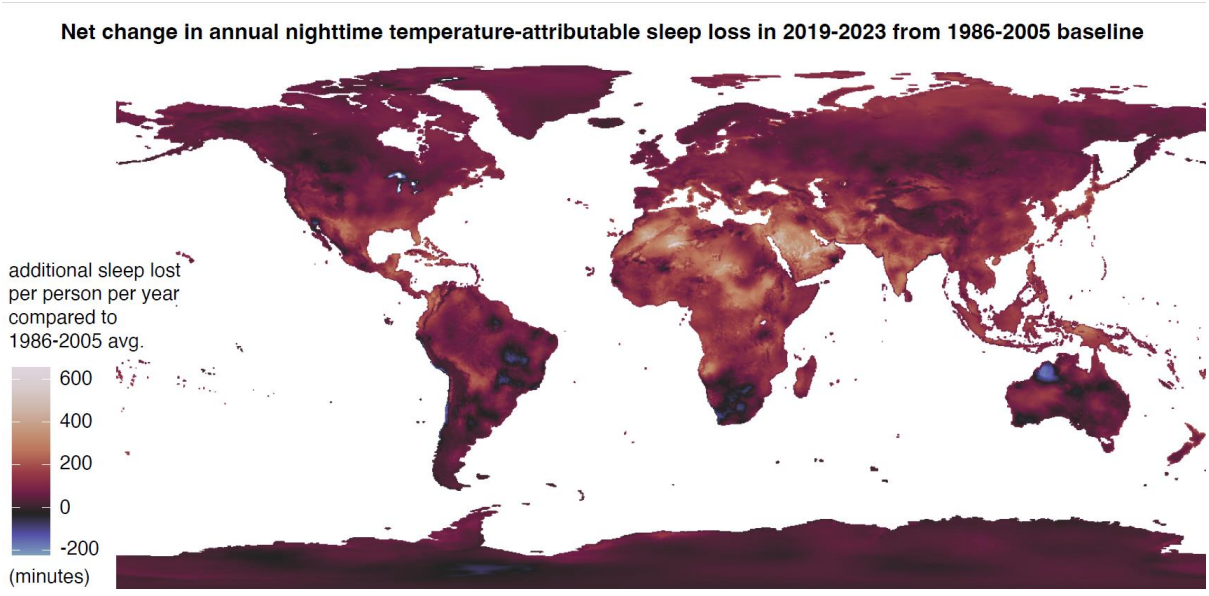


*Figure 1: The average net change in annual temperature-attributed sleep loss in 2019–2023 compared to the 1986–2005 baseline.*

## Indicator 1.1.5: heat-related mortality

*Headline finding: because of climate change, people faced, on average, a record 50 more days of health-threatening heat in 2023.*

Minimum mortality temperature is conservatively defined as exceeding the 84.5 percentile of the 1986-2005 daily average. As temperatures rise above this, the risk of health impacts, including death, increases. The first part of this indicator monitors exposure to health-threatening days, defined as those in which temperature exceeds the locally-defined minimum mortality temperature, and compares it with the number of days exceeding this threshold which would have been expected without anthropogenic climate change. The second part estimates the change in heat-related mortality, by combining the change in demographics and temperature in an epidemiological model.[107,108]

In 2019-2023, people were exposed on average to 46 more days of health-threatening heat than expected without climate change, a value that reached a record-high 50 more days in 2023. That year, 61 countries experienced at least 100 additional days of health-threatening heat than expected with no climate change. The number of health-threatening heat days added by climate change decreases with increasing HDI level, reflecting strong global inequalities in heat exposure.

Rising temperatures and aging populations resulted in a 106% increase in the number of average annual heat-related deaths of adults over 65 from 1990-1999 to 2014-2023, 139% higher than the 44% increase expected if temperatures had not changed from baseline levels. In 2023, heat-related deaths in this age group reached the highest level recorded, 167% higher than in 1990-1999, and more than double the 65% increase expected if temperatures hadn't changed from the 1990s.

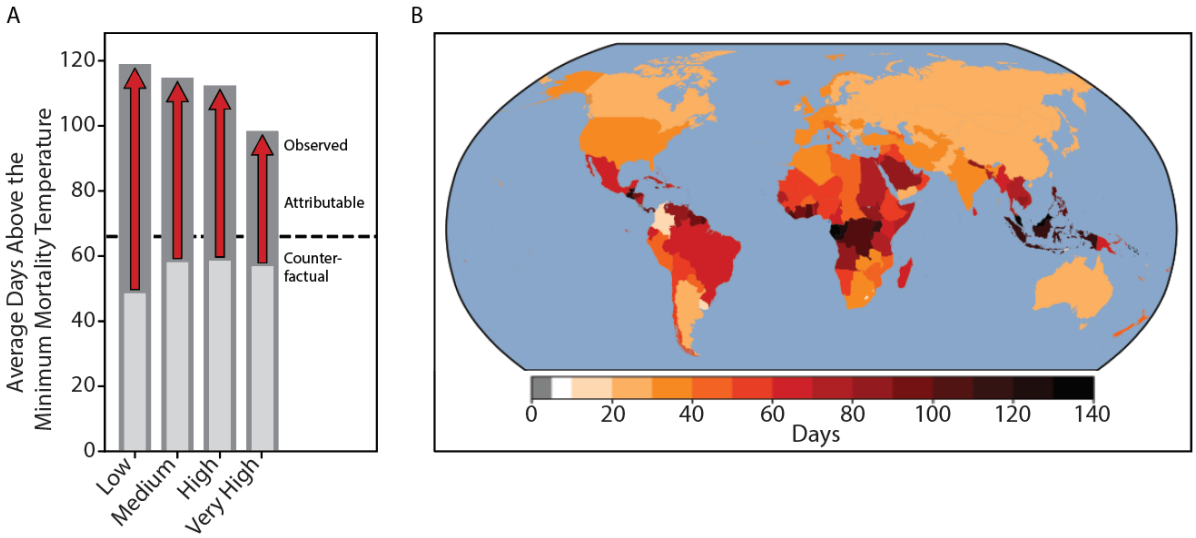


*Figure 2. Stressful heat days 2019-2023. A) Dark grey: observed stressful heat days. Light grey: stressful heat days without human-caused warming. Red arrows: heat days attributable to climate change. B) Average heat days attributable to climate change in 2019-2023, by country.*

## 1.2: Health and extreme weather–related events

Climate change is increasing the frequency and intensity of extreme weather events. Compounded by delays in adaptation and vulnerable human systems and infrastructure, there were widespread health impacts and deaths from extreme weather globally in 2023. This set of indicators monitors the growing health hazards from extreme weather events, human exposure to them, and resulting health impacts, with new indicators monitoring extreme precipitation and exposure to sand and dust storms.

## Indicator 1.2.1: wildfires

*Headline finding: the average number of days with exposure to very high or extremely high fire danger was higher in 2019-2023 than 2003-2007 for 124 (66%) countries.*

Higher temperatures and more frequent and intense droughts linked to climate change increase the risk of wildfires, which affect physical and mental health directly through burns and smoke exposure, and indirectly through infrastructure damage, service disruption, and loss of assets. In 2023, they caused devastation in Canada, Greece, the US, Algeria, Chile, and Kazakhstan.

The first part of this indicator tracks the exposure to the meteorological risk of wildfire and to active wildfires by overlaying population data with the Copernicus Emergency Management Service fire danger indices,[109] and with satellite observations of active wildfires. The second part models the mean annual exposure to wildfire smoke, combining satellite data and atmospheric modelling.

In 2019–2023, people were exposed to an average 10 additional days (11% more) of very high– or extremely high– risk of wildfires, compared to 2003–2007. Mean exposure to days of very high- or extremely high risk of wildfires increased in 124 countries between 2003-2007 and 2019-2023, decreasing in only 45 countries. The annual average exposure of people to active wildfires was higher in 95 countries in 2019–2023 compared with 2003–2007, while 106 countries saw a decrease.

Annually, people experienced 5% fewer days (0.07 days) of exposure to wildfire-related $PM_{2.5}$ particulate matter atmospheric concentrations above the WHO threshold of 15 $\mu g/m^3$ in 2014-2023 compared to 2003-2012. Across this same time period, 119 countries saw a decrease in the number of days above this threshold while 64 saw an increase.

The reduction of wildfire exposure could be attributed to prevention and management actions, reduced availability of burning material due to previous wildfires or land use change, or a change in population distribution. However, as the climate changes and the risk of wildfires escalate, increased wildfire control and management is essential to protect people from their harms.

## Indicator 1.2.2: drought

*Headline finding: in 2023, 48% of the global land area was affected by at least one month of extreme drought – the second-highest level since 1951.*

Anthropogenic climate change increases the likelihood and severity of droughts,[4,110,111] which can affect vector- and water–borne disease transmission; jeopardise water supply, food security, and livelihoods; and disrupt power generation and the transport of goods via inland waterways.[112–114] The year 2023 saw record droughts in parts of South America, triggering a critical water shortage in Uruguay, and the loss of 15% of cereal production in Argentina,[78,115] while the drought in Somalia was linked to 531 000 displacements.[78]

This indicator uses the Standardised Precipitation–Evapotranspiration Index (SPEI) to monitor the intensity and length of droughts on all land areas.[116,117] The total proportion of global land affected by extreme drought for at least one month per year increased from 15% in 1951–1960 to 44% in 2013–2024. In 2023, 48% of the global land area was affected by at least one month of extreme drought – the second-highest level since 1951, a bare 2% less than the record in 2020.

## Indicator 1.2.3: extreme precipitation

*Headline finding: in 2014-2023, 61% of all global land saw an increase in extreme precipitation events, compared to the 1961-1990 average.*

Climate change alters the hydrological cycle, increasing the frequency and intensity of both droughts and extreme precipitation over most land areas.[118–121] Extreme precipitation is associated with adverse physical and mental health outcomes.[122–124] When leading to floods, it can increase the risk of injury or drowning,[125] infrastructural damage, environmental degradation, waterborne disease outbreaks and disruption to social, ecological and economic life support systems, affecting lives and livelihoods.[126–128]

This indicator –new in the 2024 report– tracks changes in extreme precipitation events, defined as those exceeding the 99th percentile of 1961-1990, using ERA Land data.[129] Compared to 1961-1990, extreme precipitation events over land increased by a global average of 9.7% during 1991-2023, equivalent to an average 3.6 additional extreme precipitation events per 0.1° x 0.1° gridcell area (79km$^2$ mean land area), per decade. During the last decade (2014-2023), extreme precipitation events increased over 61% of land areas (Figure 3).

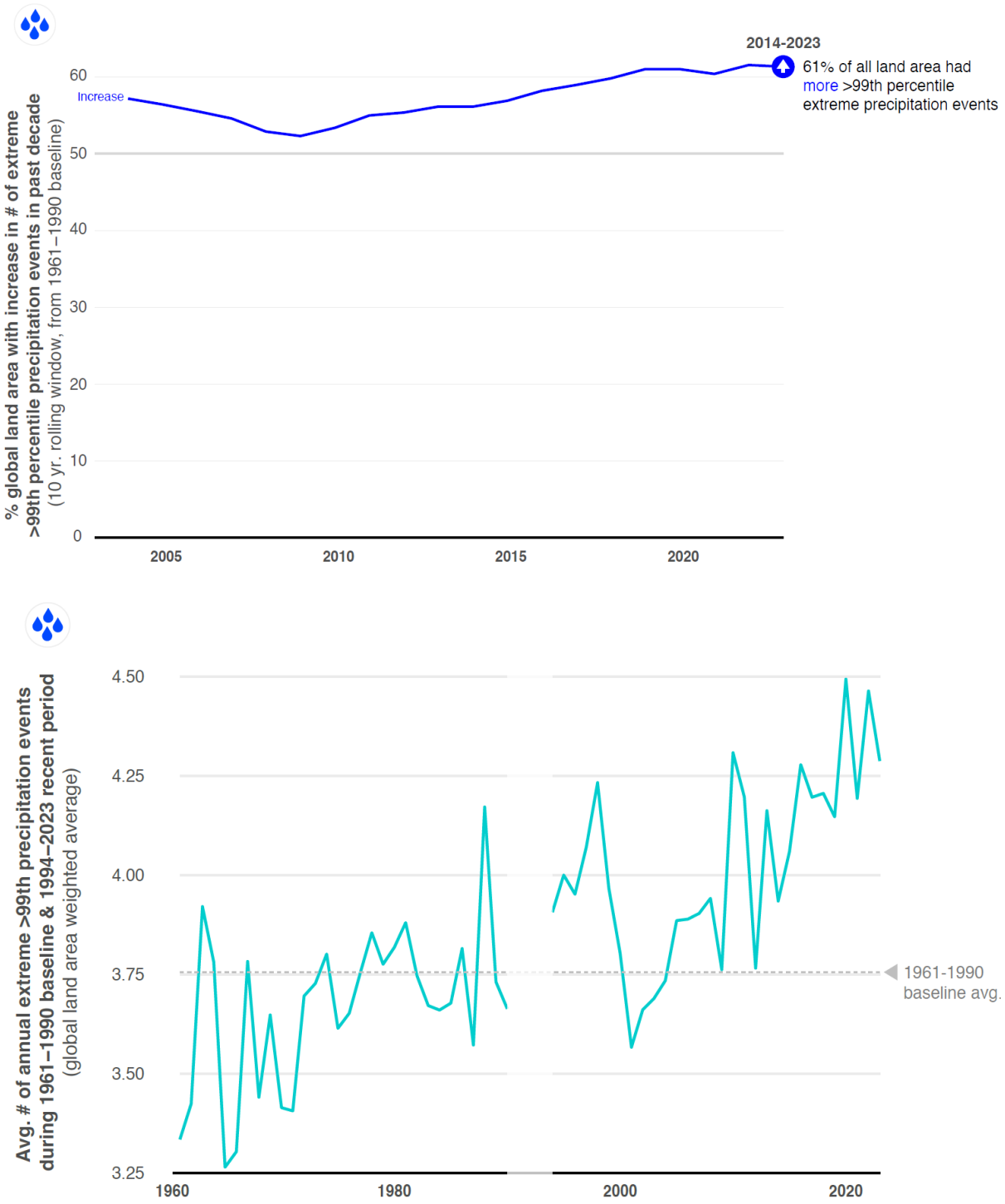


*Figure 3 Top: Percentage of global land where the number of >99th percentile precipitation events increased (blue) during the prior decade. Line depicts rolling 10-year averages (i.e. the blue point above the year 2023 represents the percentage of global land cover where the average number of extreme precipitation events observed during the most recent decade (2014-2023) exceeded the decadal average during the baseline period (1961-1990)). Bottom: Average number of annual*

*extreme precipitation events per 79km²average land area in baseline years (1961-1990) and in the most recent decade (2014-2023)*

## Indicator 1.2.4: sand and dust storms

*Headline finding: On average during* 2018-2022, 3.8 billion people were exposed to average annual concentrations of $PM_{10}$ from sand and desert dust exceeding WHO guideline levels, up by 31% from 2003-2007.

Drought, poor land management and increased wildfire-burned areas are increasing the risk of sand and dust storms (SDS).[78,130] The major component of particulate matter (PM) during a SDS is the mineral (also known as crustal) fraction. Mineral dust contributes to $PM_{10}$ air pollution, exposure to which increases the risk of asthma, cardiovascular disease, and premature death.[131–133] Transported mineral dust can also spread soil–dwelling pathogens,[134,135] and cause transportation accidents through reduced visibility.[136,137]

This indicator uses a state–of–the–art multi–model reanalysis ensemble to estimate $PM_{10}$ emissions from arid and semi-arid regions (referred to hereafter as dust-$PM_{10}$),[138] and overlays it with population data to estimate human exposure.

Globally, in 2018–2022, 3.8 billion people (48.9% of the world's population) were exposed to average annual concentrations of dust-$PM_{10}$ exceeding the WHO's annual threshold of 15 μg /$m^3$ of total $PM_{10}$ – up by 31% from the 2.9 billion (44.5% of the world population) in 2003-2007. From 2003–2007 to 2018–2022, the number of days people were exposed to dust-$PM_{10}$ concentrations above WHO daily $PM_{10}$ guidance levels (45 μg /$m^3$) increased in 42% of countries and decreased in 36% of them (Figure 4).[127] The number of days people were exposed to these unhealthy concentrations ranged from zero to a few days in unaffected areas to over 87% of days (1,600 days during the five–year periods) in the dustiest regions. Of the countries with higher mineral dust exposure, two–thirds of them fall into high or very high HDI categories, while 47% of the countries with lower mineral dust exposure are low or medium HDI countries.

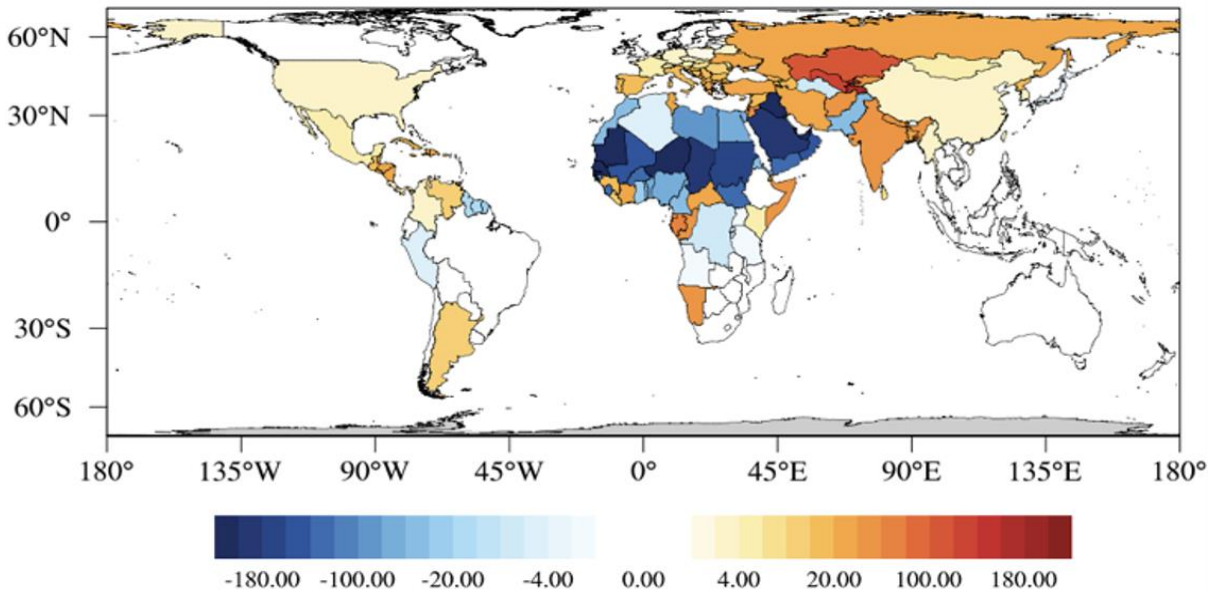


*Figure 4: Change in annual average population–weighted days of exposure to desert dust higher than 45 μg /m3 from 2003–2007 to 2018–2022.*

## Indicator 1.2.5: extreme weather and sentiment

*Headline finding: in 2023, extreme heat events cumulatively worsened human sentiment by a record 53% more than the baseline average effect between 2006-2022.*

Extreme heat can affect human mental health outcomes across a continuum of severity, from subclinical to life–altering.[139–145] This year's indicator introduces a modified methodology. First, it links geolocalised X (formerly Twitter) posts with coincident meteorological data to estimate the effect of heat exposure on expressed sentiment using a multivariate fixed-effects regression.[146] Second, it overlays this response effect with observed temperatures, to estimate the change in annual heat–attributable online sentiment expression.

Over the last ten years, on average, extreme heat events worsened sentiment by 18% (mean 95%CI: 2%, 33%) more than the estimated baseline effect. These findings suggest that the annual sentiment–worsening impacts of heat have increased globally. The largest estimated annual sentiment burden of the last decade was evident in 2023, at 53% above baseline.

## 1.3: Climate suitability for infectious disease transmission

The changing climate, alongside changes in land use (often induced by, or contributing to, climate change), and human movement, are affecting the risk of water-, vector-, food-, and air-borne disease transmission, undermining disease control efforts.[147,148] The indicators in this section track the changing environmental suitability for the transmission of important, and potentially deadly, climate-sensitive diseases.

### Indicator 1.3.1: dengue

*Headline finding: the climatic suitability for the transmission of dengue by* Aedes albopictus *and* Aedes aegypti *increased by 46.3% and 10.7% respectively between 1951–1960 and 2014–2023.*

The global burden of dengue has increased sharply over the last two decades due to ever more suitable climatic conditions and increased human mobility.[149–151] Over five million cases of dengue were reported globally in 2023.[152] Transmission is largely driven by changing distributions of mosquito vectors of genus Aedes, primarily *Aedes albopictus* and *Aedes* aegypti.

This indicator uses an updated and validated mechanistic model incorporating data on temperature, rainfall, daylight duration, and human population density to assess dengue transmission dynamics.[153–155]

The annual average transmission risk (basic reproduction number ($R_0$)) of *Aedes albopictus* and *Aedes aegypti*, increased from 1951–1960 to 2014–2023 by 46.3% and 10.7%, respectively. The change was more pronounced in the High HDI country group (60.4% for *Aedes albopictus* and 23.8% for *Aedes aegypti*). Low, Medium, and Very High HDI country groups observed increase of 11.5%, 59.3% and 20.1%, respectively, for *Aedes albopictus*. Medium and Very High HDI countries saw 8.6% and 12.8% increases, respectively, for *Aedes aegypti*, but the Low HDI group saw a 5.1% decrease in transmission risk. Similar trends were also observed for the transmission suitability of chikungunya and Zika viruses. Overall, the $R_0$ for chikungunya transmission by *Aedes albopictus* increased by 46% and for Zika transmission by *Aedes aegypti* increased by 10.8% globally in 2014–2023.

## Indicator 1.3.2: malaria

*Headline finding: between 1951-1960 and 2014–2023, an extra 17.1% of the global land area became suitable for the transmission of P. falciparum; and an extra 21.8% for the transmission of P vivax.*

This indicator uses temperature, precipitation, and relative humidity thresholds to track the length of the transmission season (LTS) for the two malaria-causing parasites that pose the greatest threat to human health *(Plasmodium vivax* and *Plasmodium falciparum*), transmitted by *Anopheles* mosquitos.[156] Between 1951-1960 and 2014–2023, an extra 17.1% of the global land area became suitable for the transmission of *P. falciparum*; and an extra 21.8% for the transmission of *P vivax*. The LTS of *P. falciparum* increased particularly sharply in the highland areas of Low HDI countries (63.9% increase, around 40 additional days), and increased by 32.2% (+0.9 months) in those of Medium HDI countries, 48.7% (+0.7 months) in High HDI, and negligibly in Very High HDI countries, putting health systems and individuals in these areas at risk.

## Indicator 1.3.3: Vibrio

*Headline finding: the environmental suitability for Vibrio transmission reached a record high in 2023, with 88,348 km of coastline with waters suitable in 2023 - up by 14·8% from the previous record in 2018.*

Pathogenic non-cholera *Vibrio* bacteria can cause severe skin, ear, and gastrointestinal infections and life-threatening sepsis. They are transmitted through direct contact with contaminated brackish waters, or through the consumption of contaminated seafood. As water temperatures rise, they become more suitable for Vibrio transmission. This indicator uses a mechanistic model that incorporates data on sea surface temperature and salinity, to monitor the suitability for Vibrio transmission in coastal water.

A record 83 countries showed coastal water conditions suitable for the transmission of *Vibrio* pathogens at any one time in 2023, and the length of coastlines with suitable conditions reached a new record-high of 88,348 km in 2023 – up by 14·8% from the previous high in 2018, and 32% above the 1990-1999 average. The total population living within 100 km from coastal waters with conditions suitable for Vibrio transmission reached a record-high of 1.42 billion,

and 2023 saw an estimated 692,000 vibriosis cases, a record high (up by 13·5% from the previous record-high of 2022).

### Indicator 1.3.4: West Nile virus

*Headline finding: the temperature suitability for the transmission of West Nile virus has increased by 4·3% from 1951–60 to 2014–2023.*

West Nile virus is a mosquito-transmitted virus that can cause lethal neurological disease in humans. Transmission is maintained in a cycle between birds and mosquitoes (primarily of the genus *Culex*) from which it can spill over into human and other mammal populations.[157] The virus is found across the globe, with its range expanding in some world regions.[158] Based on the response of vector–pathogen traits to temperature derived from experimental studies for three primary *Culex* West Nile virus vectors, this indicator tracks changes in the relative basic reproduction number of West Nile virus (WNV–R0).[159] Driven by changes in temperature, WNV–R0 was on average 4·3% higher in 2014–2023 compared to 1951–60 in the regions where the three *Culex* mosquitoes occur. Increases in WNV–R0 in the same period occurred in the very high (8·3%), high (6·2%), and medium (4·2%) HDI country groups, while there was a decrease in the low HDI country group (-1·1%).

## 1.4: Food security and undernutrition

*Headline finding: the higher frequency of heatwave days and drought months in 2022, compared to 1981–2010, was associated with 151 million more people experiencing moderate or severe food insecurity across 124 countries.*

In 2022, 735 million people experienced hunger and 3·1 billion people (42%) were unable to afford a healthy diet in 2021.[160] Climate change is exacerbating food insecurity and undernutrition by reducing crop yields, labour capacity, and access to water and sanitation; disrupting supply chains; and compromising marine resources through higher coastal sea surface temperatures, reduced oxygenation, ocean acidification, and coral reef bleaching.[161,162] Increased food insecurity contributes to malnutrition, which harms health and development.[163–165] The impacts are particularly acute for subsistence farmers and Indigenous Peoples, for whom food availability is particularly sensitive to local climatic changes.[166–169] The risk is

particularly important for Indigenous children, who experience higher levels of malnutrition compared with non-Indigenous children, with severe implications for their health throughout the lifecourse.[166,167]

The first part of this indicator combines data from the FAO Food Insecurity Experience Scale (FIES)[170–172] from 124 countries (up from 122 in 2023) with the frequency of heatwave days and drought months (SPEI–12)[173] during the growing seasons of maize, rice, sorghum, and wheat, using a time–varying panel regression. Compared to 1981–2010, a higher number of heatwave days was associated with 4·4 percentage–points higher moderate or severe food insecurity in 2022; and increasing frequency of droughts was associated with food insecurity being 2·0 percentage–points higher. The combined effect is equivalent to approximately 151 million more people experiencing food insecurity in 2022, due to climate change, suggesting insufficient adaptation.

The second part of this indicator monitors the growing risk to marine yields by tracking sea surface temperature variations in coastal waters across 148 territories.[174] It finds that in 2021–2023, average global sea coastal temperature exceeded the 1981–2010 average by 0·54°C. Moreover, the year of 2023 marked a milestone as global coastal sea surface temperatures exceeded 20°C for the first time in recorded history. This shift underscores the global threat to marine food security induced by climate change.

## Conclusion

The rapidly growing health risks and impacts of climate change, presenting complex public health challenges. Record-breaking temperatures in 2023 resulted in a record increase in heat-related deaths, and caused a record loss of hours of potential labour, safe outdoor exercise, and quality sleep (indicators 1.1). The incidence and intensity of droughts and extreme precipitation are also growing, as are the risk of wildfires and exposure to desert dust in most countries (indicators 1.2). Record coastal water temperatures in 2023 put marine food yields at risk, and the impact of heatwaves and droughts on food insecurity has continued to increase (indicator 1.4). In parallel, the risk of transmission of deadly diseases like dengue, West Nile virus, malaria and vibriosis has continued to increase (indicators 1.3). While these evolving risks and hazards are monitored individually, they are often affecting populations simultaneously, with compounding impacts that aggravate overall health outcomes.

Importantly, those indicators that capture health outcomes suggest that adaptation is not keeping pace with the growing hazards. As climate risks escalate, countries will need to dedicate growing effort and resources to avoiding the worst health impacts.

In the upcoming years, the Lancet Countdown will work to track the observed impacts on physical and – importantly – mental health; and to formally measure the attribution to anthropogenic climate change.

# Section 2: Adaptation, Planning, and Resilience for Health

With climate change increasingly threatening human health (Section 1), suitable, effective, and well-funded adaptation measures are urgently needed to minimise adverse mental and physical health impacts, and limit health-related losses and damages. [175,176]

The Paris Agreement established the Global Goal on Adaptation (GGA) of "enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change".[177] At COP28, the UAE Framework for Global Climate Resilience was adopted, providing an official framework that established health adaptation as one of the GGA targets.[178] In addition, COP28 saw the establishment of the UAE–Belém work programme, with the purpose of developing indicators for measuring progress towards the targets outlined in the framework – a critical process that will add definition to the targets and the level of ambition.

Major progress towards climate change adaptation has been made within the health sector itself in 2024: the WHO's new GPW14 set a specific goal of delivering resilient health systems; and a new World Health Assembly resolution on climate change called upon WHO Member States to commit to strengthen, invest in, and implement further adaptation actions, including to deliver climate-resilient health systems through multisectoral cooperation.

In support of these global efforts, this section reports progress and challenges in assessing, planning, and delivering climate change adaptation for health. It also presents conditions that facilitate health adaptation, both within and beyond the health sector.

## 2.1: Assessment and planning of health adaptation

A thorough assessment of health-related climate change risks and vulnerabilities is critical to inform the planning of effective adaptation interventions that protect people's health. This set of indicators tracks the progress on risk assessments and health adaptation planning.

### Indicator 2.1.1: national assessments of climate change impacts, vulnerability, and adaptation for health

*Headline finding: as of December 2023, 61% of the WHO members that committed to building climate-resilient health systems through the 26th Conference of the Parties (COP26) Health Programme reported having completed a vulnerability and adaptation assessment, up from 17% the year before.*

Within the COP26 Health Programme in 2021, countries, territories, and areas (hereafter members) committed to build climate-resilient health systems. This included the commitment to conduct climate change and health vulnerability and adaptation (V&A) assessments to inform Health National Adaptation Plans (HNAPs) and facilitate access to climate change funding for health. The Alliance for Transformative Action on Climate and Health (ATACH), led by the WHO, supports members in meeting these commitments.[179]

As of December 2023, 82 ATACH members have committed to building climate-resilient health systems through this programme. Among these, 61% (50) have conducted a V&A assessment, with 32 of these having done so since January 2020. This is a substantial increase from 17% (11 out of 64 countries) the year before. In 2023, 11 members reported having their first-ever V&A assessment under development, and 11 were updating previous V&A assessments. Of all 82 ATACH members, 67% of Low HDI countries, 76% of Medium HDI, 53% of High HDI, and 56% of Very High HDI countries had developed a V&A assessment.

## Indicator 2.1.2: national adaptation plans for health

*Headline finding: as of December 2023, 52% of WHO members that committed to building climate-resilient health systems through the COP26 Health Programme reported having developed an HNAP, up from just 6% one year before.*

In 2010, COP16 established a process for the development of National Adaptation Plans (NAPs), with the aim of reducing vulnerabilities to climate change and facilitating the integration of climate change adaptation into policies, programmes, and planning processes.[180] Health NAPs (HNAPs) build on this initiative, focusing specifically on preparing for, and adapting to, the threats of a changing climate to health systems and people's health.

As of December 2023, 43 out of 82 (52%) ATACH members had developed an HNAP, 23 of which were developed since 2020. This is an increase from 6% (4 of 64 countries) the year before. In 2023, 14 countries reported having their first-ever HNAP under development, and 6 countries were updating previous HNAPs. Of all 82 ATACH members, 61% with Low HDI, 47% with Medium HDI, 55% with High HDI, and 52% with Very High HDI had ever developed an HNAP.

### Indicator 2.1.3: city-level climate change risk assessments

*Headline finding: in 2023, 937 (96%) of 979 cities reported having completed or expecting to soon complete city-level climate change risk assessments.*

Home to 56% of the world's population, cities have a major role to play in protecting health amidst growing climate change impacts.[181] This indicator uses data from the CDP (formerly Carbon Disclosure Project) to report on city-level assessments of climate change risks.[182] In 2023, of the 979 cities responding to the climate risk assessment module, 937 (96%, 2% higher than 2022) reported having completed, being in the process of conducting, or planning to conduct within two years, city-level climate change risk assessments.

Of the 556 (57%) cities responding to the health module, 82% (454) noted that climate change is impacting health outcomes; 31% (173) noted impacts on health systems, and 9% (49) noted impacts on other sectors relevant to health. Leading climate-related health hazards identified included extreme heat (74%, 412 cities), urban flooding (42%, 232), heavy precipitation (39%, 216), and infectious diseases (37%, 204). Heat-related illnesses (80%, 447), exacerbation of respiratory disease (53%, 294) and vector-borne infections and illnesses (52%, 290) were the leading public health issues identified.

Of the 42 (4%) cities reporting that they were not undertaking a climate risk assessment, 24% (10) indicated it was due to lack of financial resources, 38% (16) due to technical capacity, and 26% (11) indicated that both played a role.

## 2.2: Enabling conditions, adaptation delivery, and implementation

Strong governance, financing mechanisms, and access to education, information and technology are essential for efficient adaptation. Indicators in this section track progress on health adaptation implementation, and on the conditions that enable it, including a new indicator on climate and health education for adaptation.

### Indicator 2.2.1: climate information for health

*Headline finding: among WMO members, only 23% of Ministries of Health reported having public health surveillance systems that integrate meteorological information.*

Climate data and information services are crucial for establishing climate-informed public health surveillance, early warning, and early response systems, which are vital for effectively anticipating and responding to climate-related health risks. Establishing these systems requires close collaboration between meteorological and health services.[183]

In 2021, 81% of the World Meteorological Organization's members (157/193) reported providing climate services for health, but only 23% (44) had at least one climate-informed public health surveillance system. The reported implementation of Health Early Warning Systems (HEWS) ranged from 35% (30/85) of countries having such systems for vector-borne diseases and 33% (28/84) for heat-related illness, to just 10% (8/83) having them in place for mental and psychosocial health, and 14% for non-communicable (12/84) and for malnutrition and foodborne diseases (12/83).[183] Notably, only 15% (12/80) of countries reported a HEWS for impacts on healthcare facilities. These data reflect the need for stronger collaboration between the health and climate sectors to increase the implementation of these potentially life-saving systems.

## Indicator 2.2.2: benefits and harms of air conditioning

*Headline finding: greenhouse gas emissions from air conditioning use increased 8% from 2016 to 2021; while 48.4% of Very High HDI country households had AC in 2021, only 4.7% of those in Low HDI countries did.*

Air conditioning (AC) is an effective technology for reducing heat exposure.[184] However, it is expensive and energy-intensive, overwhelms energy grids on hot days, and contributes to greenhouse gas emissions, air pollution, and the urban heat island effect.[185–187] Therefore, while AC can be a suitable option for vulnerable individuals if powered by renewable energy and used alongside with passive and low-energy cooling solutions, it often represents a maladaptive response.

This indicator draws on International Energy Agency (IEA) data on AC usage, at a more granular geographical level than in previous years. It also builds on studies on the protective effect of AC against heat-related mortality, using data from Indicator 1.1.5 to estimate heat-related deaths of people over age 65 potentially saved by AC use.

The global proportion of households with AC increased from 19·3% in 2000, to 30.4% in 2016 (the year the Paris Agreement entered into force), and to a record 35·3% in 2021. The average annual potential heat-related deaths of people over age 65 averted by AC increased 36% from

2015-2017 to 2019-2021. In parallel, AC-related $CO_2$ emissions increased by 8% from 2016 to 2021.

Marked inequities exist in global access to, and resultant benefits of, AC. In 2021, the proportion of households with AC reached 43·8% in High, and 48·4% in Very High HDI compared to just 4·7% in Low and 14·3% in Medium HDI countries. Accordingly, the ratio of potential heat-related deaths prevented by AC to actual heat-related deaths among those over age 65 was 0.041 for Low HDI, 0.12 for Medium, 0.74 for High, and 0.76 for Very High HDI countries. These data reflect the urgency of implementing equitable, affordable, sustainable health-protecting cooling solutions, to save lives.

## Indicator 2.2.3: urban greenspace

*Headline finding: Between 2015 and 2023, the proportion of urban centres with at least moderate levels of greenness remained constant, at 28%.*

Increasing equitable access to safe, quality urban green spaces can help reduce the negative health impacts of climate change, reducing heat exposure and flood risk, while offering physical and mental health co-benefits by improving air quality, and offering spaces for exercise, social interaction, and connection with nature (panel 4).[188–193] This indicator performs a population-weighted average of Landsat's Normalized Difference Vegetation Index (NDVI) to estimate greenspace exposure for 1,041 urban centres (larger than 500,000 inhabitants) across 174 countries.

The global average urban population-weighted NDVI has remained at 0·34 since 2015, the year the Paris Agreement was signed, and the number of cities with at least moderate exposure to greenness remained constant at 28%. There have not been substantial changes across any HDI group (Figure 5).

These data show that cities are not undertaking an expansion of urban green spaces at scale, an untapped measure that could increase resilience of urban populations in the face of climate change.

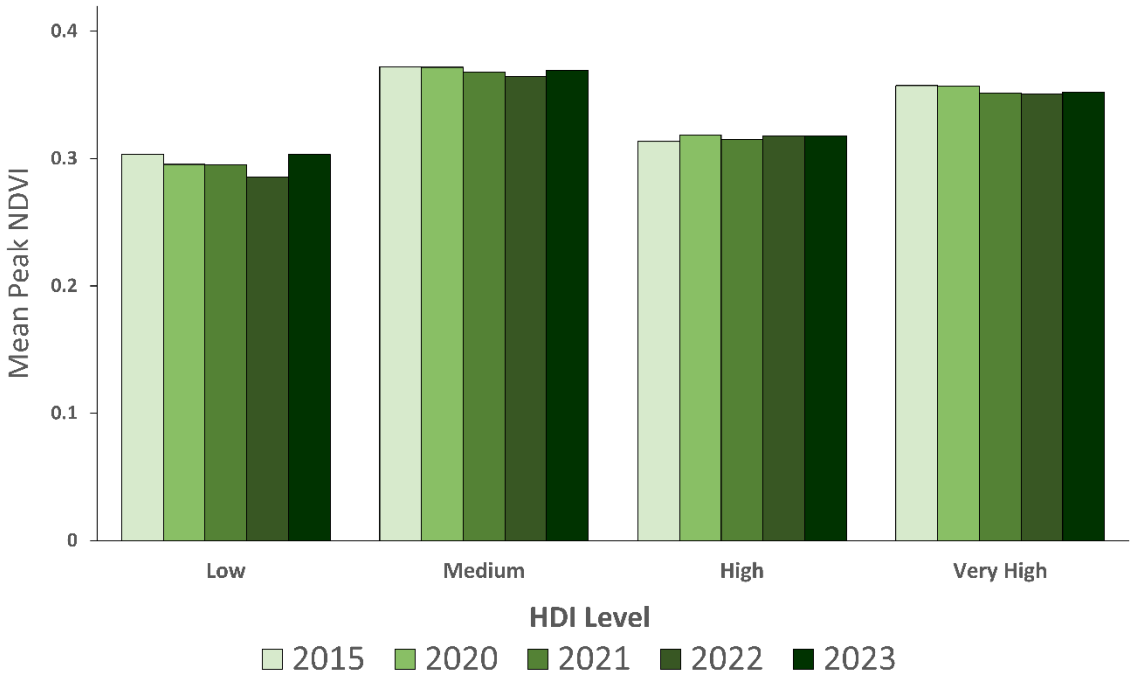


*Figure 5: Mean, population-weighted peak-season NDVI of urban centres by HDI and year.*

## Indicator 2.2.4: global multilateral funding for health adaptation programmes

*Headline finding: in 2023, the Green Climate Fund (GCF) approved adaptation projects with potential health benefits for US$ 423 million – up by 137% from 2021.*

Sustainable and just funding is essential to enable health-supportive climate adaptation and health system resilience, particularly in low- and middle-income countries (panel 5). In support of this, the Green Climate Fund (GCF) serves the Paris Agreement to operationalise financial support to the so-called "Least Developed Countries,"[194] making it a key financial mechanism to support a just transition. This indicator tracks funding allocated by the GCF to health-related adaptation projects,[195] and the funding reported by members of the ATACH in support of health adaptation and resilience.

The funding allocated by the GCF which identified adaptation outcomes increased from US$ 1.05 in 2021 to US$ 1·56 billion in 2023, following a dip to US$ 0.68 billion in 2022. Of these, the proportion dedicated to projects with identified adaptation outcomes in "health, food, and water security" increased from 17% (US$ 178 million) in 2021 to 27% in 2023 (US$ 423 million) - a 137% increase in the total funding for projects with potential health adaptation benefits.

Additionally, the GCF approved the first-ever adaptation project aimed at strengthening the health system's climate resilience in 2023, for US$ 28·2 million.[196]

Complementarily, as of December 2023, 25 ATACH members had reported 32 projects aimed at strengthening climate change and health resilience, totalling US$ 550 million. During COP28, in the context of the first-ever COP Health Thematic Day, US$ 1 billion was announced in support of climate change and health over the next 3 to 5 years. While still grossly insufficient, this funding represents a step in the right direction. In upcoming years, the Lancet Countdown will seek to monitor the unrolling of this funding.

## Indicator 2.2.5: detection, preparedness, and response to health emergencies

*Headline finding: from 2022 to 2023, 48 out of 185 (26%) WHO member states reported an increase in the implementation of health emergency management capacity, while 54 (29%) reported a decrease.*

Climate-related health risks, particularly related to infectious diseases, require robust health emergency preparedness and response systems to reduce the risk of outbreaks, epidemics, and pandemics.[197] This indicator uses data from the e-SPAR tool to monitor the self-reported level of implementation of the legally-binding International Health Regulation (IHR)'s core capacity 7 (health emergency management), and –an improvement this year–capacity 3.2 (financing for public health emergency response).[198]

In 2023, 131 of 193 (68%) countries reported high to very high implementation (capacity 7 score of 61–100) of health emergency management, of which 51 (39%) were Very High HDI countries, 39 (30%) were High HDI countries, 23 (18%) were Medium HDI countries, and only 15 (11%) were Low HDI countries. Of the 185 countries that had also reported their implementation status in 2022, 48 had increased their implementation, while 54 decreased their capacity. The Low HDI country group showed the least progress, with just 8 (17%) of these countries increasing their capacity.

The implementation of capacity 7 is positively associated with capacity 3.2 with Very High and High HDI countries having high levels of implementation for both. On the other hand, Low HDI countries tend to have low to medium levels of implementation in both capacities.

## Indicator 2.2.6: climate and health education and training in public health institutions

*Headline finding: in 2023, 70% (196) of 279 public health education institutions worldwide reported providing education in climate and health.*

Public health professionals play a crucial role in developing and implementing health-promoting adaptation and mitigation interventions.[199] However, the integration of climate change education and training is largely not mandated in public health curricula, leaving many public health professionals ill-prepared for this purpose.[200]

This indicator builds on an international survey of degree-granting public health education institutions to assess the current state of climate and health education and training among them. Of the 279 public health education institutions responding to the survey in 2023, 70% (196) reported providing education in climate and health, and 39% (108) reported training in climate was a mandatory component of their curriculum, covering approximately 45,000 students. Most (60%) of those providing climate change and health education did so through master's degree programmes.

Very High HDI country-based institutions accounted for 59% of total respondents, while 28% were High, 7% were Medium, and 6% were Low HDI institutions (Figure 6). This selection bias impedes a reliable analysis by HDI group, and efforts will focus on increasing the representation of lower HDI countries in upcoming years. However, a preliminary analysis suggests that Low HDI countries had the lowest proportion of responding institutions offering climate change and health education, which could mean that the most vulnerable countries may lag in building adaptive capacity for health, amplifying the inequities driven by climate change.

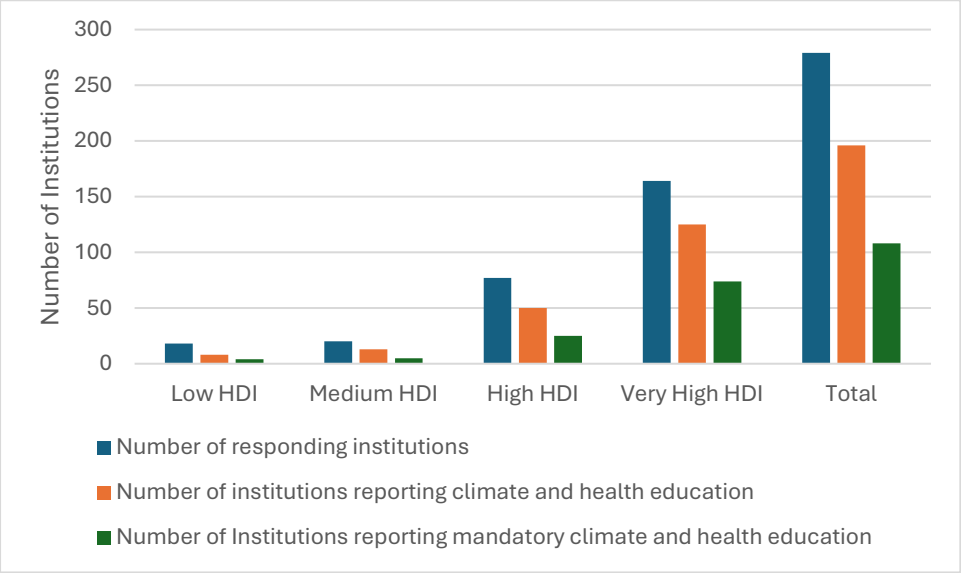


*Figure 6: Number of responding institutions and those reporting providing climate and health education, by HDI country group in which they are based.*

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*Panel 4: Nature-based solutions*

Nature-based solutions (NbS) are actions that address climate change and other environmental challenges by utilising and enhancing the capacity of natural ecosystems. Adequately implemented, they could be powerful tools for mitigating and adapting to climate change, as they provide a range of benefits that support sustainable development, including climate resilience, carbon sequestration, and biodiversity conservation.[201] Critically, NbS can also result in improved human health and well-being.

The restoration of degraded landscapes, such as forests and grasslands, is a prime example of NbS with high potential for health co-benefits.[202] Restoration of degraded forests and other ecosystems can significantly increase carbon sequestration, contributing to climate change mitigation, while also improving resilience by supporting biodiversity conservation, and providing livelihood opportunities for local communities, thereby benefitting their socioeconomic conditions and physical and mental health.[203] Restoration can also improve local air quality, with trees and other plants absorbing pollutants from the air, and it may also help reduce the risk of respiratory diseases and infectious disease risks particularly where land degradation has previously favoured disease hosts or vectors, or exacerbated land erosion and exposure to dust (indicator 1.2.3).[204]

Another example of NbS is the promotion of agroforestry, which involves integrating trees and other native or high value plants into agricultural landscapes. Agroforestry practices can increase the resilience of agricultural systems to climate change by improving soil health, increasing water retention, and providing shade and windbreaks for crops.[205] Agroforestry can also contribute to carbon sequestration, biodiversity conservation, and provide additional sources of income for farmers. This in turn can boost food security and dietary diversity with important nutritional benefits that can help combat the growing food insecurity and malnutrition (indicator 1.4.2).[206]

The implementation of NbS nevertheless faces several challenges, particularly in LMICs. These include limited access to finance, technical expertise, and supportive policies. In many cases, local communities and Indigenous Peoples, who often have the most knowledge and experience in NbS, are excluded from decision-making processes and are not adequately compensated for their contributions or losses (panel 3).[68] Additionally, NbS may not be prioritised alongside other socio-economic development imperatives in the places that may have the most to gain from them. For instance, urban green spaces such as parks and gardens are often overlooked or underinvested in rapidly growing urban centres (indicator 2.2.3).[207] This is despite evidence showing urban green space can benefit mental health, including by reducing stress, anxiety, and depression and reduction in urban heat stress.[208,209]

To overcome these challenges, there is a need for increased investments in NbS and to better understand the range and magnitude of health benefits (or in some cases harms) they may provide. This includes financing for large-scale restoration and conservation programs, support for local communities to implement NbS, and policy reforms that promote sustainable land use and management. There is also a need for increased collaboration between different stakeholders, including governments, Indigenous Peoples, civil society, and the private sector, to ensure that NbS are maximally beneficial, in line with local goals, and effectively implemented and scaled up.[210] By enhancing the capacity of natural ecosystems, NbS can support healthier and resilient communities, which is particularly important in the context of climate change and other environmental challenges.

## 2.3: Vulnerabilities, health risk, and resilience to climate change

A core goal of adaptation is to build resilience and reduce vulnerabilities to growing climate change-related health hazards. This group of indicators tracks vulnerabilities and risks to climate hazards and adaptation responses.

### Indicator 2.3.1: vulnerability to severe mosquito-borne disease

*Headline finding: the Very High HDI country group was the only group in which vulnerability to severe* Aedes-borne *disease increased between 1990-1999 and 2014-2023, with a 5.4% rise.*

Dengue incidence is growing globally, driven by increasingly favourable climatic conditions, population mobility, urbanisation, and susceptibility to circulating serotypes (indicator 1.3).[211,212] An estimated 40,000 individuals die annually from severe dengue.[213] However, adequate medical care and early intervention can reduce the fatality rate below 1%.[214] This indicator captures relative vulnerability to severe dengue by combining increased susceptibility from urbanisation, and coping capacity from improved health-care access and quality.

Mostly due to improvements in healthcare, Low, Medium, and High HDI countries experienced a 46%, 32%, and 2% reduction in dengue vulnerability, respectively, between 1990-1999 and 2014-2023. However, rapidly increasing urbanisation limited the reduction in vulnerability to just 2% in High HDI countries and drove an increase in vulnerability of 5·4% in Very High HDI countries. With exposure to dengue growing, interventions to reduce vulnerability, including dengue response capacity within health systems, integrated vector control measures to control mosquito populations, early warning and early response systems, and population awareness campaigns, are urgently needed.

## Indicator 2.3.2: lethality of extreme weather events

*Headline finding: the lethality of extreme weather events decreased by 72% in countries with climate-informed health early warning systems (HEWS), but only by 1.5% in countries without HEWS in 2014-2023 compared to 2000-2009.*

Under a changing climate, extreme weather events are increasing in frequency, intensity, and duration,[215] threatening the health, wellbeing, and survival of individuals globally.[176] However, the implementation and community uptake of health early warning systems may reduce the chance of the most severe health outcomes and death.[216]

This indicator combines data from the EM-DAT database[217] with data from the 2021 WHO Health and Climate Change Survey Report[218] to explore the relationship between lethality rates associated with disasters involving floods or storms, and the implementation of climate-informed HEWS.

The lethality rates of disasters associated with floods and storms for countries that replied to the 2021 WHO Health and Climate Change Global Survey have decreased since 2000. Countries with HEWS saw a 72% decrease in lethality, from an average 1.68 deaths per million people per event in 2000-2009 to 0.46 deaths per million people per event in 2014-2023. In countries without HEWS, however, the decrease was only 1.5%, going from 2.84 to 2.79 deaths per million people per event between 2000-2009 and 2014-2023, on average.

## Indicator 2.3.3: rising sea levels, migration, and displacement

*Headline finding: in 2023, 157·3 million people were living less than 1 metre above current sea levels.*

Global mean sea level increased by 0·20m between 1901 and 2018 and is projected to rise between 0·28–1·88m by 2100 (relative to 1995-2014), with major local variations.[219,220] Sea level rise (SLR) can lead to permanent inundation, episodic flooding, coastal erosion, saltwater intrusion, vector-borne and waterborne disease risk, and disrupted coastal livelihoods, with resulting adverse physical and mental health impacts.[221,222] Using land elevation and population data, this indicator estimates that 157·3 million people were living less than 1m above sea level in 2023, and therefore at risk of these harms - up 11% from 2010.

Populations can adapt to SLR through coastal infrastructure; ecosystems (mangroves, wetlands); land reclamation; managed realignment, living in elevated built structures, HEWSs, improved healthcare, and diversified food, freshwater supplies, and livelihoods. Where *in situ* adaptation limits are reached, human mobility could be a response, including planned relocation, temporary or permanent migration, or forced displacement. However, some people might be unable, unwilling, or not permitted to move, becoming trapped.[223] (Im)mobility can lead to health benefits and risks in sites of origin, migration routes, and destinations. The risk-benefit balance largely depends on the policies and protective measures in place. The second part of this indicator, therefore, monitors the availability of policies on climate change, migration and health.

As of December 2023, 54 policies identified across 40 countries connected climate change and migration. Policies at all governance levels rarely acknowledged the scientific links (or lack thereof) between climate change, (im)mobility, and health. Policies generally assumed that migration would occur due to *in situ* adaptation limits, without acknowledging immobile populations, or their health risks. They predominantly highlighted the negative impacts of migration, downplaying the potential positive impact of effective, climate-adapted health systems and of policies that support (im)mobile populations and *in situ* adaptation. In parallel, if *in situ* adaptation limits are reached (panel 5), policies to ensure migration is available as a safe, desirable, health-supporting option will be urgently needed.

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*Panel 5. Limits to adaptation*

The current challenges of climate change to people's health and survival are unprecedented (Section 1), with new records breached as global temperatures rise. With further heating unavoidable and current measures falling short of their potential, urgent and robust adaptation is necessary to prevent a rapid escalation of climate-related health impacts.[224]

However, while the need for adaptation is urgent, its capacity to effectively safeguard people's health is finite. According to the IPCC, limits to adaptation represent points at which systems' needs cannot be secured from intolerable risks through adaptive action, differentiating "Soft" and "Hard" limits.[225] Soft limits exist because of the current unavailability of some existing adaptation actions and stem from weak leadership and governance, institutional constraints, or inadequate funding. "Hard" limits occur when it is no longer feasibly possible to adapt, resulting in an increased risk of irreversible losses and damages.[176]

From a health adaptation perspective, reaching these limits is becoming increasingly likely as climate change continues, challenging the capacity to effectively adapt to climate-related health impacts. Based on the Lancet Countdown's evidence and expertise, it is possible to identify several limits to health adaptation, including:

- *Evidence and knowledge limits*. Evidence and knowledge are enablers of health adaptation and help identify effective ways to protect people's health. However, there are limits to the generation and implementation of useful and actionable evidence, which originate from human limits to understanding the interaction between the natural world and health outcomes.

- *Financial limits*. Under the current mitigation course, adaptation alone will be very costly and require the reallocation of funds from other sectors. These limits are more marked in lower income countries and settings, particularly given the limited international funds allocated to supporting adaptation actions, especially for health (indicator 2.2.4).

- *Governance or policy limits*. Most health-related adaptation measures require actions in sectors that support people's health, including sanitation, urban planning, transport, and energy, to optimise resources, maximise benefits and optimise trade-offs. This requires articulated cooperation across governmental sectors, effective executive functions, and adequate funding flows – all of which rarely occurs, at the international, national, and sub-national level.

- *Physiological limits.* Human physiological functions require a relatively narrow range of environmental conditions, including of heat. As climate change drives environmental changes at apace faster than humans were ever exposed to,[226,227] these limits are likely to be increasingly reached.[228]

- *Physical or infrastructure limits.* In some cases, the physical environment exacerbates the risks of climate change to people's health, but there are often limits to modifying it. This includes, for example, physical limits to protect low-lying coastal areas, flood protection barriers or built elevation as sea levels continue to rise. Similarly, modifying the built environment to make it more climate-resilient can be extremely expensive, disruptive, or slow, making it an unavailable option. This includes, for example, large-scale engineering work to improve water or sewage systems, flood protection, or increasing urban greenspaces when space is scarce.

- *Social, cultural, and behavioural limits.* Behavioural change can help build resilience to climate change. This includes, for example, adopting behaviours to shield from the heat and seek cooling solutions in cases of heatwaves, seeking safety during extreme events, or migrating. However, people's capacity or willingness to adopt protective behavioural changes is oftentimes limited by their habits, culture, beliefs, or social networks.

Overcoming these limits is theoretically possible through major societal, institutional, and technological shifts, requiring a combination of adaptation and mitigation measures. Whole-of-society and cross-sectoral actions (e.g., formal and sustained financing, strong governance, political commitment) are urgently required to face

current and future climate hazards to overcome soft limits and avoid reaching hard limits in the short- and long-term.

## Conclusion

There has been a persistent failure to adequately adapt to the rapidly growing health threats of climate change, and limits to adaptation are looming (panel 5). Only 61% of ATACH countries carried out a vulnerability and adaptation assessment (indicator 2.1.1), only 52% had HNAPs (indicator 2.1.2); and cities in Low and Medium HDI countries are lagging in assessing their climate change and health risks (indicator 2.1.3). These delays limit the capacity to implement effective, evidence-based health adaptation policies. The lack of intersectoral collaboration, especially between meteorological and health institutions (indicator 2.2.1), further hinders adaptation efforts. Some effective adaptation measures are underutilised, including the use of nature-based solutions (panel 4) like urban greenspaces (indicator 2.2.3). Instead, people turn to maladaptive responses, with a growing proportion of households using air conditioning (indicator 2.2.2).

Despite this, there is some movement in the right direction. GCF funding for projects with potential health adaptation outcomes increased 137% between 2021 to 2023 (indicator 2.2.4); more than two-thirds of countries self-reported high to very high implementation of health emergency management capacities in 2023 (indicator 2.2.5); and Low HDI countries experienced a 46% decrease in vulnerability to severe *Aedes*-borne disease since 1990 thanks to healthcare improvements (indicator 2.3.1). Additionally, the lethality of floods and storms declined since the Paris Agreement entered into force, particularly in countries with climate-informed HEWS (indicator 2.3.2); and 70% of 279 public health institutions surveyed provide climate and health education, building capacity to protect health in the face of climate challenges (indicator 2.2.6).

The new two-year UAE-Belém work programme will strengthen the UAE Framework for Global Climate Resilience[174] by outlining and developing indicators for measuring progress towards adaptation targets, including health.[178] Following the commitment of US$ 1 billion to climate and health, improved metrics to monitor vulnerabilities, climate change impacts and adaptation can help to inform funding allocations, policy decisions, and life-saving adaptation. Acknowledging this, the Lancet Countdown will allocate increased resources towards refining

its metrics, working with the WHO and other partners to put the best available science at the service of improved climate change adaptation policies.

# Section 3: Mitigation Actions and Health Co-benefits

Despite 31 years of international climate negotiations, global emissions are nowhere near meeting the Paris Agreement goal of limiting heating to 1.5°C. Indeed, current policies and actions, if sustained, would put the world on track to a potentially catastrophic 2.7°C of heating.[11] Efforts to reduce greenhouse gas emissions are therefore essential to protect the wellbeing, health, and survival of individuals in every country. Importantly, many such actions can also deliver direct health benefits in the short- and long-term.

This section provides an updated overview of progress in climate change mitigation and associated health outcomes. It examines progress towards mitigation in the energy and agriculture sector, and the opportunities for promoting health through improved air quality and diet. A new indicator monitors tree cover loss, which draws a link between climate change, biodiversity and health. Additionally, the last indicator monitors the emissions and associated health impacts from the healthcare sector – an effort which will be critical in tracking progress towards the health sector mitigation goals set in the WHO's GPW14.

## 3.1: Energy use, energy generation, and health

A global transition offers the potential for major health benefits, including from improved air quality and energy access, safer employment opportunities, and reduced vulnerability of energy supply to uncertain geopolitics. The following indicators track energy system mitigation progress and related health impacts.

### Indicator 3.1.1: energy systems and health

*Headline finding: global $CO_2$ emissions from the energy system reached an all-time high in 2023, 1.1% above 2022.*

With 67% of global GHG emissions from fossil fuel combustion,[229] preventing the most dangerous climate change scenarios requires structural changes in the energy sector. In addition to emissions, the extraction and use of fossil fuels pose myriad health impacts throughout its life cycle (panel 6).

Drawing on data from the International Energy Agency (IEA) to track mitigation in the energy sector, this indicator shows that, despite temporary changes during the COVID-19 pandemic, minimal progress has been made since the Paris Agreement entered into force in 2016.[229,230] The proportion of fossil fuels in the global energy system increased for the first time in a decade during 2021, reaching 80.3% (up from 80.1% in 2020), and the carbon intensity of the energy sector decreased by just 4.8% since 2016.[231]

Given the high GHG and air pollution emissions intensity of coal, its phase-out is crucial to protect people's health. However, the share of coal in the electricity system of Low HDI countries increased from 0.5% in 2016 to 10.4% in 2021, while Medium and High HDI countries maintained shares above 50%. Only Very High HDI countries reduced this share, from 24.4% to 19.1%. This underscores the global inequities in the access to clean, healthy energy, and the health trade-offs of an unjust transition as countries seek to meet the growing electricity demand.

Alongside increasing energy efficiency, a rapid transition to renewable energies is critical to tackling climate change.[232] The share of electricity generated from clean renewables reached a record-high 10.5% in 2021, almost doubling that in 2016 (5.5%).[233] In this period, the share grew from 6.7% to 11.6% in Very High, 4.2% to 10.3% in High, and 4.6% to 8.2% in Medium HDI countries. In Low HDI countries, those most affected by energy poverty, the proportion grew from only 1.2% in 2016 to just 2.3% in 2023.[233]

## Indicator 3.1.2: household energy use

*Headline finding: shares of harmful biomass energy use in homes have decreased minimally, from 32% in 2016 to 30% in 2021; remaining at around 92% in Low HDI countries*.

Household energy use is a key determinant of health and is linked to economic development. However, almost 2.3 billion people still use dirty fuels and technologies for cooking.[234] This indicator uses IEA data to track household energy use by fuel source. Between 2016 and 2021, per-capita household energy use increased 3% globally. Meanwhile, mostly driven by Medium and High HDI countries, the share of heavily polluting solid biomass decreased from 32% to 30%, and electricity increased from 24% to 26%. However, Low HDI countries saw almost no change in the share of solid biomass for domestic energy use, which remained at around 92% since 2016. Indeed, although 15 million gained access to electricity between 2022 and 2023, 745 million people still lack access to this essential service.[235]

The use of dirty fuels for cooking represents a substantial health hazard in lower HDI countries, especially exposing women and young children to high levels of air pollution.[236] Data from the WHO to monitor progress against Sustainable Development Goal 7 (SDG7) reveals that, globally, 60% of the rural population has access to so-called "clean cooking fuels" in 2023, [237] compared to 77% of the urban population. Major disparities exist between countries, and only 13% of all low HDI countries had access to these resources, contrasting to the near-universal access observed in Very High HDI (98%) countries. Importantly, the SDG7 considers liquefied petroleum gas (LPG) a "clean" fuel.[237] However, its $NO_2$ emissions are still hazardous. In 2021, 35% of the global population used LPG as the main fuel for cooking, with an average of 42% in Very High, 56% in High, 34% in Medium, and 7.4% in Low HDI countries.

These data underscore the opportunity of tackling energy poverty by increasing access to reliable, healthy, renewable energy, particularly in the most underserved countries.

## Indicator 3.1.3: sustainable and healthy road transport

*Headline finding: from 2016 to 2021, the use of electricity for road transport increased by only 0.18%.*

Road transport contributes around 16% of global $CO_2$ emissions.[238] Transitioning to electric vehicles (EVs), while also reaching net zero-GHG electricity supply, is therefore important. The annual sale of electric cars increased from 0.7 million in 2016 to 17 million in 2024.[239] However, global transport emissions have almost returned to their pre-pandemic peak in 2022.[238,240]

To maximise health gains and avoid the growing inequities the unaffordability of EVs can generate, the transition to EVs should be complemented with an expansion of public transport, and safe active travel (like walking or cycling). Such a shift would deliver substantial air pollution benefits, reduce inequities in access to transport services, and improve public health through increased physical activity.[241]

This indicator, which uses IEA data, finds that the share of road transport energy supplied by electricity only increased from 0.09% in 2016 to 0.27% in 2021. Fossil fuels still accounted for 95.2% of all road transport energy in 2021, with biofuels supplying the remainder.

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*Panel 6: The health impacts of energy production from cradle to grave*

Clean and affordable energy access is fundamental for good health. It helps keep indoor temperatures within healthy levels, contributes to food and medicine preservation, enables the delivery of quality healthcare services, and supports health and development through access to information and education.[242] However, the energy system can also adversely affect health, throughout its whole life cycle, including extraction, production, operation, and disposal of energy sources.

**Fossil fuels**

Fossil fuels are the largest contributors to the global energy system and can affect health throughout their life cycle. Workers and inhabitants in proximity to fossil fuel extraction sites are most affected compared to the wider population. Some occupational health hazards are caused by physical working conditions such as poor lighting, high noise levels, and low oxygen levels in mining, fracking, or drilling during fossil fuel extraction.[243] Significant population health risks originate from exposure to air, soil, and water pollution at different stages of the fossil fuel life cycle,[244] with children being disproportionately affected, and Indigenous populations, who are overrepresented near extraction sites, remain at greater risk than the general population.[245]

Health impacts of fossil fuel extraction and energy production include:

- Exposure to hazardous air pollutants produced during coal combustion in power plants and industrial production and unconventional gas drilling cause respiratory symptoms, cardiovascular diseases, higher risk of cancer, and preterm delivery among workers and populations living near extraction sites and power plants.[244,246]

- Oil and gas extraction processes expose workers to various hazardous chemicals and particulate matter, which can cause long-term health effects on the skin, eyes, brain, nervous system, respiratory and gastrointestinal systems.[247,248]

- Exposure to oil through contaminated water can produce neurological and haematological disorders and skin and eye irritation in inhabitants near oil fields. Genotoxicity was observed consistently among residents living near oil fields.[249]

- Exposure to air pollution from fossil fuels at the point of end-use (e.g. heating, lighting and cooking), particularly nitrogen dioxide and particulate matter has substantial negative health impacts.

- Household-level coal combustion can cause fluorosis, arsenism, selenosis, lung cancer, and adverse child development.[244]

- Natural gas combustion can cause bronchoconstriction, airway hyperresponsiveness, and airway inflammation with increased risk of asthma, bronchitis, and wheezing.[250]

The end of life for fossil fuels includes risks of and exposure to:

- Coal combustion produces coal ash, containing radioactive elements, minerals, and heavy metals, with reported health impacts on children living near coal ash impoundments.[244]

- Oil spill cleanup workers have developed chronic conditions of psychological disorders, lower respiratory tract symptoms and reduction of lung function, and genotoxicity and alternations in hormonal status.[249]

**Non-fossil fuels-based energy**

For non-fossil-fuel based energy, which includes energy from biomass, nuclear power, electricity stored in batteries and renewable sources (e.g. solar energy, wind power, hydropower, geothermal energy, and hydrogen), health impacts happen at the stage of extraction and production primarily among the workers involved. In addition to typical workplace hazards, a few types of occupational hazards and diseases are known to be associated with energy industry workers and communities living nearby. Although workplace hazards are not unique to the energy industry, the health impacts may be exclusive when hazards are in conjunction with extreme working conditions.[251]

Risks for non-fossil-fuel workers include:

- Falling and other accidents, e.g., during the installation of turbines in the wind industry[251] and the installation of photovoltaic (PV) panels for using solar energy.[252]

- Exposure to hazardous substances, e.g., toxic fumes from heat or other volatile compounds generated in the wind industry,[251] toxic methylmercury converted from mercury in soils when dams are built for hydropower,[253] and toxic organic materials used in the processes of biofuel manufacture[254–256] and making photovoltaics.[257] Besides, heavy metals, radioactive materials, and hydrogen sulphide occur in the development of geothermal energy.[258]

- Fire and explosion, freeze burns, and electrical shocks are observed in the hydrogen industry, battery industry, and biofuel manufacture sector workers. Many deaths and injuries have been caused by hydrogen explosions in creating hydrogen fuel cells[259] and methanol explosions in the process of biofuel blending and alcohol denaturing.[255]

- Health impacts can occur from the environmental risks of metal and rare earth ores extraction for the production of batteries, solar panels, wind turbines, etc.[260] The mining activities may contaminate soil, water, and air from dust, small particulate materials, harmful pollutants, and toxic chemicals, leading to health problems for people living in or near mining areas. Ores may also contain radioactive material, causing cancers at high levels of long-term exposure.[261,262]

For non-fossil fuels, the operation-to-use stage and the end-of-life stage health impacts are largely limited. These include:

- Fire and explosion of Lithium-ion batteries (thermal runaway phenomena) and leakage of chemical materials due to improper use, storage and disposal.[263,264]

- Exposure to hazardous groundwater and soil contaminants due to improper disposal of photovoltaics,[265] or exposure to radioactivity due to accidents during power generation and improper nuclear waste disposal.

- Similar to fossil fuels, air pollution and aerosol particles released by burning biomass, mainly from traditional biofuels (e.g., wood, waste, etc.), for cooking and heating may cause health impacts.[266]

No robust scientific evidence suggests wind turbines result in physiological health effects,[267] the annoyance the low-frequency noise could generate may still cause psychosocial harms.[268–270] Living near nuclear power plants

may also cause psychological impacts due to various socio-psychological factors such as fear of exposure, disasters, or lack of transparency regarding actual or potential leaks.[271,272]

Taking all of the above impacts into account, the health impacts of energy from non-fossil fuels are overall considerably lower than those of fossil fuels. It is however important that, as the transition to zero-carbon energy gets underway, the risks of renewable energies are carefully assessed and managed, to avoid unintended harms, and an unintentional exacerbation of global health inequities.

## 3.2: Air quality and health co-benefits

Exposure to air pollution increases the risk of respiratory and cardiovascular disease, cancer, diabetes, neurological disorders, and adverse pregnancy outcomes.[273] Many major sources of GHG emissions also contribute to air pollution. This section monitors the potential health co-benefits of mitigation efforts through improved air quality.

### Indicator 3.2.1: mortality from ambient air pollution by sector

*Headline finding: deaths attributable to $PM_{2.5}$ from fossil fuel combustion decreased 6.9% from 2.25 million in 2016 to 2.09 million in 2021.*

In the transition to a Net Zero future, countries can reap major public health benefits from prioritising interventions that reduce exposure to air pollution. This indicator combines atmospheric modelling with information of activity in emitting sectors, to estimate mortality associated with anthropogenic $PM_{2.5}$. In an improvement from previous years, it incorporates new concentration–response functions (CRFs) recently published, resulting in more attributable deaths than in previous years.[274]

From 2016 to 2021, global average exposure to $PM_{2.5}$ from all anthropogenic sources fell by 4.6%, driven predominantly by High and Very High HDI countries. However, average global anthropogenic $PM_{2.5}$ exposure remained over 4 times higher than the 5µg/m$^3$ WHO guideline level. Combined with demographic changes, deaths attributable to anthropogenic $PM_{2.5}$ increased 4.8%, reaching at least 6.4 million in 2021. This indicator suggests that fossil fuel burning contributed to 2.09 million of these deaths (a value lower than suggested in a recent study, and could therefore even be a conservative estimate), with coal burning accounting for nearly 980,000 of them. [275] Importantly, deaths attributable to fossil fuel-derived $PM_{2.5}$ fell by an estimated 156,000 (6.9%) since 2016 (2.25 million). Of this reduction, 59% was due to reduced coal-related pollution, mostly in High and Very High HDI countries. However, biomass burning caused 1.24 million deaths in 2021, an increase of 135,000 from 2016.

There were marked differences in progress between HDI groups. While the mortality rate (deaths every 100,000 individuals) attributable to fossil fuels decreased by 22.8% in Very High HDI countries,17.5% in Low and 11.7% in High HDI ones, they only declined 3.7% in Medium HDI countries. The Medium HDI country group still had the highest mortality rate (36 deaths per 100,000) in 2021 as it did in 2016 (38 deaths per 100,000). Meanwhile, biomass-related mortality rate decreased by 1.6% in Very High HDI countries, but increased across Low, Medium and High HDI countries by 4.3%, 10.5% and 8.9 % respectively. The death rate from biomass remains highest in Medium HDI countries (26 deaths per 100,000). (*Figure 7*).

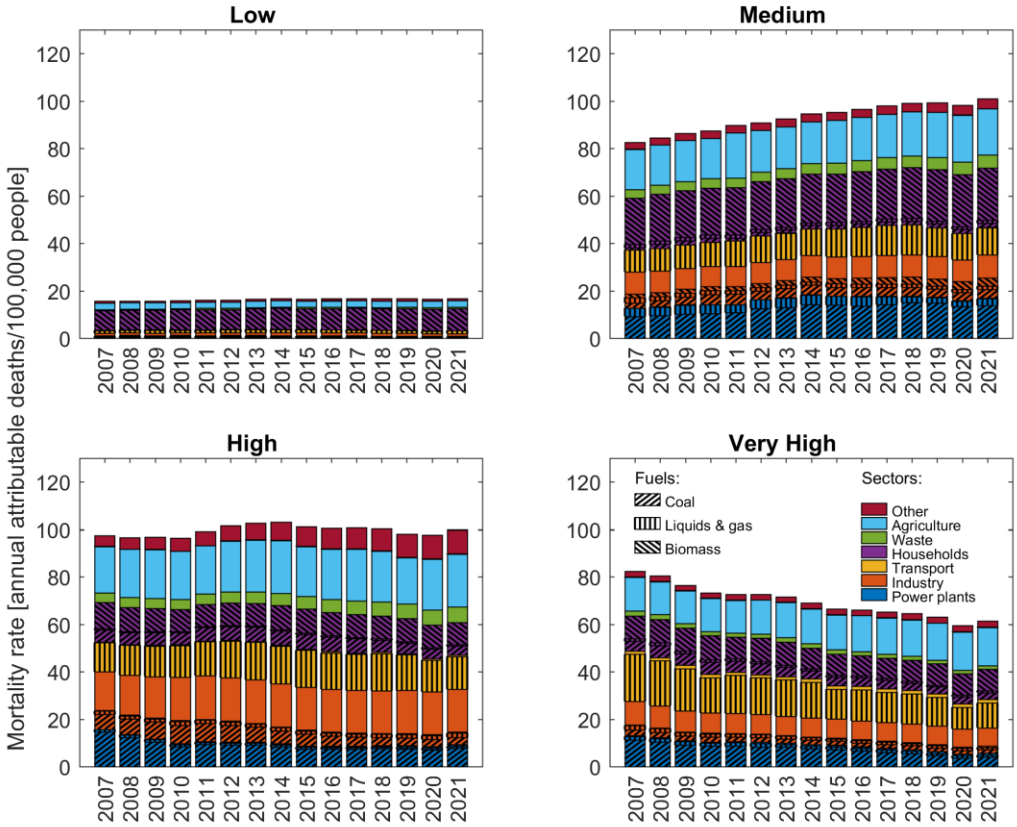


Figure 7 Annual mortality rate attributable to $PM_{2.5}$ exposure from 2007-2021, by fuel, sector, and HDI country level

## Indicator 3.2.2 household air pollution

*Headline finding: indoor $PM_{2.5}$ derived from to the burning of solid household fuels resulted in 2.3 million deaths across 65 countries in 2020.*

Despite efforts to increase access to clean energy under the Sustainable Development Goal 7,[276] 2.4 billion people worldwide still use dirty fuels and inefficient technologies to meet their household energy needs, leading to high concentrations of indoor air pollution, and to other health harms from energy poverty.[277] This indicator uses a Bayesian hierarchical model to estimate the deaths attributable to $PM_{2.5}$ household air pollution (HAP) by source of emission in 65 countries (42% of which are Low, 26% Medium, 28% High, and 5% Very High HDI countries).[278–282]

In 2020, household use of solid fuels for cooking and heating led to an estimated national-level annual average indoor $PM_{2.5}$ concentration of 412 $\mu g/m^3$ [95% CI 353-471], almost 12 times the WHO interim target of 35$\mu g/m^3$, and 82 times the maximum guideline levels proposed by WHO(15$\mu g/m^3$).[283] Concentrations were higher in rural households, with an average of 514 $\mu g/m^3$ [95% CI 446-582]; 3.4 times the urban household average [149 $\mu g/m^3$, 95% CI 126-173] (*Figure* 8).[281,282] This air pollution was responsible, on average, for 78 deaths [95% CI 72-84] per 100,000 inhabitants, with a rural average of 86 [95% CI 79-92] and an urban average of 60 [95% CI 54-66] per 100,000. In the 65 countries studied, indoor $PM_{2.5}$ from solid household fuels was responsible for roughly 2.3 million deaths in 2020 alone – deaths that could be avoided by transitioning to renewable energy sources.

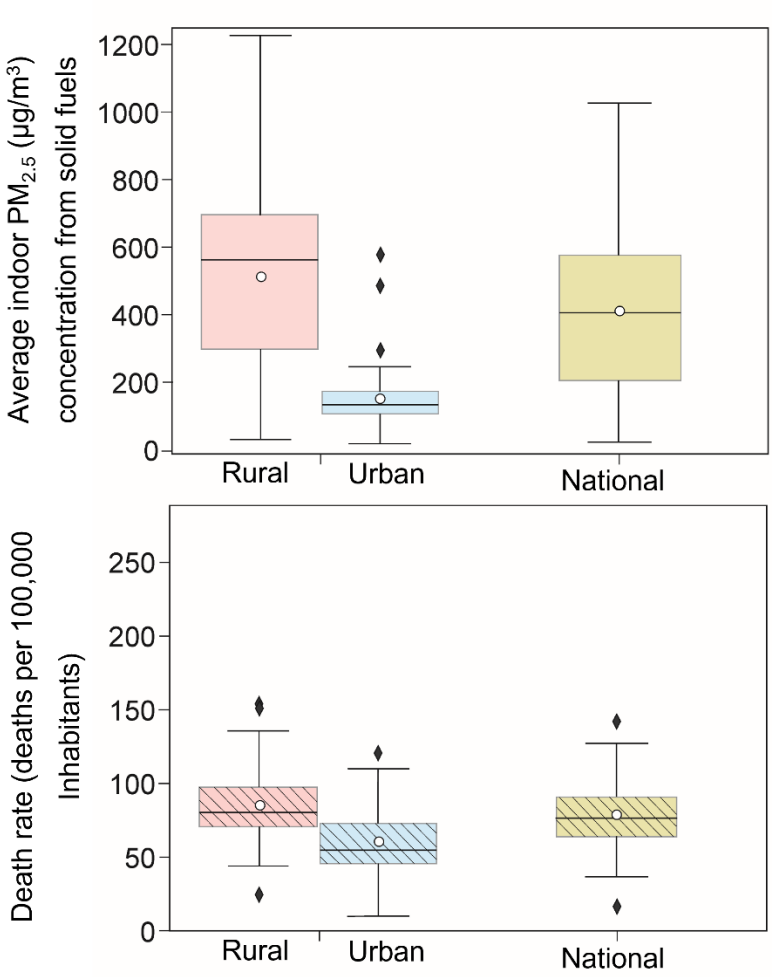


*Figure 8 Estimated urban, rural, and national-level annual weighted average household $PM_{2.5}$ indoor concentration (in µg/m³) and the related attributable premature death rate (per 100,000 population) of polluting solid fuels*

## 3.3: Food, agriculture, and health co-benefits

Food systems account for up to 30% of global GHG emissions.[284] This set of indicators tracks progress towards transitioning to healthy, plant-forward diets, and delivering the associated benefits to public health.

### Indicator 3.3.1: emissions from agricultural production and consumption

*Headline finding: global agricultural emissions increased by 2.8% from 2016 to 2021. Red meat and dairy contributed to 53% of agricultural emissions in 2021.*

Actions in the agricultural sector - a major contributor to GHG emissions and other environmental degradation - are critical to meet the goals of the Paris Agreement. This indicator combines data from production and trade of agricultural products with their GHG emission intensities, to estimate GHG emissions from agricultural products available in each country, excluding those from induced deforestation.

Globally, consumption-based agricultural emissions grew 2.8% from 2016, to 2021 with 53% of 2021 emissions driven by the consumption of red meat and dairy. Per-person, emissions were similar in Low and Medium HDI countries (0.68 and 0.76 $tCO_2e$/person, respectively in 2021). High HDI countries' per-person emissions grew since 1990, reaching 0.87 $tCO_2e$/person in 2021, albeit with a slower pace of increase since 2016. On the contrary, consumption-based emissions dropped 7% since 2016 in Very High HDI countries. However, these countries were still the biggest contributors to agricultural emissions, at 0.91 $tCO_2e$/person in 2021, 56% of which derived from red meat and dairy consumption.

## Indicator 3.3.2: diet and health co-benefits

*Headline finding: between 2016 and 2021, the burden of diet-related diseases has increased from 141 to 144 deaths per 100,000 people (+3%), including increases from 15 to 17 deaths per 100,000 attributable to meat intake (+10%).*

Imbalanced diets with excessive intake of red and processed meat and low intake of high-quality plant-based foods are not only major drivers of greenhouse gas emissions (indicator 3.3.1), but also increase health risks. [285–288] This indicator monitors the deaths attributable to GHG-intensive diets and inadequate caloric consumption through a comparative risk assessment.[289, 290] Between 2016 and 2021, yearly diet-related deaths increased by 830,000 deaths (+8%), from 10.4 to 11.2 million, an increase from 141 to 144 deaths per 100,000. This included 315,000 more deaths from low intake of whole grains, vegetables, and legumes, 170,000 from high red meat intake, and 70,000 from high dairy intake. The increases in diet-related disease burden were greatest in countries with Very High HDI (+13 deaths per 100,000), followed by countries with High (5/100,000), Medium (2/100,000), and Low HDI (1/100,000). Dedicated dietary policies, could play a major role in both tackling climate change, and building healthier, more resilient populations.[291–293]

## Indicator 3.4: tree cover loss

*Headline finding: between 2016 and 2022, the world lost almost 182 million hectares of forest cover, 5% of the global tree cover.*

Forests are crucial carbon sinks and biodiversity reservoirs. They can also be a source of food, medicine, and knowledge, especially for indigenous peoples.[294] Poor forest conservation exacerbates climate change, and increases the risk of forest fires, zoonotic diseases, and allergies.[294,295] Understanding the patterns of forest loss is vital for supporting climate strategies and public health (panel 4).[294–296] This indicator uses satellite data to track the loss of vegetation five meters or taller, in areas with at least 30% tree cover density.[297,298]

Between 2001 and 2022, the world lost approximately 11.5% (459,384,000 hectares) of its tree cover. Of these losses, 40% (181,847,000 ha, 5% of the global tree cover) occurred since the Paris Agreement entered into force. Tree cover loss was highest in Very High HDI countries, which lost almost 90 million ha since 2016. Despite increasing, deforestation was lower in Low and Medium HDI countries, at 20 and 22 million hectares lost, respectively, since 2016 (Figure 9).Forestry activities were the  cause of 30% of the global tree cover loss between 2016 and 2022, followed by agriculture (27%), wildfires (22%), and commodity-driven deforestation (20%).

The continuous and increasing tree cover loss underscores the urgent need for concerted global and regional efforts to support tree conservation and the role forests play in health promotion and addressing climate change. With 36% of the world's intact forests within Indigenous Peoples' lands, ensuring Indigenous People's involvement in forest protection efforts is of critical importance.[299]

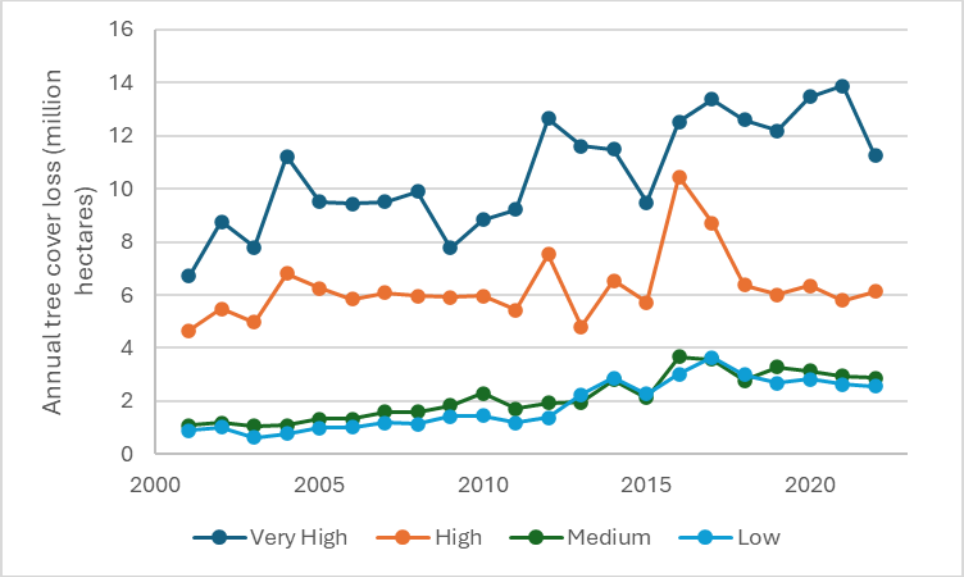


*Figure 9: Annual global loss of tree cover from 2001 to 2022, stratified by Human Development Index Group*

## Indicator 3.5: healthcare sector emissions and harms

*Headline finding: in 2021, healthcare sector-related GHG emissions were 9.5% higher than 2020 and 36% higher than 2016, and associated air pollution contributed to 4.6 million Disability-Adjusted Life Years (DALYs) in 2021.*

Quality healthcare requires the use of energy, goods, services, and infrastructure, which consumes resources and currently contributes to GHG emissions and air pollution. Delivering low-GHG-emitting and sustainable health systems is essential in a world that meets the goals of the Paris Agreement and enables a healthy future. Under the WHO's ATACH, 74 countries committed to developing net zero-emission or sustainable, low-GHG health systems,[300] and 149 countries signed the UAE declaration on Climate and Health,[15] committing to promoting steps to curb emissions in the health sector.

This indicator combines an environmentally-extended multi-region input-output (EE-MRIO) model with national healthcare expenditure data to develop the world's most comprehensive and regularly-updated monitoring system on healthcare-sector GHG emissions.

Healthcare GHG emissions contributed to 4.6% of global GHG emissions in 2021, up by nearly 10% from 2020, largely due to COVID-19 pandemic-related shifts in patterns. This marked a 36% increase in healthcare-related GHG emissions since 2016. In 2021, health systems in High

and Very High HDI countries contributed to 91% of global healthcare emissions, with average per-capita emissions 2.6 and 8.4 times higher in Very High countries than in Medium and Low HDI countries. Air pollution ($PM_{2.5}$ and ozone) from healthcare operations and supply chains is estimated to have caused 4.6 million Disability-Adjusted Life Years (DALYs) in 2021, a jump of nearly 20% from 2020.

Universal Health Coverage (UHC) Index scores are correlated with healthcare GHG emissions up to ~500 kg $CO_2$e per capita, after which increased emissions cease to correlate with improved UHC (Figure 10). Reaching net-zero GHG emission healthcare will require continuous and meaningful improvements to healthcare facilities, operations, energy use, and supply chains while working towards improving outcomes and achieving UHC.

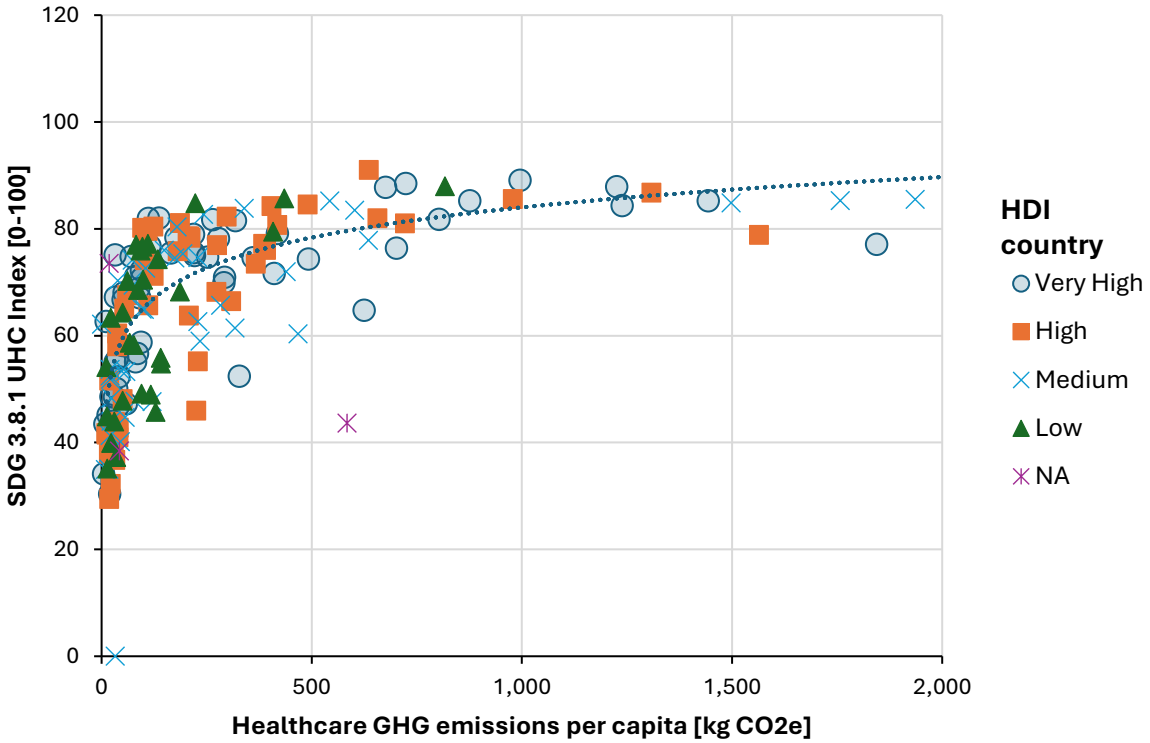


*Figure 10: National per-capita greenhouse gas emissions from the healthcare sector vs Universal Healthcare Coverage (UHC) Index score.*

## Conclusion

Progress towards meeting the Paris Agreement goals has been concerningly inadequate. Persistent failure to implement the necessary structural changes has pushed emissions to their

highest level yet, with fossil fuels accounting for 67% of greenhouse gas emissions in 2022. Moreover, the limited progress to date has been uneven and is exacerbating global health inequities, and the inaction in mitigation and associated risks and exposures has resulted in millions of avoidable deaths each year. Since the Paris Agreement entered into force, only Very High HDI countries reduced their coal use, and coal-related air pollution caused 764,000 deaths in 2021 (indicators 3.1.1 and 3.2.1). Global road transport emissions have nearly rebounded to pre-pandemic levels, and global agricultural emissions rose by 2.8% since 2016, with red meat and dairy accounting for 53% of these emissions (indicators 3.1.3 and 3.3.1). The increase in meat and dairy intake has pushed diet-related deaths up by 830,000 from 2016 to 2021 (indicator 3.3.2). Healthcare sector emissions rose by nearly 10% between 2020 and 2021 (indicator 3.5). In 2021, healthcare accounted for 4.6% of global emissions, and associated $PM_{2.5}$ and ozone pollution contributed the loss of 4.6 million DALYs (indicator 3.5).

These data unequivocally show the health imperative for concerted and equity-driven efforts at the national and international levels to implement structural changes in energy systems, transportation, agriculture and diets, and healthcare systems. This will hold the key to achieving a sustainable and healthy future for all.

# Section 4: Economics and Finance

Climate change is profoundly affecting the global economy. Recent data suggest that the world economy is on track to an income reduction of between 11% and 29% by 2050, threatening the social and economic systems on which human health and wellbeing often depend.[301,302] The damages expected within the next 26 years vastly outweigh the mitigation costs required to limit global heating to 2°C (by a factor of six according to a recent study).[303] The health impacts of climate change contribute to economic losses, increase health system costs, limit labour productivity, and threaten important economic sectors including tourism.[280,304,305] The resulting deterioration of the socioeconomic conditions that support good health can aggravate health impacts and overburden the most vulnerable countries, widening global inequities.

A swift and just transition to a net zero-GHG economy is therefore crucial to limit economic and health-related losses and damages; but requires profound structural and economic changes and substantial capital investment.[302] Years of delay in delivering the US$ 100 billion promised annually to support the most vulnerable countries in a just transition have hampered progress and further exacerbated global inequities.[301]

COP28 saw the long-awaited operationalisation of the Loss and Damage (L&D) Fund, an important milestone for a just transition.[306] Adding onto it, COP28 also saw US$ 1 billion committed to climate change and health.[307,308] Details on how these funds will be disbursed, and who will contribute to the L&D fund, will be negotiated at COP29. This COP will also be the stage for the negotiation of the New Collective Quantified Goal on Climate Finance, setting a new financial goal for supporting "developing" countries, in excess of US$ 100 billion.[302]

This section is presented in a new structure, to better reflect the different dimensions of these policy processes. The first set of indicators track the economic losses and damages associated with the health impacts of climate change; the second monitors the extent to which countries are delivering a just, health-promoting restructuring of their economies; and the third set monitors the shift of financial systems away from fossil fuels, and towards a health-supporting economy. This year, two new indicators highlight countries' preparedness for such a transition and call out potential losses through stranded assets.

## 4.1: The economic impact of climate change and its mitigation

As the impacts of climate change grow, so do the associated economic losses. This set of indicators monitors the economic losses resulting from the health impacts of climate change.

### Indicator 4.1.1: economic losses due to weather-related extreme events

*Headline finding: in 2023, weather-related extreme events caused US$ 212 billion in global economic losses.*

In addition to direct health impacts, extreme weather events can also damage health centres, impede access to health services, and cause economic losses that can undermine the social determinants of health. This indicator uses data provided by Swiss Re to track the economic losses from extreme weather events.[309]

From 2010-2014 to 2019-2023, average annual economic losses induced by weather-related extreme events increased by 23% in real terms, to US$ 227 billion. The percentage of global losses that were uninsured fell from 67% to 55% in 2023. While 60.5% of losses in Very High HDI countries were insured, 0.0%, 18.5%, and 16.4% of those in Low, Medium, and High HDI countries, respectively, were insured. As a result, the economic burden of climate change currently falls disproportionately on lower HDI countries, with replacement costs falling directly on those affected or going unreplaced.

## Indicator 4.1.2: costs of heat-related mortality

*Headline finding: the average annual monetised value of global heat-related mortality for 2019-2023 was US$ 199 billion, an increase of 179% from 2000-2004.*

In 2023, record-breaking high temperatures resulted in record-breaking heat-related mortality and associated economic losses globally. This indicator calculates the monetised value of heat-related deaths by combining data from indicator 1.1.5 with the value of a statistical life-year (VSLY). The global monetised value of heat-related deaths of people over 65 rose to US$ 240 billion in 2023 – the highest level in the observed period, and 236% higher than the 2000-2004 annual average. The average annual monetised value during 2019-2023 was US$ 199 billion, 179% higher than in 2000-2004. Low HDI countries saw the greatest increase from 2000-2004 to 2019-2023, at 240%, with increases of 194% in Medium, 228% in High, and 139% in Very High HDI countries.

## Indicator 4.1.3: loss of earnings from heat-related labour capacity reduction

*Headline finding: in 2023, the global potential income loss from labour capacity reduction due to extreme heat was US$ 835 billion.*

The loss of labour capacity due to heat exposure (indicator 1.1.3) leads to income losses, potentially harming the health and wellbeing of workers, their families, communities, and national economies. This indicator combines data from indicator 1.1.3 with the International Labour Organization (ILO)'s wage data to quantify the potential loss of earnings resulting from heat-related labour capacity loss.[310]

In 2023, the global potential loss of income was US$ 835 billion, equivalent to 0.82% of gross world product. Average potential income lost was highest in Low and Medium HDI countries, equivalent to 7.6% and 4.4% of their GDP respectively (Figure 11), an increase from 6.1% and 3.8% in 2022. Losses in the agricultural sector accounted for 37% of all global losses, with 31% in construction. Agricultural workers in Low and Medium HDI countries are often among the world's poorest and least resilient to major economic shocks,[311–313] and agricultural losses accounted for an average of 81% and 65% of the potential losses in these countries, respectively (Figure 11).

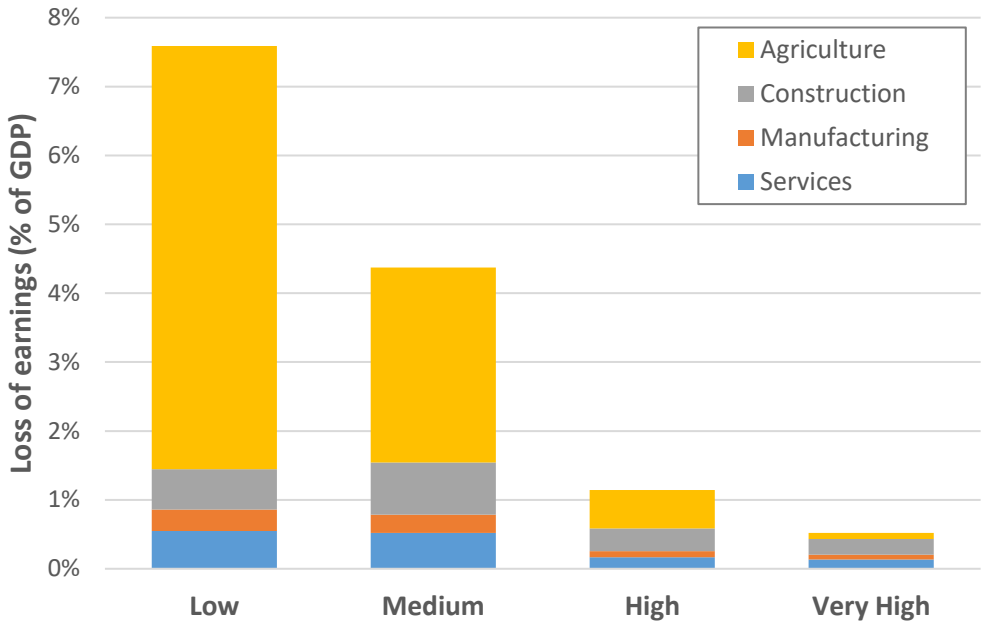


*Figure 11: Average potential loss of earnings in 2023 of countries in each HDI group as a result of potential labour loss due to heat exposure. Losses are presented as share of GDP and sector of employment.*

## Indicator 4.1.4: costs of the health impacts of air pollution

*Headline finding: the monetised value of premature mortality due to air pollution reached a record high in 2021, amounting to US$ 4.95 trillion, 14.0% above 2016 levels.*

The millions of deaths associated with anthropogenic $PM_{2.5}$ pollution annually (indicator 3.2.1) result in economic losses, which can be reduced through robust mitigation. Building on indicator 3.2.1, this indicator places a monetised value on the years of lost life (YLLs) from exposure to anthropogenic ambient $PM_{2.5}$. This value reached a record high of US$ 4.95 trillion in 2021, a 14.0% increase since the Paris Agreement entered into force, and 22.6% since 2007. The monetised values have risen by 1.3%, 21.4%, and 33.3% in Low, Medium and High HDI countries respectively since 2016, but have fallen by 0.3% in Very High HDI countries.

## 4.2: The transition to net zero-carbon, health-supporting economies

Fossil fuels are deeply entrenched in the global economy. Consequently, a safe transition to a healthy, net zero future requires countries to prepare for a profound economic transformation, while avoiding unintended harms. This set of indicators monitors the progress countries are making toward such transformation, introducing two new indicators tracking country preparedness for net zero, and the impact on the value of coal-power assets becoming stranded in the transition to a healthy future.

### Indicator 4.2.1: employment in low-carbon and high-carbon industries

*Headline finding: global direct employment in fossil fuel extraction increased by 0.4% in 2022 to 11.8 million. The same year, direct and indirect employment in renewable energy grew 8.1% to 13.7 million employees.*

Employees in the fossil fuel sector generally face greater health risks than those in the renewable energy sector (panel 6).[314,315] The renewable energy sector thus presents new and healthier local job opportunities. Using data from the International Renewable Energy Agency and IBISWorld, this indicator compares employment in renewable energy and fossil fuel extraction.

Globally, the renewable energy industry employed 13.7 million people directly or indirectly in 2022, marking a 35.6% increase since 2016 (+3.6 million jobs), and 8.1% rise from 2021 levels. Of the employees in 2022, 62% were in Asia (40% in China). While direct employment in fossil fuel extraction increased 0.4% from 2021 to 2022 mostly in response to the disruption of fossil fuel supplies following the invasion of Ukraine, it declined by 10.3% (-1.35 million jobs) since 2016, suggesting the response to the Paris Agreement may have influenced employment trends.

### Indicator 4.2.2: compatibility of fossil fuel company strategies with the Paris Agreement

*Headline finding: the strategies of the 114 largest oil and gas companies as of March 2024, put them on track to exceed their share of GHG emissions consistent with limiting global heating to 1.5°C by 189% in 2040, up from 173% in March 2023.*

To limit global heating and avoid the most harmful impacts of climate change, oil and gas (O&G) emissions need to be reduced dramatically. This indicator assesses the alignment of O&G companies' production strategies with Paris Agreement goals, using the Rystad Energy database of projected production based on current commercial activities, regardless of pledges.[316] In an improvement from last year, the number of companies covered has been increased to 114, now covering 80% of all production projected by 2040. Projected emissions are compared to the IEA's Net Zero Emissions pathway compliant with 1.5°C of heating, assuming current market shares.[317]

As of March 2024, strategies of the world's largest 114 O&G companies indicate that they are on a trajectory to exceed the share of GHG emissions compatible with 1.5°C by an average of 59% in 2030 (up from 43.0% in November 2016 and 52% in March 2023), and 189% in 2040 (up from 120% in 2016 and 173% in 2023). For 33 of these companies, this excess in 2040 was over 300%. Eight of the largest nine companies were state-owned national O&G companies (NOCs), which together were projected to generate 30.2% of global production in 2040, exceeding their 1.5°C-compatible share by 226%.

Of the 40 O&G companies with the largest production projected by 2040, 33 (83%) have further increased their 2040 excess production since November 2016, when the Paris Agreement went into effect (Figure 12), and for 16 of these companies, this increase was over 100%.

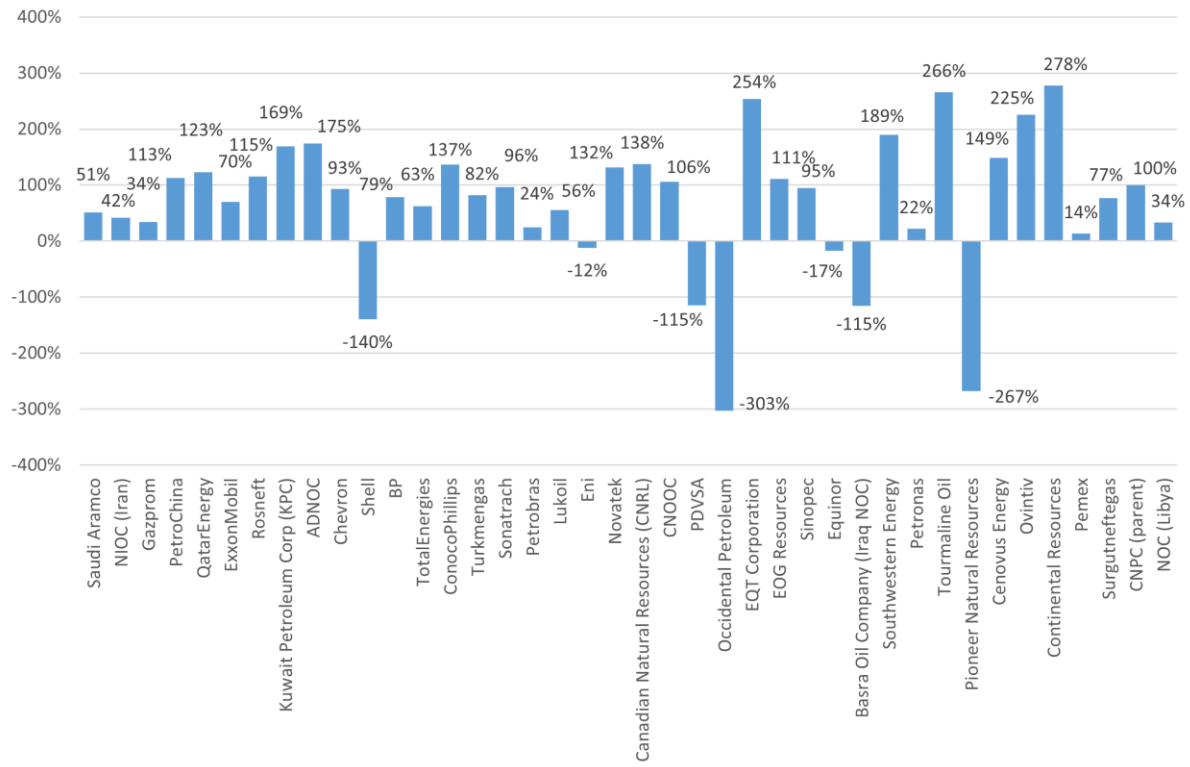


*Figure 12: Increase in 2040 projected production excess above a pathway consistent with 1.5°C of warming since the Paris Agreement (between November 2016 and March 2024) for the 40 largest O&G companies by 2040 projection, ranked in order of 2040 production (the largest on the left-hand side)*

## Indicator 4.2.3: stranded coal assets from the energy transition

*Headline finding: the cumulative value of current assets in the global coal-fired power generation sector expected to be stranded between 2025 and 2034 will reach US$ 164.5 billion.*

On a path that supports a healthy future and keeps within the 1.5°C goal of the Paris Agreement,[318,319] many of today's fossil fuel assets must cease operating. This must often occur well before their economic life ends, and thus stranding the remaining capital investment. Continuing to invest in fossil fuels therefore not only hampers mitigation efforts and causes millions of deaths each year from exposure to air pollution, but also harms the economy, by increasing the economic value of stranded assets.[320,321]

The phase out of coal is particularly important in the transition to a healthy future, not only due to its high GHG intensity, but also because of the nearly 980,000 deaths associated with coal

combustion annually (indicator 3.2.1). Using data from Global Energy Monitor on nearly 14,000 coal-fired units, this indicator tracks the annual value and spatial distribution of current coal-fired power generation assets that would be stranded under the carbon allowances limits of the 1.5°C goal. Carbon allowance limits for 2019-2100 are calculated based on fairness principles of historical responsibility, capability to pay, and equal per capita convergence.[322–325]

The value of current coal-fired power generation assets that will be stranded in a path to 1.5°C of heating is expected to reach US$ 15.6 billion in 2030, assuming the annual utilization hours of each unit remains unchanged. Of these assets, 26.8% are based in Very High HDI countries, with 59.0%, 13.9%, and 0.2% in High, Medium, and Low HDI countries, respectively. The total cumulative economic value that would be lost between 2025 and 2034 is expected to reach US$ 164.5 billion. Of these assets, 32% are based in Very High HDI countries, with 54.4%, 13.1%, and 0.5% in High, Medium, and Low HDI countries, respectively. These losses will be even higher if investments in coal power capacity continue. These results underline the importance of policymakers refraining from opening further coal-fired power plant to limit future stranding losses. In future years, this indicator will track progress towards transitioning to a healthy, sustainable economy, by monitoring the value of current assets that will become stranded in a 1.5°C trajectory, as investments in fossil fuel assets change.

## Indicator 4.2.4: country preparedness for the transition to net zero

*Headline finding: in 2023, all Low HDI countries had transition preparedness scores below the global average, while 93% of Very High HDI countries had scores above average.*

The transition towards a net zero GHG economy is essential for a healthy future. However, this requires major structural changes, that can yield both profound health benefits and unintended harms. Countries reliant on fossil fuel exports or with emissions-intensive energy production, manufacturing, transportation, and construction, with a large portion of the labour force employed in such activities, and high social inequality face high transition risks. This indicator assesses countries' transition risk through a complex index that incorporates 20 institutional, economic, societal, and technological factors, weighted to derive a final preparedness score ranging from 0 and 1.

There is a strong correlation between countries' transition preparedness and their HDI (Figure 13). The global average preparedness score in 2023 was 0.52. Countries with a Very High HDI had an average preparedness score of 0.74, whereas those with Medium and Low HDI scored 0.35 and 0.20 on average, respectively. All countries with a Low HDI, 96% of those with Medium

HDI, and 84% of those with High HDI had scores below the global average, while 93% of Very High HDI countries had scores above this value.

These findings underscore the inequalities in preparedness among economies and human systems for transitioning to a healthy, net zero-GHG future, exposing people in the most vulnerable countries to significant risks. Supporting countries in their transition to net zero is essential for ensuring a just transition that minimises unintended consequences.

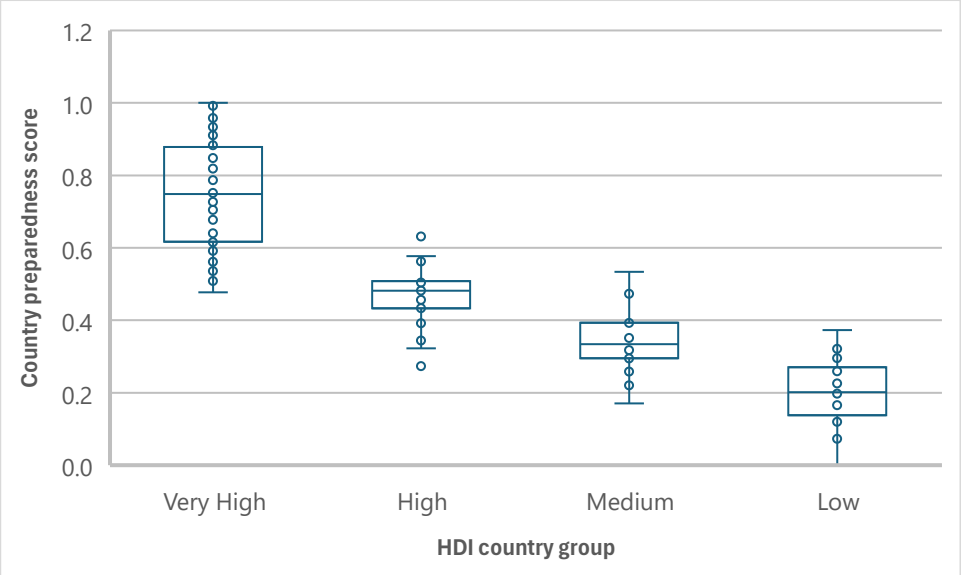


*Figure 13: 2023 transition preparedness score by HDI group*

## Indicator 4.2.5: production-based and consumption-based attribution of $CO_2$ and $PM_{2.5}$ emissions

*Headline finding: the Very High HDI country group remained the only group with higher consumption-based than production-based emissions for both $CO_2$ and $PM_{2.5}$* in 2022*, with differences accounting for 3.7% and 6.1% of global total emissions, respectively.*

Due to international trade, the consumption of imported goods and services in one country can contribute to GHG emissions and air pollution in foreign producing countries. This indicator uses an environmentally extended multi-region input-output (EE-MRIO) model[326,327] to quantify countries' contribution to $CO_2$ and $PM_{2.5}$ emissions, examining production-based accounting (where physical emissions occur) and consumption-based accounting (allocating emissions to countries based on their consumption of goods and services).

In 2022, 18.7% of global $CO_2$ emissions and 19.4% of global $PM_{2.5}$ emissions occurred in the production of goods and services traded between countries in different HDI groups. Despite accounting for only 19.9% of the world's population, Very High HDI countries were responsible for nearly half (48.1%) of the world's total consumption-based $CO_2$ emissions. This group remains the only one with higher consumption-based than production-based emissions for both $CO_2$ and $PM_{2.5}$, with consumption-accounting for 3.7% and 6.1% more emissions, respectively, than their local production alone. Between 2021 and 2022, production and consumption-based emissions of $PM_{2.5}$ by Very High HDI countries increased by 6.1% and 8.9%, respectively. However, the High and Medium HDI country groups had the highest level of in-situ production-based $PM_{2.5}$ emissions, with a net total of 13.7% and 9.9% of their local $PM_{2.5}$ emissions, respectively, induced by consumption in Very High HDI countries. China and the United States accounted for nearly half of global $CO_2$ emissions with 32.9% and 13.5% for production-based and 29.8% and 15.9% for consumption-based accounting, respectively.

## 4.3: Financial Transitions for a Healthy Future

Shifting finance away from fossil fuels, and towards clean energy and health promoting activities can be the most effective way for driving the transition to net zero. The financial transition will take centre stage at COP29, offering an opportunity for a healthier future. This set of indicators monitors the extent to which finance is supporting a healthy transition.

### Indicator 4.3.1: clean energy investment

*Headline finding: investment in zero-carbon energy accounted for 80% of investment in electricity generation in 2021*.

The transition to zero-GHG energy, alongside energy efficiency, is critical to enabling a liveable future (Section 3). Using data from the IEA, this indicator monitors trends in global investment in energy supply and energy efficiency.

Between 2020 and 2021 total investment increased by 14%, rising in all forms of energy supply and end-use efficiency except coal for electricity generation. In 2021, electricity generation accounted for 28% of total investment, with 80% invested in zero-GHG sources. However, fossil fuels continue to account for more than 90% of non-electricity sector investment. Energy

efficiency accounted for 15% of all investment – up from 13% in 2020. To be on track for net-zero global emissions by 2050, investment in zero-GHG energy, energy efficiency, and electricity networks must nearly quadruple by 2030, accounting for at least 90% of all energy investment.

## Indicator 4.3.2: funds divested from fossil fuels

*Headline finding: between 2008 and the end of 2023, US$ 40.67 trillion was committed to fossil fuel divestment, with healthcare institutions accounting for US$ 54.3 billion.*

Maintaining investments in fossil fuel companies contributes to their expansion and increases the risk of assets becoming stranded as the world shifts to a net-zero future. This indicator uses data provided by stand.earth to track the value of funds divested from fossil fuels.[328]

From January 2008 to December 2022, 1,613 organisations, with assets worth at least US$ 40.67 trillion, committed to divest from fossil fuels. Of these, only 28 were healthcare institutions, with assets totalling US$ 54.3 billion. In 2023, there were 52 additional commitments to divestment recorded amounting to US$ 154 billion, with only one of these being a healthcare institution.[329]

Nearly 90% of all total divestment (US$ 36.3 trillion) has been announced since the beginning of 2017, suggesting the Paris Agreement may have catalysed movement away from fossil fuel companies. However, while 22.4% of total divestment by healthcare institutions occurred in 2017, divestment stalled since, with a cumulative total of only 2.1% divested between 2018 and 2023.

## Indicator 4.3.3: net value of fossil fuel subsidies and carbon prices

*Headline finding: 84% of the 86 countries reviewed had a net-negative carbon price in 2022, generating a record net subsidy to fossil fuels of US$ 1.4 trillion*

Fossil fuel subsidies encourage their use and hinder the transition to healthier options, whereas carbon pricing promotes this transition.[330,331] This indicator calculates net economy-wide average carbon prices and revenues, comparing carbon prices and monetary fossil fuel subsidies, across 86 countries responsible for 93% of global $CO_2$ emissions.

The energy crisis triggered by Russia's invasion of Ukraine in 2022, caused a sharp increase in international energy prices. With most countries' energy systems still heavily reliant on fossil fuels, most resorted to heavy fossil fuel subsidies to control local energy prices. Indeed, in

2022, 47 countries operated a carbon pricing mechanism, but only 15 generated a net-positive carbon price, a decrease from 23 in 2021 – almost all of which were Very High HDI countries. The 72 countries (83%) with net-negative carbon prices (i.e., net subsidy) allocated US$ 1.4 trillion in 2022 alone, up from US$ 683 billion in 2021, mainly due to much higher international energy prices. Net subsidies exceeded 10% of national health spending in 47 countries, and 100% in 23 countries.

Redirecting funds away from fossil fuels, and towards activities that promote human health and wellbeing would yield net positive benefits for local communities.[234,332] However, to ensure energy access, promote health, and lessen disparities, it is crucial that countries reduce their reliance on fossil fuels, in favour of more diversified and locally-available renewable energy solutions. In the phase out of fossil fuel subsidies, it is also crucial that low-income countries, which are particularly vulnerable to shifting energy costs, are adequately supported.[333]

## Indicator 4.3.4: fossil fuel and green sector bank lending

*Headline finding: after a decade of growth, green sector lending declined by 8% from 2021 to 2022. Meanwhile, fossil fuel lending fell by 14%.*

Redirecting finance away from fossil fuels and towards equitable deployment of low-GHG emission technologies and infrastructures is essential for a just transition.[334] This indicator uses Bloomberg data to monitor fossil fuel and green sector debt provided or facilitated by banks.

In 2022, fossil fuel lending still exceeded green lending by US$ 11 billion. The average annual lending to the fossil fuel sector decreased by 3.4% to US$ 556 billion in the years after the Paris Agreement entered into force (2017-2022), compared to the 2011-2016 average (US$ 578 billion). Fossil fuel lending fell 14% from 2021 to 2022, likely reflecting the record profits of the oil and gas sector in 2022.[335] However, finance remains at levels comparable to those of 2016 – a year in which a historical drop in the price of oil caused a pronounced dip in lending.[336]

Green lending grew rapidly, from US$ 7 billion in 2012, to US$ 498 billion in 2021. In 2021, green lending reached 5.5 times the level in 2016, when the Paris Agreement entered into force. However, it dropped by 8% from 2021 to 2022, likely reflecting an uncertain investment environment in the face of high inflation and rising interest rates, which poses particular challenges for new green projects due to their high capital costs.[337]

## Conclusion

The economic losses associated with the health impacts of climate change are growing (indicators 4.1.1-4.1.4), and increasingly threatening the socioeconomic conditions on which good and wellbeing depend, thereby compounding the health harms of climate change.

Preventing the worst health harms of climate change requires a transformation of the global economy. However, while there have been some steps away from fossil fuels and towards clean renewable energy, financial and economic support of the fossil fuel industry continues, hampering transition efforts. With their energy systems still heavily reliant on fossil fuels, many countries increased their fossil fuel subsidies in response to the soaring fossil fuel prices that followed Russia's invasion of Ukraine. As a result, 83% of the 86 countries reviewed had a net-negative carbon price in 2022, for a net total of US$ 1.4 trillion (indicator 4.3.3). Bolstered by record profits and permissive policies, fossil fuel companies have persisted in increasing their fossil fuel production plans, and were on track to exceed emissions consistent with 1.5°C of heating by 189% in 2040, up from 173% as of March 2023 (indicator 4.2.2). And bank lending to the green sector fell for the first time from 2021 to 2022 (indicator 4.3.4).

Concerningly, most countries' economies and societies are unprepared for the transition to a healthy future, particularly in the lower HDI country group (indicator 4.2.4). Moreover, the perpetuation of fossil fuels has pushed the value of coal-fired power generation assets at risk of stranding in a 1.5°C-compatible scenario to US$ 92.4 billion in 2030.

There is an urgent need for financial mechanisms to support countries in the transition to net zero-GHG emissions. With the Loss and Damage Fund now in place, it is crucial that the health impacts of climate change, and potential unintended harms to health and to the economy, are factored into its disbursement, to enable a just transition towards a healthier future.

# Section 5: Public and Political Engagement with Health and Climate Change

The previous sections demonstrate that the delay in implementing the necessary actions to tackle climate change, in line with the goals of the Paris Agreement, is increasingly harming people's health. The countries that have contributed least to rising temperatures are often most affected, and climate change is thereby exacerbating global inequities.[338,339] The implementation of measures that accelerate the transition away from health-harming fossil fuels and GHG emission-intensive activities is therefore critical to protect people's health and survival from the growing threats of climate change.[340–342] However, such action, requires global and national environments in which different parts of society are engaged with health and climate change.[343,344]

This section focuses on the engagement with health and climate change of societal actors that are crucial in driving action, including media, individuals, scientists, governments, international organisations, and corporations. In addition to tracking changes over the past year, it reflects on broader shifts in engagement by these actors since 2016 when the Paris Agreement came into effect.[345] New to this year, the media coverage and scientific engagement indicators also assess the extent to which engagement with health and climate change in these two domains explicitly references fossil fuels.

## Indicator 5.1: media engagement with health and climate change

*Headline finding: in 2023, 24% of all newspaper articles on climate change mention health, a slight decline from 2022.*

Newspapers play an important role in influencing public engagement with health and climate change,[346,347] and setting the political agenda.[348] This indicator tracks coverage of health and climate change in 66 newspapers across 37 countries using a method based on keyword searches of relevant newspaper databases. The sample includes widely-read newspapers in English, Chinese, German, Portuguese, and Spanish, covering all six WHO regions and at least one newspaper in each HDI group.

In 2023, 24% (12,658 of 53,867) of climate change articles referred to health – a decrease of 10% since 2022 (14,134 articles). Despite this, media coverage of health and climate change (and climate change more broadly) has grown substantially since 2016 (Figure 14). In 2016,

there were 5,447 articles discussing health and climate change, while in 2023 this figure had risen by 123%, to 12,658. The number of newspaper articles referencing health, climate change, and fossil fuels has also increased 127% between 2016 (1,814 articles) and 2023 (3,859 articles), promoting greater awareness of the health harms of fossil fuels.

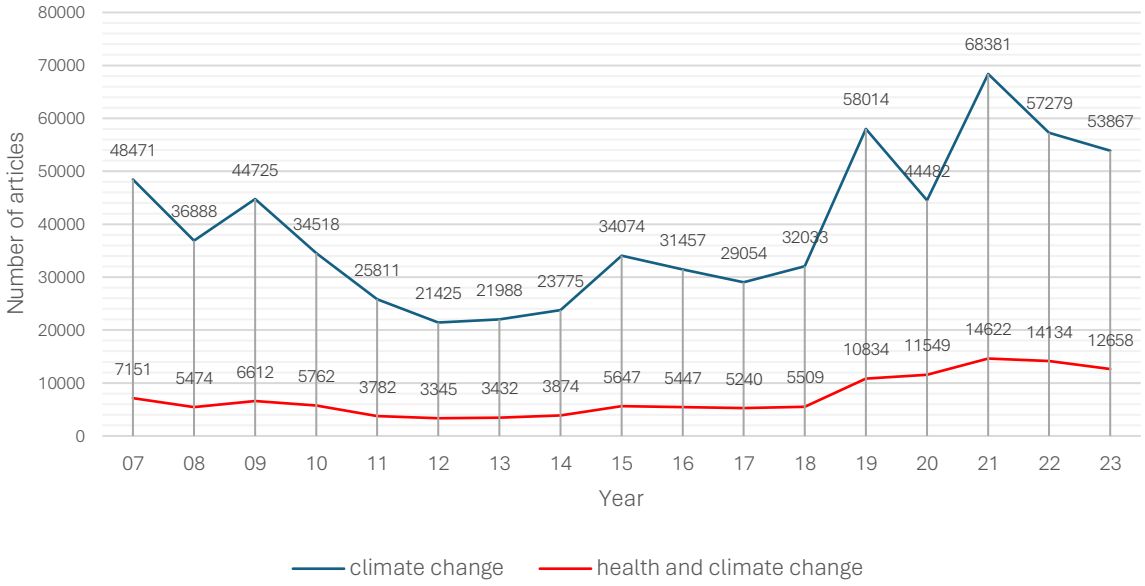


*Figure 14: Number of newspaper articles mentioning climate change, and health and climate change combined in 65 newspapers from 36 countries, 2007-2023.*

## Indicator 5.2: individual engagement with health and climate change

*Headline finding: although individual engagement with health and climate change remained low in 2023, views of Wikipedia articles on the human health effects of climate change increased by 40% from 2022.*

This indicator measures individual engagement with health and climate change through searches on the online encyclopaedia *Wikipedia* – a major source of trusted information globally, and one of the most visited websites in the world.[349,350] It tracks individuals' clicks between an article on health and one on climate change, and vice versa ('clickstream activity'), focusing on English-language Wikipedia, which represents around 50% of global traffic to Wikipedia.[351]

The indicator finds that individuals rarely move between health and climate change articles. In 2023, only 0.03% of all click views leading to a health-related article came from a climate

change-related article; and only 0.32% of all click views leading to a climate change-related article came from a health-related article. This low clickstream activity is observable across the 2018-2023 period. However, with more articles now dedicated to the health-climate change nexus, 2023 saw a 40% increase in average views of the human health effects of climate change articles compared to 2022.

## 5.3: Scientific engagement with health and climate change

Peer-reviewed journal articles are the primary source of scientific evidence for governments, international organisations, the media, and the public, providing the basis for action on climate change.[352,353] This set of indicators tracks engagement on health and climate change in the scientific literature.

### Indicator 5.3.1: scientific articles on health and climate change

*Headline finding: the number of scientific papers investigating the links between health and climate change increased by 7.3% in 2023 compared with 2022, reaching its highest recorded level.*

Funding for research on the links between health and climate change has grown in recent years, contributing to greater scientific engagement and understanding.[354] This indicator uses a machine-learning approach to monitor and classify peer-reviewed academic articles on health and climate change.[355] The scientific literature has expanded rapidly, with 66% of the approximately 35,802 health and climate change articles published since 2016 (Figure 15). In 2023, there were 4,080 publications on health and climate change, an increase of 7.3% from 2022. Most articles focus on countries with Very High and High HDI levels (53% and 32% respectively), with much less research on Medium and Low HDI countries (16% and 8% respectively), with some articles covering multiple locations. While 2023 saw an increase in articles on mitigation and adaptation, 83% (3403 of 4080) of articles focused on health impacts (Figure 15). Interestingly, only 4% of health and climate change articles explicitly reference fossil fuels in the title or abstract, instead focusing on emissions or heating to understand climate change and its health consequences. Indeed, less than 1% of studies on either health impacts or health links to adaptation mention fossil fuels. In contrast, 28% of mitigation studies explicitly reference fossil fuels – particularly coal and diesel – because the focus on the health effects of mitigation is often linked to air pollution from combustion processes. In addition, the

predominant language of publications remains English, which creates restrictions for speakers of other languages to access or contribute to the scientific knowledge on health and climate change.

## Indicator 5.3.2: scientific engagement on the health impacts of climate change

*Headline finding: 31% of the 4662 studies published on health impacts of climate variables in 2023 focus on cases in which changes in climate variables can be attributed to human influence – up by 117% from 2016.*

Increasing the understanding of health impacts of anthropogenic climate change is essential to characterise health risks, and design efficient measures to protect and promote health. This indicator tracks the number of scientific studies of the health impacts of changes in climate variables, in cases in which the changes in those variables can be attributed to anthropogenic climate change.[356]

The number of articles studying events in which changes in the climate variables driving health impacts can be attributed to anthropogenic climate change increased by 117% from 2016 (7806) to 2023 (16926). However, the proportion of all articles covering the health impact of climate variables remained largely constant, at 30% (of 25761) in 2016 and 31% (of 54414) in 2023. The most common health outcome in these studies was infectious disease (36% of studies). However, there have been rapid increases in studies of mental health (158% increase) and water security (102% increase) since 2016, reaching 11% and 5% of all partially attributable studies in 2023, respectively. Inequalities in terms of the locations of these partially attributable studies persist. The number of studies per million people in countries with Very High and High HDI are 6.6 and 2.1, while for Medium and Low HDI countries, these proportions are 1.5 and 1.5 studies per million people.

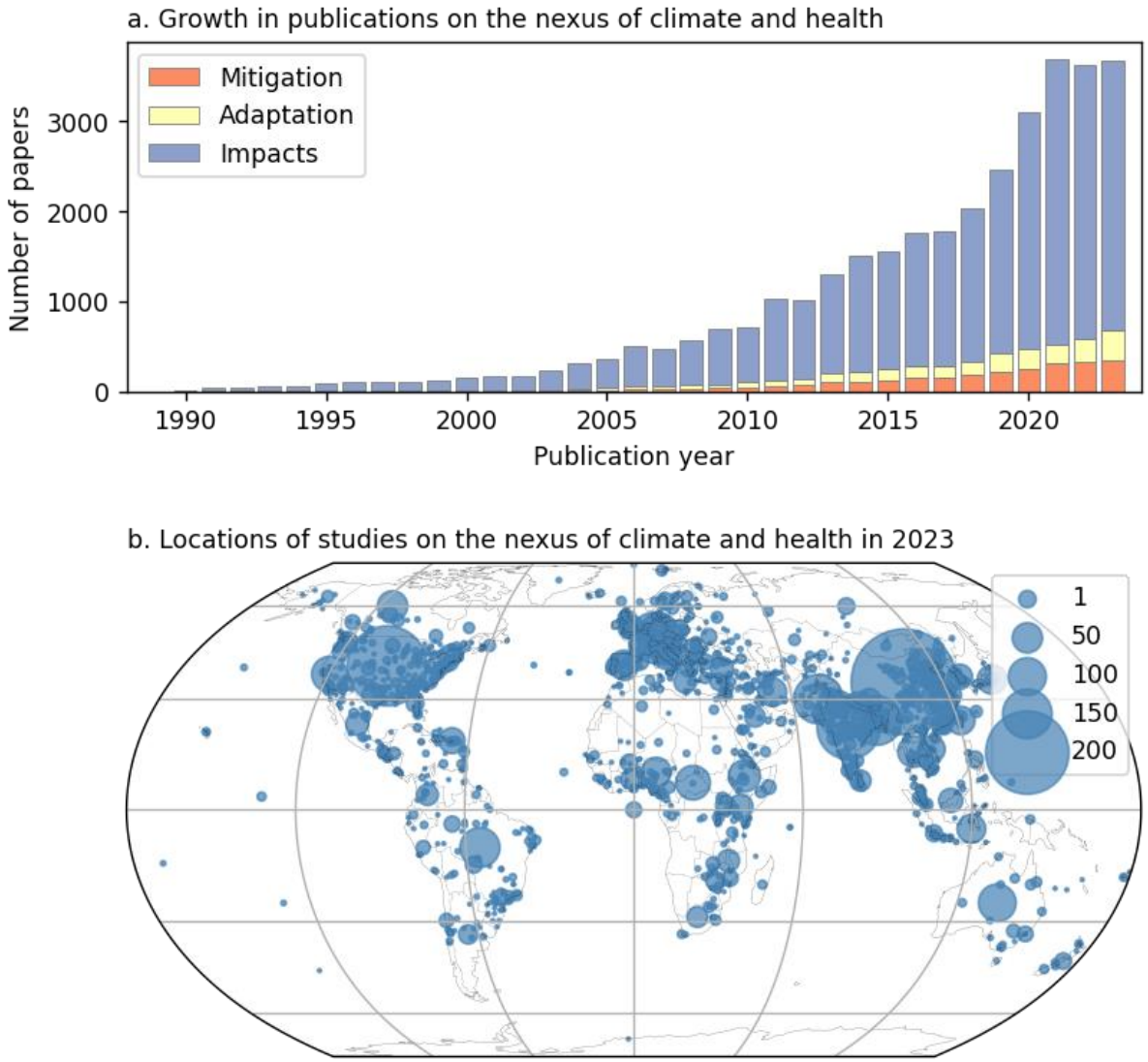


*Figure 15: Number of scientific articles on health and climate change (a) by year between 1985 and 2023; and (b) by location in 2023.*

## 5.4: Political engagement with health and climate change

Engagement by governments and political leaders is central to delivering climate change action that protects human health.[357,358] This set of indicators monitors political engagement with health and climate change through national leaders and international organisations.

### Indicator 5.4.1: government engagement

*Headline finding: in 2023, 35% of governments mentioned health and climate change in their annual UN General Debate statements compared to 50% in 2022*

The annual UN General Debate (UNGD) provides a global forum for national governments to address the UN General Assembly and discuss priority issues in world politics requiring international action.[359,360] This indicator monitors references to health and climate change in UNGD speeches.

The proportion of countries referencing health and climate change in these speeches declined in 2023 – from 50% (97 of 193) in 2022 to 35% (68 of 192). This, however, is still much higher than in 2016, when only 15% (30 of 194) of governments discussed health and climate change. Engagement continues to be led by the countries least responsible but most affected by climate change – particularly, SIDS, which represented 57% (39 of 68) of the governments discussing the intersection of health and climate change in 2023. These discussions had a strong emphasis on the human devastation of extreme weather events.[361] The public health costs of climate change were also emphasised, with Fiji's statement explaining that "for small island developing states, the triple burden of non-communicable diseases, mental health and the climate emergency are straining our health infrastructure and resources."[362]

The second part of this indicator tracks engagement with health and climate change in the NDCs. As the major policy instrument of the Paris Agreement, countries are required to periodically report more ambitious contributions towards the international climate commitments with updated NDCs.[345,363,364] The increase in health coverage from the first NDCs (70%, 135 of 192) to the second or updated NDCs (94%, 162 of 172) has not continued into the third round of NDCs, with less than half of NDCs submitted as of February 2024 mentioning a health keyword (47%, 27 of 58). While this represents a significant decline in health engagement, fewer than a third of countries, to date, have submitted a third NDC. Across the three rounds of NDCs, engagement with health is highest among Low (between 94% and 100%) and Medium (between 86% and 97%) HDI countries, followed by High HDI countries (between 78% and 97%). Engagement is lowest among the Very High HDI countries (between 28% and 89%).

## Indicator 5.4.2: engagement by international organisations

*Headline finding: international organisations focused on climate mitigation and adaptation referred to the health co-benefits of climate mitigation in a record 20% of their X posts in 2023.*

International organisations (e.g., UN agencies, international and regional financial institutions, and supranational bodies such as the EU and African Union) are increasingly at the forefront of action on climate change.[365–367] This indicator tracks engagement on the health co-benefits of climate mitigation on the official X (formerly Twitter) accounts of international organisations (IOs), which remains a key platform for their public communication.[368,369]

The indicator measures engagement with the health co-benefits of climate mitigation using a dataset of 50,000 English-language tweets covering 41 IOs that have an operational focus on climate mitigation or adaptation across wide-ranging sectors (e.g., trade and finance, development and disaster risk management, or food and agriculture). There has been a marked increase in the proportion of tweets mentioning health co-benefits of climate mitigation since 2016, increasing from 11% (13040 of 120478 tweets) that year, to 18% (15525 of 88034 tweets) in 2022, and reaching a record high of 20% (10069 of 51113 tweets) in 2023.

## Indicator 5.5: corporate sector engagement with health and climate change

*Headline finding: corporate sector engagement with health and climate change increased to its highest level in 2023 with 60% of companies referring to the health dimensions of climate change in their UN Global Compact reports*.

Corporations have substantial influence over efforts to tackle climate change. A recent report found that 57 public and private corporations produced 80% of all global emissions between 2016 and 2022.[370] Corporate engagement with health and climate change is therefore critical in the transition to a healthy future.

Over 24,000 companies from 168 countries have signed up to the UN Global Compact (UNGC) making it the largest global corporate sustainability initiative.[371] While the UNGC has been criticised for enabling so-called greenwashing, recent evidence suggests companies' involvement in the UNGC is associated with improved environmental and social responsibility.[372–374] This indicator measures corporate sector engagement by tracking references to health and climate change in the annual Communication of Progress (GCCOP) reports that companies submit.[375]

Corporate sector engagement with the health-climate change nexus has seen an upward trend since 2016, with the largest increase in engagement occurring over the past year. The proportion

of companies mentioning health and climate change in their GCCOP reports grew from 16% (559 of 3573 companies) in 2016, to 38% (2314 of 6089 companies) in 2022, and to 60% (2744 of 4567) in 2023. A higher proportion of companies continue to engage with health (93% in 2023) or climate change (89% in 2023) separately.

## Conclusion

Engagement with health and climate change has grown substantially since 2016, when the Paris Agreement came into effect. Across different societal actors – the media, scientific community, governments, international organisations, and corporations – engagement with the health-climate change nexus is higher than in 2016, and there are signs that individual engagement is increasing too. This growing awareness was reflected in the unprecedented focus on health at COP28 in December 2023, which included a Health and Climate Thematic Day, a first health and climate ministerial meeting, and 149 countries endorse the COP28 health-climate declaration.[376–378]

Yet, this section also demonstrates that engagement across societal domains remains low compared to engagement with health and climate change as separate issues, as evidenced by media coverage, government engagement, and Wikipedia users' digital footprints. Furthermore, the indicators continue to highlight stark global differences in engagement with health and climate change. The generation of relevant scientific knowledge is lagging for the world's most affected and vulnerable regions, while calls for action on health and climate change are led the by governments of the countries most exposed to climate change, rather than those most responsible for GHG emissions. Some indicators, such as media coverage and government engagement, also saw reductions in engagement in 2023, demonstrating that progress can be reversed. This is especially important given the growing signs in some countries of a backlash from parts of society against specific mitigation policies, despite their health co-benefits.[379–381] Such political contestation underscores the need to promote people-centred and inclusive society-wide actions to tackle climate change, and protect the health and survival of people worldwide.[382]

# Conclusion: the 2024 report of the *Lancet* Countdown

Data in this report show that the health threats and impacts of climate change are exceeding all previous records.

In 2023, people were exposed, on average, to an unprecedented 50 more days of health-threatening heat than expected without climate change, resulting in 167% more annual deaths of adults over 65 than in the 1990s (indicator 1.1.1 and 1.5.5). The hours of sleep lost due to heat exposure reached 6% above 1986-2005, and heat exposure led to record losses of the hours available for safe outdoor physical activity and labour (indicators 1.1.3 and 1.1.4). Meanwhile, heat exposure resulted in a record worsening of online sentiment expressions globally (indicator 1.2.4). In 2023, extreme drought affected 48% of the global land area - the second-highest level recorded (indicator 1.2.2). This contributed to exposure to dangerous levels of desert dust, which increased in 48% of countries from 2003-2007 to 2018-2022, and to the risk of wildfires increasing in 66% of countries between 2003-2007 and 2019-2023 (indicators 1.2.1 and 1.2.3). The increased frequency of droughts and heatwaves has resulted in a record 151 million more people experiencing moderate or severe food insecurity in 2022 than in 1986-2010 (indicators 1.4.1). Additionally, the risk of deadly infectious diseases like dengue, malaria, vibriosis and West Nile virus is rising in new parts of the world (indicators 1.3.1-1.3.4).

Persistent delays in adaptation compound the health impacts. As of December 2023, only 61% of countries that committed to building climate-resilient health systems reported having completed a vulnerability and adaptation assessment; and only 52% had developed an HNAP (indicators 2.1.1 and 2.1.2). Inadequate adaptation has driven more households to use polluting AC, while nature-based solutions, including urban greenspaces, remain underutilised (indicators 2.2.2-2.2.3, panel 4).

With current policies and actions putting the world on track to 2.7°C of heating by 2100 if maintained,[11] limits to adaptation are looming closer (panel 5). Transformative, sustained mitigation efforts would not only avoid the most catastrophic impacts of climate change, but also the multiple health harms of fossil fuels (panel 6). The transition to clean energy sources could prevent at least 2.3 million deaths annually through reduced solid fuel-derived indoor air pollution, and 3.33 million through reduced fossil fuel and biomass-derived outdoor air pollution, annually (indicators 3.2.1 and 3.2.2). Mitigation in the agricultural sector could additionally save 11.2 million lives annually through healthier, more plant-based diets (indicator 3.3.2), and a people-centred transformation can enable healthier cities and lifestyles.

However, the world is increasingly off-track from meeting the goals of the Paris Agreement, and many key indicators point to a world moving in the wrong direction. The carbon intensity of the energy system has remained practically unchanged, and energy-related emissions reached an all-time high in 2023 (indicator 3.1.1), while agricultural emissions grew by 2.3% since 2016. Within the healthcare sector itself, emissions increased 10%, just from 2020 to 2021 (indicator 3.4).

Delays in implementing the required transformative actions mean that most countries are grossly unprepared for a healthy, net zero-GHG emission future, with people in Low and Medium HDI countries most at risk (indicator 4.2.4). An entrenched fossil fuel dependence increasingly threatens national economies, with the losses associated with current coal-fired power generation sector assets that are expected to be stranded, to a cumulative total of US$ 164.5 billion between 2025 and 2034 (indicator 4.2.3). Meanwhile, the most underserved countries are lagging in the adoption of clean, renewable energy, and remain exposed to the harms of energy poverty (indicators 3.1.1 and 3.1.2).

Governments and corporations around the world are exacerbating the risks. Fuelled by record profits, oil and gas giants expanded their production plans, and, as of March 2024, were on track to exceed emissions compatible with 1.5°C by 189% in 2040, 16 percentage-points above the year before (indicator 4.2.2). In addition, as energy prices soared and countries' energy systems remained reliant on fossil fuels in 2022, governments allocated a record-breaking US$ 1.4 trillion to net fossil fuel subsidies (indicator 4.3.3), dwarfing any financial commitments in support of climate action made at COP28.

Against this concerning backdrop, an increased focus on health within UNFCCC negotiations in COP28, and the prioritisation of climate change within the WHO's GPW 14, marks important progress. The engagement of individuals, corporations, scientists, and international organisations with climate change and health is growing (indicators 5.2, 5.3.1, 5.3.2, 5.4.2 and 5.5), raising hopes that a healthy, prosperous future could still be within reach.

However, avoiding a catastrophic increase of death, disease, and destruction will require, urgent, decisive, and health-focused actions, exceeding the ambition of international commitments. Entering a new phase of activities, the Lancet Countdown will increase its efforts to deliver actionable evidence, and support the world in ensuring a prosperous, healthy future for all.

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