

# *The 2021 report of the Lancet Countdown on health and climate change: code red for a healthy future*

Article

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# The 2021 Report of The *Lancet* Countdown on Health and Climate Change

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## List of Abbreviations

A&RCC – Adaptation & Resilience to Climate Change
CDP – Carbon Disclosure Project
CFU – Climate Funds Update
CO <sub>2</sub> – Carbon Dioxide
CO <sub>2</sub> e – Carbon Dioxide Equivalent
COP – Conference of the Parties
ECMWF – European Centre for Medium-Range Weather Forecasts
EE-MRIO – Environmentally Extended Multi-Region Input-Output
EJ – Exajoule
EM-DAT – Emergency Events Database
ERA – European Research Area
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
GHG – Greenhouse Gas
GNI – Gross National Income
GtCO <sub>2</sub> – Gigatons of Carbon Dioxide
GW – Gigawatt
GWP – Gross World Product
HIC – High Income Countries
HDI – Human Development Index
IEA – International Energy Agency
IHR – International Health Regulations
IPC – Infection Prevention and Control
IPCC - Intergovernmental Panel on Climate Change
IRENA - International Renewable Energy Agency
LMICs – Low- and Middle-Income Countries
LPG – Liquefied Petroleum Gas
Mt – Metric Megaton
MtCO <sub>2</sub> e – Metric Megatons of Carbon Dioxide Equivalent
MODIS – Moderate Resolution Imaging Spectroradiometer
MRIO – Multi-Region Input-Output
NAP – National Adaptation Plan
NASA – National Aeronautics and Space Administration

NDCs - Nationally Determined Contributions  
NHS – National Health Service  
NO<sub>x</sub> – Nitrogen Oxide  
NDVI – Normalised Difference Vegetation Index  
OECD – Organization for Economic Cooperation and Development  
PM<sub>2.5</sub> – Fine Particulate Matter  
PV – Photovoltaic  
SDG – Sustainable Development Goal  
SDU – Sustainable Development Unit  
SIDS – Small Island Developing States  
SSS – Sea Surface Salinity  
SST – Sea Surface Temperature  
tCO<sub>2</sub> – Tons of Carbon Dioxide  
tCO<sub>2</sub>/TJ – Total Carbon Dioxide per Terajoule  
TJ – Terajoule  
TPES – Total Primary Energy Supply  
TWh – Terawatt Hours  
UN – United Nations  
UNFCCC – United Nations Framework Convention on Climate Change  
UNGA – United Nations General Assembly  
UNGD – United Nations General Debate  
VC – Vectorial Capacity  
WHO – World Health Organization  
WMO – World Meteorological Organization



# 1 The 2020 Report of the Lancet Countdown 2 on Health and Climate Change

## 3 Executive Summary

4 The Lancet Countdown: Tracking Progress on Health and Climate Change is an international  
5 collaboration which independently monitors the health consequences of a changing climate.  
6 Publishing updated, new and improved indicators each year, it represents the consensus of  
7 leading researchers from 38 academic institutions and UN agencies. The 44 indicators of the  
8 2021 report of the Lancet Countdown expose an unabated rise in the health impacts of  
9 climate change, and the current health consequences of the delayed and uneven response of  
10 countries around the world – providing a clear imperative for accelerated action that puts  
11 the health of people and planet first.

12 This year's report coincides with the 26<sup>th</sup> UN Framework Convention on Climate Change  
13 Conference of the Parties (COP26), a moment when countries are facing pressure to realise  
14 the ambition of the Paris Agreement to keep global average temperature rise to 1.5 °C,<sup>1</sup> and  
15 mobilise the finance required for all countries to deliver an effective climate response. These  
16 negotiations unfold in the context of the COVID-19 pandemic – a global health crisis which  
17 has claimed millions of lives, affected livelihoods and communities around the globe and  
18 exposed deep fissures and inequities in the world's capacity to cope with, and respond to,  
19 health emergencies.<sup>2-4</sup> Yet, in its response to both crises, the world is faced with an  
20 unprecedented opportunity to ensure a healthy future for all.

## 21 22 Deepening inequities in a warming world

23 Record temperatures in 2020 resulted in a new high of 3.1 billion more days of heatwave  
24 exposure among people over 65 and 626 million more exposures affecting children under  
25 1 year old, as compared to a 1986-2005 baseline (indicator 1.1.2). Looking to 2021, people in  
26 these age groups, along with those facing social disadvantages, were the most affected by the  
27 record-breaking temperatures of over 40°C that affected the Pacific northwest areas of the  
28 USA and Canada in June 2021<sup>5</sup> – an event that would have been virtually impossible without  
29 human-caused climate change.<sup>6</sup> Although the tally will not be known for several months,  
30 hundreds of people prematurely died from the heat.<sup>7,8</sup> Furthermore, populations in countries  
31 with low and medium levels of UN-defined Human Development Index (HDI)<sup>9</sup> have  
32 experienced the biggest increase in heat vulnerability over the past 30 years, with risks to  
33 their health further exacerbated by the lower availability of cooling mechanisms and urban  
34 green space in these countries (indicators 1.1.1, 2.3.2 and 2.3.3).

35 Agricultural workers in countries with low and medium HDI were among the worst affected  
36 by exposure to extreme temperatures, bearing almost half the 295 billion potential work  
37 hours lost due to heat in 2020 (indicator 1.1.4). These lost work hours could have devastating  
38 economic consequences to these already vulnerable workers – data in this year’s report  
39 shows that potential earnings lost were equivalent to 4-8% of national GDP in the low HDI  
40 country group (indicator 4.1.3).

41 Through these impacts and alongside rising average temperatures and altered rainfall  
42 patterns, climate change is beginning to reverse years of progress in tackling the food and  
43 water insecurity that still affects the most underserved populations around the world,  
44 undermining a cornerstone of good health.<sup>10</sup> In any given month in 2020, up to 19% of the  
45 global land surface was affected by extreme drought, a value that had not exceeded 13% from  
46 1950 to 1999 (indicator 1.2.2). In parallel, warmer temperatures are affecting the yield  
47 potential of the world’s major staple crops: a 6.0% reduction for maize; 3.0% for winter  
48 wheat; 5.4% for soybean; and 1.8% for rice in 2020, relative to 1981-2010 (indicator 1.4.1);  
49 exposes the rising risk of food insecurity in a warming world.

50 Adding to these health hazards, the changing environmental conditions are also increasing  
51 the suitability for the transmission of many water-, air-, food-, and vector-borne pathogens.  
52 Although socioeconomic development, public health interventions, and advances in medicine  
53 have reduced the global burden of infectious disease transmission, climate change threatens  
54 to undermine eradication efforts.<sup>11,12</sup>

55 The number of months with environmentally suitable conditions for the transmission of  
56 malaria (*Plasmodium falciparum*) rose by 39% from 1950-1959 to 2010-2019 in densely  
57 populated highland areas in the low HDI country group – threatening highly disadvantaged  
58 populations, previously comparably safe from this disease due to their geographical location  
59 (indicator 1.3.1). The epidemic potential for dengue, Zika and chikungunya, which currently  
60 affect primarily populations in Central and South America, the Caribbean, Africa and south  
61 Asia, increased globally by 13% for the transmission by *A. aegypti* and 7% higher for *A.*  
62 *albopictus* from the 1950s, with the biggest relative increase was seen in countries with very  
63 high HDI (indicator 1.3.1). However, it is people in the low HDI country group who are  
64 confronted with the highest vulnerability to these arboviruses (indicator 1.3.2).

65 Similar findings are observed in the environmental suitability for *Vibrio cholerae*, a pathogen  
66 estimated to cause almost 100,000 deaths annually, particularly among populations with  
67 poor access to safe water and sanitation.<sup>13</sup> Between 2003 and 2019, the coastal areas suitable  
68 for *Vibrio cholerae* transmission increased significantly across all HDI country groups – but,  
69 with 98% of their coastline suitable to the transmission of *Vibrio cholerae* in 2020, it is people  
70 in the low HDI country group that face the highest environmental suitability for this disease  
71 (indicator 1.3.1).

72 The concurrent and interconnecting risks posed by extreme weather events, infectious  
73 disease transmission, and food, water and financial insecurity are overburdening the most  
74 vulnerable. Through multiple simultaneous and interacting health risks, climate change is  
75 threatening to reverse years of progress in public health and sustainable development.

76 Even with overwhelming evidence on the health impacts of climate change, countries are not  
77 delivering an adaptation response proportionate to rising risks their populations face. In  
78 2020, 63% of all countries were yet to achieve a high level of implementation of national  
79 health emergency frameworks, leaving them unprepared to respond to pandemics and  
80 climate-related health emergencies (indicator 2.3.1). Importantly, only 55% of low HDI  
81 countries had reported at least medium-level of implementation of these frameworks,  
82 compared with 89% of very high HDI countries. In addition, only 37 of 70 countries reported  
83 having a national adaptation plan for health, with insufficient human and financial resources  
84 identified as the key barrier for their implementation (indicator 2.1.1). With a world facing  
85 unavoidable temperature rise, even under the most ambitious climate change mitigation,  
86 accelerated adaptation is essential to reduce vulnerabilities and protect the health of people  
87 around the world.

88

### 89 [An inequitable response fails everyone](#)

90 Six months into 2021, the world had failed to deliver global equitable access to the COVID-19  
91 vaccine: more than 75% of all vaccine doses had been given to people in just 10 countries.<sup>14</sup>  
92 Data in this report exposes similar inequities in the global climate change mitigation response.

93 To meet the Paris Agreement goals and prevent catastrophic levels of warming, global  
94 greenhouse gas emissions must halve within a decade.<sup>15,16</sup> However, at the current pace, it  
95 would take over 150 years for the energy system to fully decarbonise (indicator 3.1), and the  
96 unequal response between countries is resulting in an uneven realisation of the health co-  
97 benefits of a low-carbon transition.

98 Partly responsible for the slow decarbonisation rate is the use of public funds to subsidise  
99 fossil fuels. Out of 84 countries reviewed, 65 were still providing an overall subsidy to fossil  
100 fuels in 2018, using funds in many cases equivalent to substantial proportions of the national  
101 health budget, and which could otherwise be redirected to deliver net benefits to health and  
102 wellbeing. Further, all the 19 countries whose carbon pricing policies did outweigh the effect  
103 of any fossil fuels subsidies came from the very high HDI group (indicator 4.2.4).

104 While countries in the very high HDI group have collectively made the greatest progress in  
105 energy system decarbonisation, they are still the main contributors to CO<sub>2</sub> emissions through  
106 their local production, accounting for 45% of the global total (indicator 4.2.5). Meanwhile,  
107 with a slower pace of decarbonisation and poorer air quality regulations, the medium and  
108 high HDI country groups produce the most PM<sub>2.5</sub> emissions and have the highest rates of air

109 pollution-related mortality – about 50% higher than the total mortality in the very high HDI  
110 group (indicator 3.3). Turning to the low HDI country group, with comparatively lower levels  
111 of industrial activity, its local production contributes to only 0.7% of global CO<sub>2</sub> emissions, and  
112 it has the lowest mortality rate from ambient air pollution. However, with only 12% of its  
113 inhabitants relying on clean fuels and technologies for cooking, the health of these  
114 populations is still at risk from dangerously high concentrations of household air pollution  
115 (indicator 3.2). Importantly, even within the most affluent countries, people in the most  
116 deprived areas overwhelmingly bear the health burden from exposure to air pollution.<sup>17,18</sup>  
117 These findings expose the health costs of the delayed and unequal mitigation response, and  
118 underscore the millions of lives to be saved annually through a low-carbon transition that  
119 prioritises the health of all populations.

120 However, the world is not on track to realising these health gains: current global  
121 decarbonisation commitments would lead to 2.7-3.1°C of warming by the end of the  
122 century,<sup>19</sup> and present direction of post-COVID-19 spending is threatening to make this  
123 situation worse, with just 18% of all funds committed for recovery by the end of 2020  
124 expected to reduce greenhouse gas emissions.<sup>20,21</sup> Indeed, the economic recovery from the  
125 pandemic is already predicted to lead to an unprecedented 5% increase in GHG emissions in  
126 2021, which will bring global anthropogenic emissions back to their peak levels.<sup>22</sup>

127 In addition, the current economic recession is threatening to further undermine the target of  
128 mobilising US\$100 billion per year from 2020 onwards to promote low-carbon shifts and  
129 adaptation responses in the most underserved countries - even while this quantity is now  
130 dwarfed by the trillions allocated to COVID-19 recovery.<sup>23,24</sup> The high levels of borrowing that  
131 lower income countries had to resort to during the pandemic could further erase their ability  
132 to deliver a green recovery, and maximise the health gains to their population of a low-carbon  
133 transition.<sup>25,26</sup>

134

135 [An unprecedented opportunity to ensure a healthy future for all](#)

136 The overshoot in emissions resulting from a carbon-intensive COVID-19 recovery would  
137 irreversibly push the world off track meeting climate commitments and the Sustainable  
138 Development Goals – and lock in humanity to an increasingly extreme and unpredictable  
139 environment. Data in this report expose the health impact and health inequities of the current  
140 1.2°C world and confirms that, on the current trajectory, climate change will become the  
141 defining narrative of human health.

142 However, by directing the trillions of dollars that will be committed to COVID-19 recovery  
143 towards the WHO's prescriptions for a healthy, green recovery, the world could meet the  
144 Paris Agreement goals, protect the natural systems that support wellbeing, and minimise  
145 inequities through reduced health impacts and maximised co-benefits of a universal low-  
146 carbon transition.<sup>27</sup> Promoting equitable climate change mitigation and universal access to

147 clean energies could save millions of lives annually from reduced exposure to air pollution,  
148 healthier diets, and more active lifestyles, and contribute to reducing health inequities  
149 globally.<sup>28</sup> This pivotal moment of economic stimulus represents a historical opportunity to  
150 securing the health of present and future generations.

151 There is a glimpse of this story unfolding through several promising trends in this year's data:  
152 electricity generation from renewable wind and solar energy has increased by an annual  
153 average of 17% between 2013-2018 (indicator 3.1); investment in new coal capacity  
154 decreased by 10% in 2020 (indicator 4.2.1); and the global number of electric vehicles reached  
155 7.2 million in 2019 (indicator 3.4). Additionally, the global pandemic has driven increased  
156 engagement in health and climate change across multiple domains in society, with 91 heads  
157 of state making the connection in the 2020 UN General Debate, and newly widespread  
158 engagement among very high HDI countries (indicator 5.4). Whether COVID-19 recovery  
159 supports, or reverses these trends, is yet to be seen.

160 Neither SARS-CoV-2 nor climate change respect national borders. Without widespread,  
161 accessible vaccination across all countries and societies, the virus and its new variants will  
162 continue to put the health of everyone at risk. Likewise, tackling climate change requires all  
163 countries to deliver an urgent and coordinated response, with COVID-19 recovery funds  
164 allocated to support and ensure a just transition to a low carbon future and climate change  
165 adaptation in all corners of the world. Leaders of the world have an unprecedented  
166 opportunity to deliver a future of improved health, reduced inequity, and economic and  
167 environmental sustainability. However, this will only be possible if the world acts together to  
168 ensure no one is left behind.  
169

## 170 Introduction

171 The COVID-19 pandemic has changed societies in ways previously unimaginable, with  
172 deepening and widespread concerns about global health security, inequities, and  
173 anthropogenic influences on the environment. As of the 11<sup>th</sup> of May 2021, the pandemic had  
174 resulted in almost 191 million cases and 4.1 million deaths,<sup>2,3</sup> and its multidimensional  
175 impacts on health and wellbeing, together with its disruption to work, social, and leisure  
176 activities, still continue. The overwhelming healthcare demand caused 94 of 105 countries  
177 examined to experience disruptions to the delivery of essential health services, further  
178 undermining health and wellbeing.<sup>29</sup> Adding to this, COVID-19 led to a worldwide economic  
179 recession, an estimated 90 million people were pushed below the extreme poverty threshold  
180 in 2020,<sup>30,31</sup> and pandemic-induced borrowing by the World Trade Organization's 'developing'  
181 countries amounted to US\$130 billion by July that year.<sup>26</sup>

182 But while the world's attention has been diverted towards the ongoing acute health crisis,  
183 the health effects of human-induced climate change continue to increase. Climate change  
184 contributed to the unusually high temperatures seen during 2020 in the United Kingdom and  
185 Siberia, to the record-breaking well-over 40°C heatwave that affected populations across the  
186 Pacific northwest areas of the USA and Canada in June 2021 and caused over 1000 deaths,  
187 with that number expected to increase, to an accelerated glacier retreat that is putting the  
188 city of Huaraz (Peru) under imminent flooding risk, and to Australia's devastating 2019/2020  
189 bushfire season.<sup>6,32-35</sup> Over a six month period in 2020, 84 disasters from floods, droughts,  
190 and storms affected 51.6 million people in countries already struggling with COVID-19,<sup>36</sup> with  
191 the escalating impacts threatening their ability to respond to health emergencies. Meanwhile,  
192 climate impacts may undermine the capacity of countries to repay their debts, further  
193 hindering their progress towards the Sustainable Development Goals (SDGs).<sup>25,37</sup> As with  
194 COVID-19, the health impacts of climate change are inequitable, with disproportionate effects  
195 on the most vulnerable in every society, including the poor, members of minority groups,  
196 women, children, older adults, people with chronic diseases and disabilities, and outdoor  
197 workers.<sup>38</sup> Such interrelationships between climate change and COVID-19 provide ongoing  
198 evidence of the interconnectedness of the world, and of the health consequences of  
199 inequities. The 2021 report of the *Lancet* Countdown depicts the synergies and interactions  
200 between these two crises.

201 The world is now 1.2°C warmer than in the pre-industrial period, the past seven years rank  
202 as the hottest seven on record, and 2020 tied with 2016 as the hottest yet.<sup>39-41</sup> Atmospheric  
203 CO<sub>2</sub> concentrations have reached a concerning milestone – now 50% higher than in the pre-  
204 industrial era.<sup>42</sup> Changes such as reduced soil moisture could limit the Earth's carbon  
205 reuptake, resulting in further CO<sub>2</sub> in the atmosphere.<sup>43</sup> Furthermore, some climate tipping  
206 points are close to or may have surpassed critical thresholds and could interact to further  
207 destabilise the Earth's climate system.<sup>44,45</sup> While the dramatic reductions in transport and  
208 industrial manufacturing during the pandemic resulted in energy-related emissions for 2020  
209 falling by 5.8%, the largest annual percentage decline since World War II, this was short-lived

210 and emissions have risen in 2021.<sup>22,46,47</sup> Without an adequate response, the health effects of  
211 climate change will worsen throughout the coming decades.

212 The world now turns with hope to the 2021 UN Framework Convention on Climate Change  
213 (UNFCCC) conference in Glasgow (COP26), originally scheduled for 2020. Over the past year,  
214 the world has seen more ambitious climate targets from governments and businesses, and  
215 73% of global emissions are now covered by net zero emissions targets announced by May  
216 2021. Nevertheless, these announcements are non-binding, and even with their full  
217 implementation the world would be on track to ~2.4°C (1.9-3.0°C) of warming by 2100.<sup>48</sup>

218 These climate announcements are being made against the backdrop of huge investments in  
219 economic recovery from COVID-19. Depending on their consistency with climate targets,  
220 these investments could take the world in one of two directions – either driving it towards  
221 the goals of the Paris Agreement, or locking it into increased emissions and climate change  
222 that will damage the health of current and future generations. As humanity faces a critical  
223 turning point, the indicators in this report provide the health evidence to inform a global  
224 response to the impacts of climate change, and identify the considerable health,  
225 environmental and economic benefits that would result if a ‘green recovery’ from COVID-19  
226 was prioritised.

227

## 228 [Five years of tracking progress on health and climate change](#)

229 The *Lancet* Countdown is an independent, international, and multidisciplinary collaboration  
230 that monitors the health impacts of climate change, and progress – or lack thereof – in the  
231 world’s response. It draws on the expertise of climate scientists, economists, energy and  
232 transport experts, social and political scientists, public health experts and health professionals  
233 among others, spanning 38 academic and UN institutions. Together, they report on 44  
234 indicators, organised within five domains: climate change impacts, exposures, and  
235 vulnerabilities; adaptation, planning, and resilience for health; mitigation actions and health  
236 co-benefits; economics and finance; and public and political engagement. The 2021 report of  
237 the *Lancet* Countdown is its sixth annual report, building on nine years of collaborative work.

238 The *Lancet* Countdown’s indicator domains were selected through an open, global  
239 consultation process that identified scientifically documented links between health and  
240 climate change, with indicators developed according to well-established methods, and to the  
241 availability of reliable and regularly updated data with adequate geographical and temporal  
242 scales.<sup>49</sup> Each year, the indicators have been improved upon through an open, iterative and  
243 adaptive approach, and new indicators have been introduced to provide an increasingly  
244 complete picture of the health dimensions of climate change. For the two most recent  
245 reports, prior to the formal peer review, all new indicators underwent an independent  
246 assessment process led by world experts in their respective domains, adding rigour and  
247 transparency to the collaboration’s research. Existing indicators are undergoing a similar,

248 independent quality improvement process, aimed at ensuring they continue to use the best  
249 available data and methods.

250 Three new important indicators are added to the 2021 report: the first incorporates  
251 considerations of mental wellbeing by tracking the effect of heat on expressed online  
252 sentiment; the second captures the influence of heat on safe physical activity; and the third  
253 tracks consumption-based greenhouse gas and PM<sub>2.5</sub> emissions. Most of the pre-existing  
254 indicators underwent major improvements, with strengthened methods, datasets and  
255 metrics, and expanded geographical and temporal coverage. All indicators, including their  
256 methods, data sources, caveats, and plans for future improvements, are described in detail  
257 in the appendix – an essential manual for this report. The final indicators for the 2021 report  
258 are listed in panel 1.

259 Each indicator, wherever possible and appropriate, is disaggregated into very high, high,  
260 medium, and low Human Development Index (HDI) country groups, as defined by the United  
261 Nations Development Programme (UNDP), in the latest year for which data are available  
262 (2019).<sup>9</sup> This composite index captures three key dimensions: a long and healthy life (with life  
263 expectancy as a proxy), education (captured by the mean of years of schooling for adults),  
264 and standard of living (measured by per capita gross national income).<sup>9</sup> In line with the  
265 priorities of *The Lancet's* Diversity Board, gender disparities are also considered wherever  
266 relevant. However, a stark lack of gender-disaggregated data, means that few indicators are  
267 able to capture these differences quantitatively, and often do so using sex disaggregation as  
268 a proxy for gender (see panel 2).

269 The COVID-19 pandemic will alter the trends of many of the indicators reported – some of  
270 which can be identified in this report, and others which will become apparent in the coming  
271 years. COVID-19 has also altered population demographics and mortality rates, as well as the  
272 structure and size of the labour force. These changes are not reflected in the current  
273 indicators, presenting methodological challenges in the assessment of the health impacts of  
274 climate change. How this impacts the methods and assumptions of the *Lancet* Countdown's  
275 indicators will become clearer in future reports, as more data become available.

276 The global reach of the *Lancet* Countdown is expanding. Two regional offices – in South  
277 America (based at Universidad Peruana Cayetano Heredia, Lima, Peru) and in Asia (based at  
278 Tsinghua University, Beijing, China) – were established in 2020. These regional collaborators  
279 contributed indicators to the global 2021 report and are working on nationally- and  
280 regionally-relevant health and climate change research, accompanied by local  
281 communications and policy engagement. A third regional office, based at the University of  
282 the West Indies, was established in September 2021, aiming to build on the network and  
283 evidence base of health and climate change in Small Island Developing States (SIDS). The  
284 *Lancet* Countdown is also working in collaboration with the European Environment Agency,  
285 incorporating policy-relevant data from its indicators into the European Climate and Health  
286 observatory.



287 National and regional reports were published for Australia (in partnership with the *Medical*  
288 *Journal of Australia*), China, and SIDS.<sup>50-52</sup> For the third year now, the data underpinning each  
289 of the *Lancet* Countdown's indicators have been shared through an online data visualisation  
290 platform, where they can be explored at finer spatial and temporal scales.

291 The work of this collaboration is driven by the ongoing support from *The Lancet* and the  
292 Wellcome Trust, the *Lancet* Countdown's scientific advisory group and higher-level advisory  
293 board, and, importantly, the *Lancet* Countdown's authors and collaborators. The  
294 collaboration welcomes further offers of support from new experts and new institutions,  
295 willing to build on this analysis, as the *Lancet* Countdown monitors the world's response to  
296 the health effects of climate change across this decade.  
297

Working Group	Indicator	
Climate Change Impacts, Exposure, and Vulnerability	1.1: Health and Heat	1.1.1: Vulnerability to Extremes of Heat
		1.1.2: Exposure of Vulnerable Populations to Heatwaves
		1.1.3: Heat and Physical Activity
		1.1.4: Change in Labour Capacity
		1.1.5: Heat and Sentiment
		1.1.6: Heat-Related Mortality
	1.2: Health and Extreme Weather Events	1.2.1: Wildfires
		1.2.2: Drought
		1.2.3: Lethality of Extreme Weather Events
	1.3: Climate-Sensitive Infectious Diseases	1.3.1: Climate Suitability for Infectious Disease Transmission
		1.3.2: Vulnerability to Mosquito-Borne Diseases
	1.4: Food Security and Undernutrition	1.4.1: Terrestrial Food Security and Undernutrition
		1.4.2: Marine Food Security and Undernutrition
	1.5: Migration, Displacement and Rising Sea Levels	
	Adaptation, Planning, and Resilience for Health	2.1: Adaptation Planning and Assessment
2.1.2: National Assessments of Climate Change Impacts, Vulnerability, and Adaptation for Health		
2.1.3: City-Level Climate Change Risk Assessments		
2.2: Climate Information Services for Health		
2.3: Adaptation Delivery and Implementation		2.3.1: Detection, Preparedness and Response to Health Emergencies
		2.3.2: Air Conditioning: Benefits and Harms
		2.3.3: Urban Green Space
2.4: Health Adaptation-Related Global Funding and Financial Transactions		
Mitigation Actions and Health Co-Benefits	3.1: Energy System and Health	
	3.2: Clean Household Energy	
	3.3: Premature Mortality from Ambient Air Pollution by Sector	
	3.4: Sustainable and Healthy Transport	
	3.5: Food, Agriculture, and Health	3.5.1: Emissions from Agricultural Production and Consumption
		3.5.2: Diet and Health Co-Benefits
	3.6: Mitigation in the Healthcare Sector	
Economics and Finance	4.1: The Economic Impact of Climate Change and its Mitigation	4.1.1: Economic Losses due to Climate-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 Economics of the Transition to Zero-Carbon Economies	4.2.1: Coal and Clean Energy Investment
		4.2.2: Employment in Low-Carbon and High-Carbon Industries
		4.2.3: Funds Divested from Fossil Fuels
		4.2.4: Net Value of Fossil Fuel Subsidies and Carbon Prices
		4.2.5: Production- and Consumption-Based Attribution of CO <sub>2</sub> and PM <sub>2.5</sub> Emissions
Public and Political Engagement	5.1: Media Coverage of Health and Climate Change	
	5.2: Individual Engagement in Health and Climate Change	
	5.3: Coverage of Health and Climate Change in Scientific Journals	
	5.4: Government Engagement in Health and Climate Change	
	5.5: Corporate Sector Engagement in Health and Climate Change	

## 299 Section 1: Climate Change Impacts, Exposures, and Vulnerability

300 Climate change threatens human health and wellbeing through impacts on weather,  
301 ecosystems and human systems – increasing exposure to extreme events, changing the  
302 environmental suitability for infectious disease transmission, altering population movements,  
303 and undermining people’s livelihoods and mental health.<sup>53-57</sup> The resulting strains on health  
304 and social systems are felt disproportionately by the most disadvantaged in society, with  
305 climate change amplifying inequities.<sup>53,54</sup>

306 Section 1 of the 2021 report monitors the health impacts of climate change, with indicators  
307 tracking climate hazards, human exposure and vulnerabilities, and the resulting health  
308 outcomes. The first group of indicators addresses the direct implications of rising  
309 temperatures for health, exploring changes in the exposure and vulnerabilities of world  
310 populations to extreme heat, as well as its impacts on health and wellbeing (indicators 1.1.1–  
311 1.1.6, see panel 1). Each of these indicators takes gridded heat data as a starting point, and  
312 overlays them with relevant exposure and vulnerability data to reflect health outcomes. Two  
313 new indicators are introduced: one examines how heat is reducing the possibility to  
314 undertake outdoor exercise safely (indicator 1.1.3); the other approaches the challenge of  
315 assessing the influence of extreme heat on sentiment, using Twitter data to capture people’s  
316 online expressions (indicator 1.1.5).<sup>58</sup>

317 The second group of indicators in this section sheds light on climate-sensitive extreme events,  
318 tracking exposure to wildfire and wildfire risk (indicator 1.2.1), the incidence of droughts  
319 (indicator 1.2.2), and the lethality of extreme weather events (indicator 1.2.3). Capturing the  
320 influence of environmental changes on ecological niches for human pathogens, the section  
321 also models the changing suitability for the transmission of climate-sensitive infectious  
322 diseases, expanding the analysis from previous years to capture three new diseases of global  
323 public health relevance (Zika, chikungunya and *Vibrio cholerae*), and improving models to  
324 reflect the reproduction number for arbovirus transmission. With health outcomes of vector-  
325 borne disease transmission strongly influenced by socioeconomic factors and healthcare  
326 access, indicator 1.3.2 incorporates considerations of implemented adaptation measures to  
327 capture the changing vulnerability to arboviruses. This is followed by indicators of  
328 environmental pressure on terrestrial and marine food productivity, this year extending the  
329 analysis to assess the association between heat stress and severe food insecurity (indicators  
330 1.4.1 and 1.4.2). The final indicator in this section focuses on exposure to sea level rise and its  
331 implications for human mobility (indicator 1.5).

332

333 1.1 Health and Heat

334 Indicator 1.1.1: Vulnerability to the Extremes of Heat

335 *Headline finding: although vulnerability to heat in the low and medium Human Development*  
336 *Index country groups remains 27-38% lower than that of the very high Human Development*  
337 *Index group, it is increasing rapidly and is today 19% and 20% higher than in 1990, respectively*

338 Exposure to extreme heat poses an acute health hazard, with individuals over 65 years of  
339 age,<sup>59-61</sup> urban populations,<sup>60,61</sup> and those with underlying health conditions<sup>59,60</sup> particularly  
340 at risk. Heat disproportionately affects the marginalised or under-resourced that have limited  
341 access to cooling mechanisms and healthcare, amplifying health and social inequities.<sup>62-65</sup>

342 This indicator tracks vulnerability to extreme heat, through an index that combines the  
343 proportion of the population older than 65 years, the prevalence of relevant chronic diseases  
344 (respiratory disease, cardiovascular disease, and diabetes) in that group, and the proportion  
345 of the total population living in urban areas.

346 With aging populations, high prevalence of chronic diseases, and increasing urbanisation, the  
347 very high HDI countries exhibited the highest vulnerability to extremes of heat. Vulnerability  
348 is rising across all HDI groups, with countries of low and medium HDI experiencing the highest  
349 increases from 1990 levels (19% and 20%, respectively). The heat indicators that follow each  
350 present worsening trends, highlighting a great need to identify populations that are  
351 vulnerable to the health impacts of heat, at the national and at the local level. Further work  
352 will be done to capture other heat vulnerabilities within this indicator.

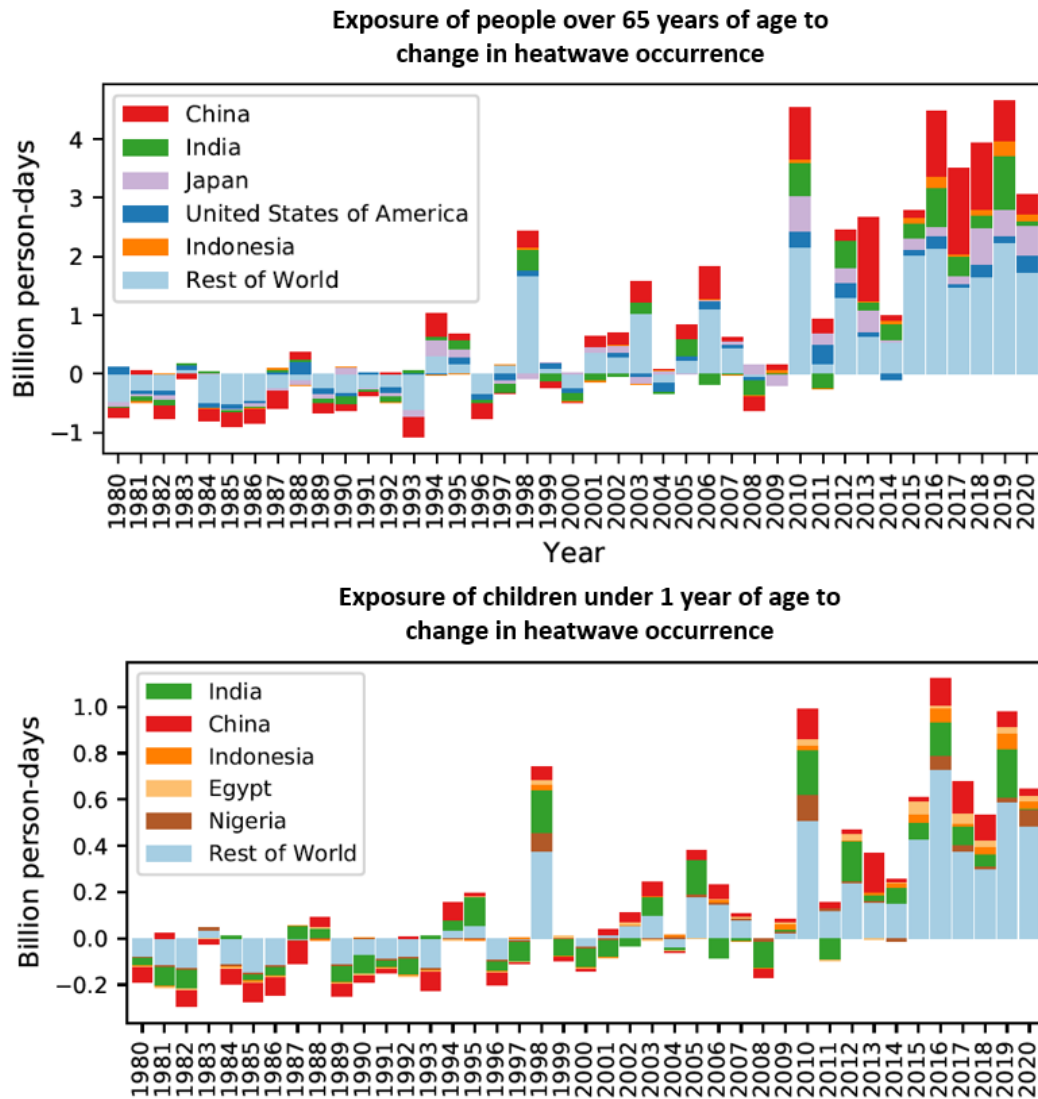
353

354 Indicator 1.1.2: Exposure of Vulnerable Populations to Heatwaves

355 *Headline finding: in 2020, compared with the 1986-2005 baseline, children under 1 and adults*  
356 *over 65 were affected by 626 million and 3.1 billion more days of heatwave exposure,*  
357 *respectively*

358 Young children and older persons are especially susceptible to the health risks of high  
359 temperatures and heatwaves.<sup>66</sup> This indicator reports the total number of days adults aged  
360 over 65 years and (for the first time) children from birth to 1 year, were exposed to life-  
361 threatening heatwave events. In an improvement from previous years, the definition of a  
362 heatwave now aligns with the World Meteorological Organization (WMO) and other scientific  
363 literature.<sup>67-69</sup> Additional details are given in the appendix (pp 5-7).

364 Results show a steady increase in the person-days of exposure for adults over 65 years, with  
 365 the last 10 years seeing an annual average of 2.9 billion additional events and 3.1 billion more  
 366 person-days of exposure (or an average of 4.1 days per person >65 years) in 2020, with  
 367 respect to the 1986-2005 baseline (Figure 1). For children under 1 year, there were an  
 368 estimated 626 million additional person-days of exposure (4.6 days per person <1 year)  
 369 affecting this vulnerable group in 2020, compared with baseline years.



370

371 *Figure 1. Change in person-days of heatwave exposure relative to the 1986-2005 baseline. A) in the*  
 372 *population aged over 65 years; B) in the population aged under 1 year of age. In each case, the*  
 373 *countries with the highest exposure averages over the past 5 years are highlighted.*

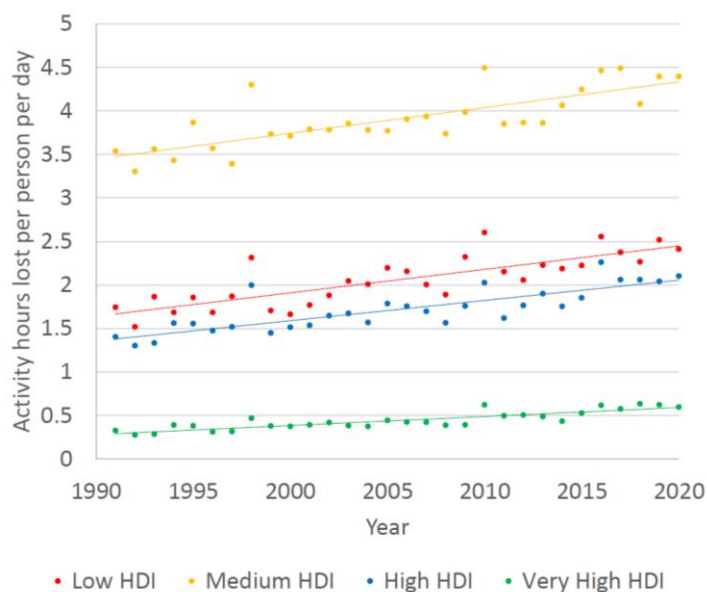
374

375 Indicator 1.1.3: Heat and Physical Activity

376 *Headline finding: the last four decades saw an increase in the number of daily hours in which*  
377 *temperatures were too high for safe outdoor exercise, with people in the medium Human*  
378 *Development Index country group experiencing an average loss of 4.4 hours of safe exercise*  
379 *per day in 2020*

380 Physical exercise provides mental health benefits, and reduces the risk of cardiovascular  
381 disease, diabetes, cancer, cognitive decline and all-cause mortality.<sup>70-74</sup> However, high  
382 temperatures can reduce the frequency and duration of physical activity, and the desire to  
383 engage in exercise,<sup>75-77</sup> and even low levels of physical activity can pose a risk to health under  
384 high temperatures.<sup>78</sup> This indicator estimates the hours of physical activity potentially lost per  
385 person due to ambient temperature, humidity, and radiant heat, by tracking the number of  
386 hours per day during which the wet bulb globe temperature (WBGT) exceeds 28°C, a  
387 threshold above which national sports medicine authorities of the USA, Australia and Japan  
388 recommend outdoor physical activities to be conducted with discretion.<sup>79,80</sup>

389 Due to rising temperatures, the loss in the number of hours available for safe physical activity  
390 per day increased in all four country HDI groups (Figure 2). The greatest rate occurred the  
391 medium HDI country group, with an average increase from 3.5 hours per person per day in  
392 1980 to 4.4 hours per person per day in 2020.



393  
394 *Figure 2. Average potential activity hours lost per person per day by 2019 Human Development Index*  
395 *country group, 1980-2020.*

396

397 Indicator 1.1.4: Change in Labour Capacity

398 *Headline finding: in 2020 the world lost 295 billion potential work hours due to extreme heat*  
399 *exposure, with 79% of all losses in countries of low Human Development Index level occurring*  
400 *in the agricultural sector*

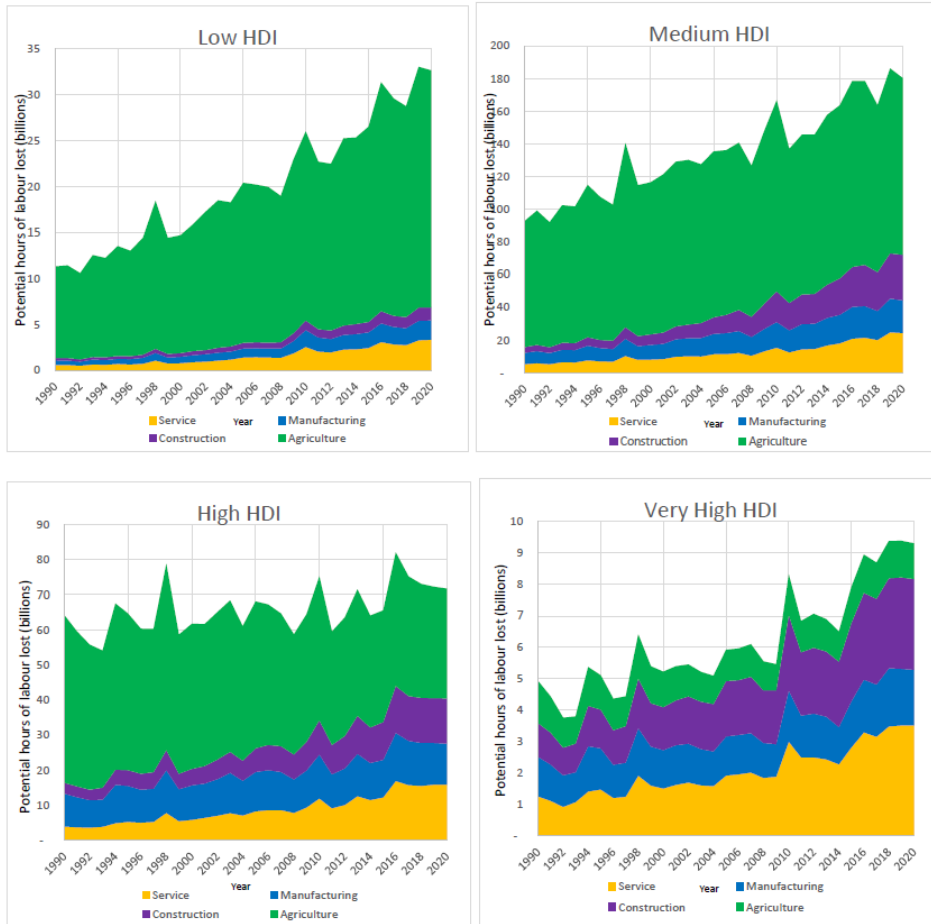
401

402 As well as through its direct impacts on health, high temperatures can also affect people's  
403 ability to work.<sup>81</sup> This indicator estimates the potential work hours lost as a result of heat  
404 exposure, by linking WBGT with the power (metabolic rate) typically expended by a worker  
405 within the construction, manufacturing, agriculture, and all other sectors.

406 In a rising trend, 295 billion potential work hours were lost across the globe in 2020 due to  
407 heat exposure – equivalent to 88 work hours per employed person. The three most populous  
408 countries with medium HDI levels, Pakistan, Bangladesh, and India experienced the greatest  
409 losses (2.5-3 times the world average, equivalent to 216-261 hours lost per employed person  
410 in 2020). In contrast, the three most populous countries with very high HDI levels (the USA,  
411 Japan, and Russia) accounted for the smallest numbers of labour hours lost. With lockdowns  
412 around the world, COVID-19 led to the loss of millions of hours of effective labour, particularly  
413 within service, construction, and manufacturing sectors.<sup>82</sup> The changes in labour structure  
414 induced by COVID-19 are not currently accounted for by this indicator.

415 Almost half of the total potential work hours lost globally occurred in the agricultural sector  
416 of low and medium HDI countries. Occupational heat exposure disproportionately affects  
417 labourers in the agricultural sector of low HDI countries, with 79% (25.8 out of 32.6 billion  
418 hours) of these countries' losses occurring in this sector, compared with only 12% (1.1 out of  
419 9.3 billion hours) in very high HDI countries. The impacts could therefore extend to food  
420 production. While heat affects labour capacity across all genders, differences in occupation  
421 may drive gender disparity. Men make up 80% of the total employment in the construction  
422 sector, and indigenous women and women in rural areas, who are highly dependent on local  
423 natural resources for their livelihood would be particularly affected by the impacts of climate  
424 change on labour capacity.<sup>83-85</sup>

425



426

427 *Figure 3. Heat-related potential hours of labour lost by sector and 2019 country Human Development*  
 428 *Index group, 1990-2000*

429

430 Indicator 1.1.5: Heat and Sentiment

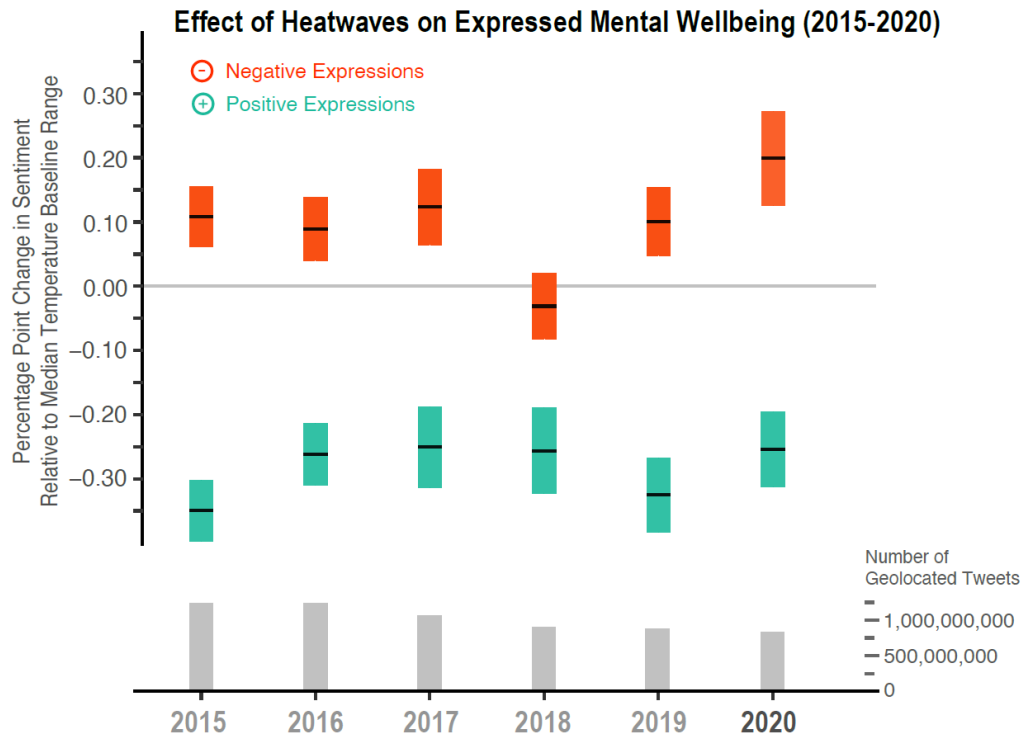
431 *Headline finding: Exposure to heatwave events significantly worsens expressed sentiment,*  
 432 *with a 155% increase in negative expressions during heatwaves in 2020 relative to the 2015-*  
 433 *2019 average*

434 Climate change-related increases in heat extremes pose diverse risks to mental health  
 435 globally, ranging from altered affective states to elevated mental health-related  
 436 hospitalisations and suicidality.<sup>55-57,86-89</sup> However, because the definition, acknowledgement,  
 437 stigmatisation, and treatment of mental health varies across different regions and cultures,<sup>58</sup>  
 438 capturing the mental health impacts of climate change still remains a challenge that the  
 439 Lancet Countdown will work to address in upcoming years.

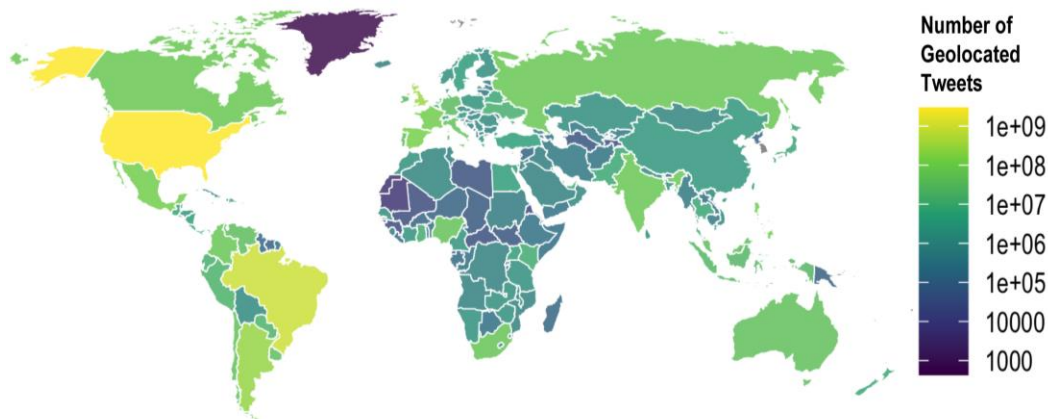


440 This indicator, new to the 2021 report, tracks the effect of heatwaves on the sentiment of  
441 expressions from Twitter users around the world, using previously published methods for  
442 estimating climate impacts.<sup>90-92</sup> Briefly, this indicator classifies the sentiment expressed in  
443 over six billion geolocated tweets collected between 2015 and 2020, using the Linguistic  
444 Inquiry Word Count (LIWC) sentiment classification tool.<sup>94</sup> It then deploys a multivariate  
445 ordinary least squares fixed effects model to estimate the annual effect of heatwaves on  
446 expressed sentiment. In this way, it compares sentiment expression during as-good-as-  
447 random heatwave days (as defined in indicator 1.1.2) with non-heatwave days in 40,000  
448 unique localities for nearly one million individuals per day. Potential temporal and  
449 geographical confounders were adjusted for by taking into account the month, calendar  
450 date, and location of each tweet in the analysis. Further detail is provided in the appendix (pp  
451 15-18). This indicator offers a glimpse into the influence of extremes of heat on sentiment of  
452 people around the world. However, since Twitter access and social media use are not evenly  
453 distributed, higher income countries are disproportionately represented.

454 Local heatwave exposure was found to significantly reduce positive expressions and increase  
455 negative expressions (Figure 4). In 2020, the percentage point increase in negative sentiment  
456 during a heatwave day rose to 0.20 (95% CI: 0.31-0.08), 155% higher than the 2015-2019  
457 average effect. Compared to the recent 2015-2019 baseline, the magnitude of this additional  
458 increase was substantive, equivalent to three quarters of the total rise in negative sentiment  
459 observed during a benchmark flooding event (see appendix, p 18). In parallel the reduction in  
460 positive sentiment observed during 2020 was 11.9% smaller than that observed during 2015-  
461 2019.



462



463

464 *Figure 4. Heatwaves and sentiment. Top: Annual effect of heatwave exposure on the sentiment of*  
 465 *online expressions from 2015-2020. Coloured intervals depict 95% CIs of the estimated average*  
 466 *change in positive (green) and negative (orange) sentiment expressions during days with heatwaves,*  
 467 *relative to the median daily maximum temperature baseline range for each location and year.*  
 468 *Sentiment was extracted from Twitter posts using a dictionary-based approach across multiple*  
 469 *languages. Grey bars depict the geolocated Tweet count by year of observation. Bottom: Country-*  
 470 *level count of geolocated tweets for 2015-2020.*

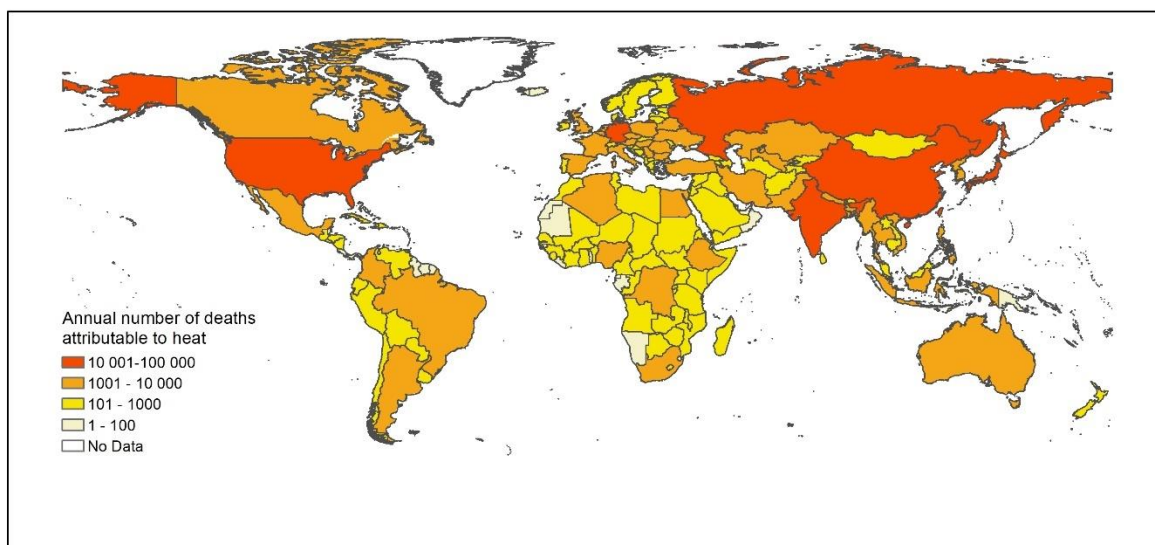
471

472 Indicator 1.1.6: Heat-Related Mortality

473 *Headline finding: heat-related mortality in the ≥65 population reached a record high of an*  
474 *estimated 345,000 deaths in 2019. Between 2018 and 2019, all WHO regions except for*  
475 *Europe saw an increase in heat-related deaths in this vulnerable age group*

476 Exposure to extreme heat increases risk of cardiovascular, cerebrovascular and respiratory  
477 mortality, as well as all-cause mortality.<sup>95</sup> As in the 2020 report, this indicator uses the  
478 exposure-response function and minimum mortality temperature defined by Honda and  
479 collaborators<sup>96</sup> to estimate deaths attributable to extremes of heat, with work ongoing to  
480 increase the accuracy of local estimates.<sup>96,97</sup> Using life expectancy data from the Global  
481 Burden of Disease 2019 Study,<sup>98</sup> years of life lost (YLL) were also calculated to better reflect  
482 health burdens.

483 Heat-related mortality for the 65-and-older population increased throughout the period of  
484 study, reaching a record high of almost 345,000 deaths in 2019 (Figure 5) - 80.6% higher than  
485 in the 2000-2005 average. Between 2018 and 2019, India and Brazil experienced the biggest  
486 absolute increase in heat-related mortality. Although heat related mortality fell from 2018 to  
487 2019 in the WHO European region (due to fewer attributable deaths in countries such as  
488 Germany, Russia, and the UK), this region still remains the most affected, with almost 108,000  
489 deaths attributable to heat exposure in 2019.



490

491 *Figure 5. Heat-related mortality among the 65-and-older population in 2019, by country*

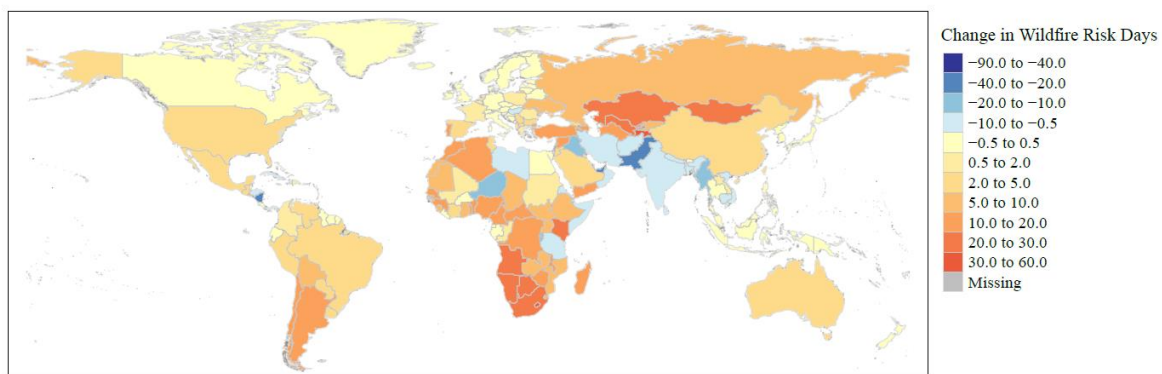
492 1.2 Health and Extreme Weather Events

493 Indicator 1.2.1: Wildfires

494 *Headline finding: nearly 60% of countries saw an increase in the number of days people were*  
495 *exposed to 'very high' or 'extremely high' fire danger in 2017-2020 compared to 2001-2004,*  
496 *and 72% experienced an increased human exposure to wildfires across the same period*

497 Hotter and drier conditions caused by climate change increase the risk of wildfires and the  
498 extent of their damage.<sup>99</sup> As in previous years, this indicator tracks wildfire exposure by  
499 joining satellite-observed active fire spots,<sup>100,101</sup> as well as human exposure to high and very  
500 high climatological wildfire danger by combining areas with a Fire Danger Index score of over  
501 5 and population data.<sup>102</sup> A full description of the methods can be found in the appendix (pp  
502 22-23). This indicator does not yet quantify exposure to wildfire smoke, which can affect much  
503 greater populations and have large health consequences. For example, it is estimated that  
504 smoke from the 2019/2020 Australian fires affected 80% of Australia's population and  
505 resulted in hundreds of deaths and thousands of hospital presentations.<sup>103</sup>

506 Globally, in 2017-2020, there was an additional annual average of 215,531 person-days of  
507 wildfire exposure compared to 2001-2004. Overall, 72.4% (134 out of 185) of countries  
508 experienced an increase in wildfire exposure over this time. But the increase was unequal:  
509 83% (27 out of 32) of low HDI countries experienced an increase in wildfire exposure  
510 compared with 62.5% (40 out of 64) of very high HDI countries. The largest increases were  
511 observed in The Democratic Republic of the Congo, India, and China. Over the same time  
512 period, the climatological danger of wildfire increased in 110 countries, with the largest  
513 growth occurring in Lebanon, Gambia, and Lesotho (Figure 6).



514 *Figure 6. Annual population-weighted mean changes in days of very high and extremely high fire*  
515 *danger from 2001-2004 to 2017-2020 for each country/territory. Large urban areas with population*  
516 *density  $\geq 400$  persons/km<sup>2</sup> are excluded in the calculations of population-weighted mean values.*  
517

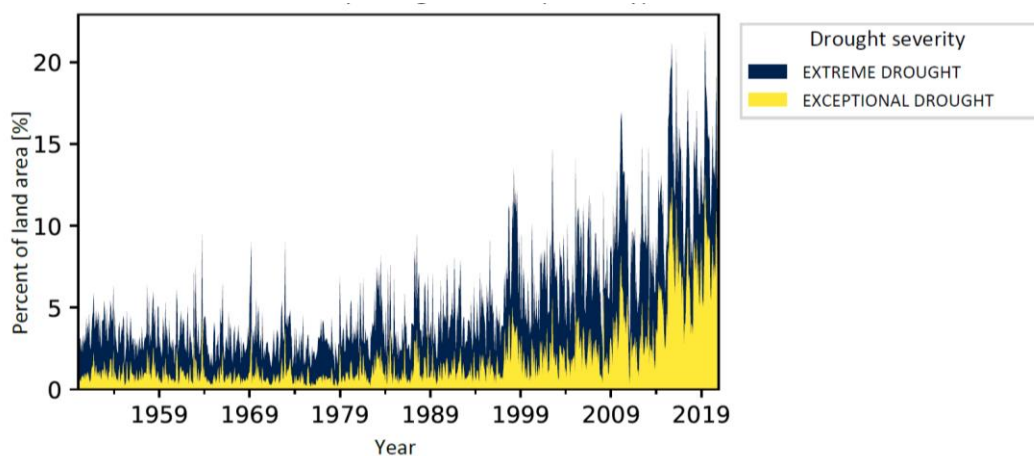
518 Indicator 1.2.2: Drought

519 *Headline finding: in 2020, up to of 19% of the global land surface was affected by extreme*  
520 *drought in any given month*

521 Climate change is driving an increase in the frequency, intensity, and duration of drought  
522 events. This is posing threats to water security, sanitation and food productivity, and  
523 increasing the risk of wildfires and exposure to pollutants.<sup>53,104</sup>

524 This indicator tracks the land area affected by extreme drought events using the Standardised  
525 Precipitation-Evapotranspiration Index (SPEI), capturing the changes in precipitation and the  
526 effect of temperature on evaporation and moisture loss.

527 The global land surface area affected by extreme drought conditions has consistently  
528 increased over the past 30 years. The percentage of the world's land surface experiencing  
529 extreme drought in a given month reached a maximum of 22% in the 2010-2019 decade, a  
530 value that had only ever reached 13% in 1950-1999 (Figure 7). Furthermore, the 5 years with  
531 the most area affected have all occurred since 2015, and the Horn of Africa, a region impacted  
532 by recurrent extreme droughts and food insecurity,<sup>105</sup> was one of the most affected areas in  
533 2020.



534  
535 *Figure 7. Percentage of land area affected by drought events per month*

### 536 Indicator 1.2.3: Lethality of Extreme Weather Events

537 *Headline finding: the last 30 years have seen statistically significant increases in the number*  
538 *of extreme weather events, yet only the low Human Development Index country group*  
539 *experienced a statistically significant increase in the number of people affected by these*  
540 *events*

541 This indicator tracks the number of occurrences of climate-sensitive weather-related  
542 disasters, and the number of people affected and killed per event. Data is taken from the  
543 Centre for Research on the Epidemiology of Disasters,<sup>106</sup> and presented as standardised  
544 anomalies across the 1990-2020 period. The number of extreme weather events has seen a  
545 consistent and statistically significant increase in all HDI country groups over the last 30 years,  
546 with the very high HDI country group experiencing the highest increase (see appendix pp 27-  
547 31). However, only the low HDI country group experienced a statistically significant increase  
548 in the number of people affected per disaster event, a situation that might reflect greater  
549 population shifts to high-risk areas or inequities in adaptive capacity and preparedness to  
550 respond to worsening climate change hazards.

551

### 552 1.3 Climate-Sensitive Infectious Diseases

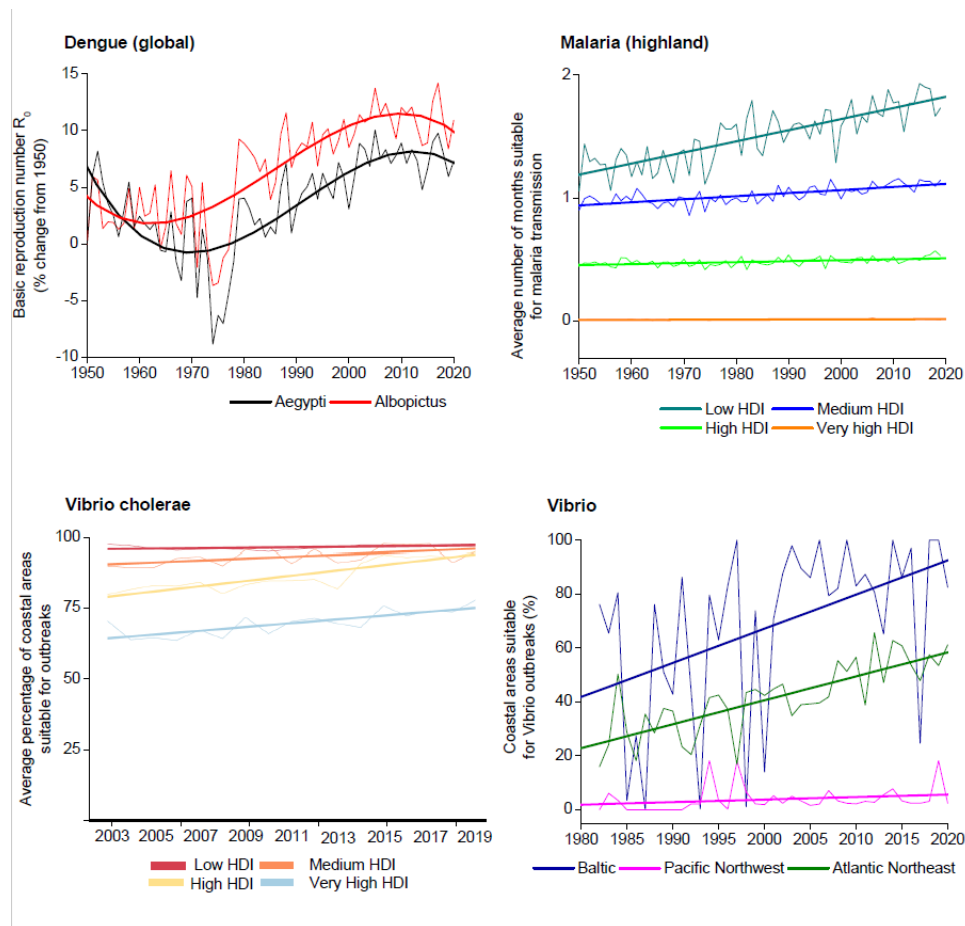
#### 553 Indicator 1.3.1: Climate Suitability for Infectious Disease Transmission

554 *Headline finding: in the last decade, the area of coastline suitable for Vibrio bacterial*  
555 *transmission has increased by 35% in the Baltic, 25% in the Atlantic Northeast, and 4% in the*  
556 *Pacific Northwest. The number of months suitable for malaria transmission increased by 39%*  
557 *between 1950-1959 and 2010-2019 in highland areas of the low Human Development Index*  
558 *country group*

559 Climate change is affecting the distribution of arthropod-, food-, and water-borne  
560 diseases.<sup>11,12</sup> Together with global mobility and urbanisation, climate change is a major driver  
561 of the increase in dengue cases,<sup>107</sup> which have doubled every decade since 1990.<sup>98</sup> Other  
562 important emerging or re-emerging arboviruses, transmitted by the same vectors, are likely  
563 similarly responsive to climate change.<sup>108</sup> This indicator tracks the environmental suitability  
564 for the transmission of arboviruses (dengue, chikungunya and Zika) using an improved model  
565 to capture the influence of temperature and rainfall on vectorial capacity and vector  
566 abundance, and overlaying it with human population density data to estimate the  $R_0$  (the  
567 expected number of secondary infections resulting from one infected person). The  $R_0$  for all  
568 arboviral diseases tracked has increased rapidly from the 1950s, and, in 2020, was 13% higher  
569 for the transmission by *A. aegypti* and 7% higher for *A. albopictus*, than in baseline years  
570 (1950-1954). The largest increases in epidemic potential for dengue, Zika and chikungunya  
571 were in countries with very high HDI, mainly driven by the ongoing expansion of *Aedes*  
572 mosquitoes.

573 The influence of the changing climate on the length of the transmission season for  
574 *Plasmodium falciparum* malaria is also tracked, using a threshold-based model that  
575 incorporates precipitation accumulation, average temperature, and relative humidity.<sup>36</sup>  
576 There were significant changes in the number of months suitable for transmission of malaria  
577 in highland areas ( $\geq 1,500$  m above sea level) between 2010-2019 compared to 1950-1959,  
578 with an increase of 39% in highlands within the low HDI country group, and an increase of  
579 15% in those within medium HDI group. The difference between high and medium HDI areas  
580 is even more marked at a sub-national level. This suggests that climate change might make  
581 malaria eradication efforts increasingly difficult in already disadvantaged areas.

582 Finally, this indicator monitors the environmental suitability for the transmission of *Vibrio*  
583 bacteria in coastal waters. *Vibrio* pathogens can cause gastroenteritis and life-threatening  
584 cholera, as well as severe wound infections and sepsis.<sup>37</sup> Driven by changes in sea surface  
585 temperature and sea surface salinity, the environmental area of coastline showing suitable  
586 conditions for the transmission of non-*cholerae* *Vibrio* species at any one point during the  
587 year increased by 56% (from 7.0% to 10.9% of the coastline) in northern latitudes (40-70° N)  
588 in 2020 compared to a 1980s baseline. From the 1980s to the most recent decade, the area  
589 of coastline suitable for these bacteria at any point during the year has risen from 47.5% to  
590 82.4% in the Baltic, 29.9 to 54.9% in the Atlantic Northeast, and 1.2 to 5.1% in the Pacific  
591 Northwest (Figure 8). Between 2003 and 2019, there was an increase in the proportion of  
592 coastline with suitable conditions for *Vibrio cholerae* across all HDI country groups, with the  
593 low HDI country group being having the highest suitability on average, at 98.6% of countries'  
594 coastlines in 2019. However, it was the high HDI country group that showed the biggest  
595 increase in suitable coastline area during this period, at a rate of almost an additional 1% of  
596 their coastline becoming suitable each year ( $r^2=0.78$ ,  $df=15$ ,  $p<0.01$ ).



597  
 598 *Figure 8. Change in climate suitability for infectious diseases. Solid lines represent the annual change.*  
 599 *Straight lines represent the trend since 1950 (for dengue and malaria), 1982 (for Vibrio bacteria), and*  
 600 *2003 (for Vibrio cholerae)*

601

602 **Indicator 1.3.2: Vulnerability to Mosquito-Borne Diseases**

603 *Headline finding: while vulnerabilities to arboviruses transmitted by A. albopictus and A.*  
 604 *aegypti have decreased across all countries since the year 2000, countries in the low Human*  
 605 *Development Index group remain on average the most vulnerable*

606 As demonstrated by indicator 1.3.1, climate change is making environmental conditions  
 607 increasingly favourable for the transmission of certain arboviruses. While interventions to  
 608 reduce vulnerabilities can partly counteract these threats, environmental pressures make this  
 609 increasingly challenging. This indicator combines the environmental suitability for the  
 610 transmission of dengue (as described in indicator 1.3.1) with key indicators of social  
 611 vulnerability to this disease: access to sanitation and water services, income level, and  
 612 healthcare quality.<sup>109,110</sup>



613 Due to improvements in sanitation, income and healthcare quality, vulnerability to mosquito-  
614 borne diseases is decreasing, even despite increases in their environmental suitability.  
615 However, improvements have been slower in the lower HDI country groups: while the  
616 vulnerability for transmission by *A. aegypti* has decreased by 34% in the low HDI country  
617 groups from 2000 to 2017, the reduction in the high HDI country groups has been of 61%. The  
618 vulnerability index remains inversely related to the level of HDI, with countries in the low HDI  
619 group having a vulnerability index over 360 times higher than countries in the very high HDI  
620 group in 2017 (appendix pp 45-46).

621

## 622 1.4 Food Security and Undernutrition

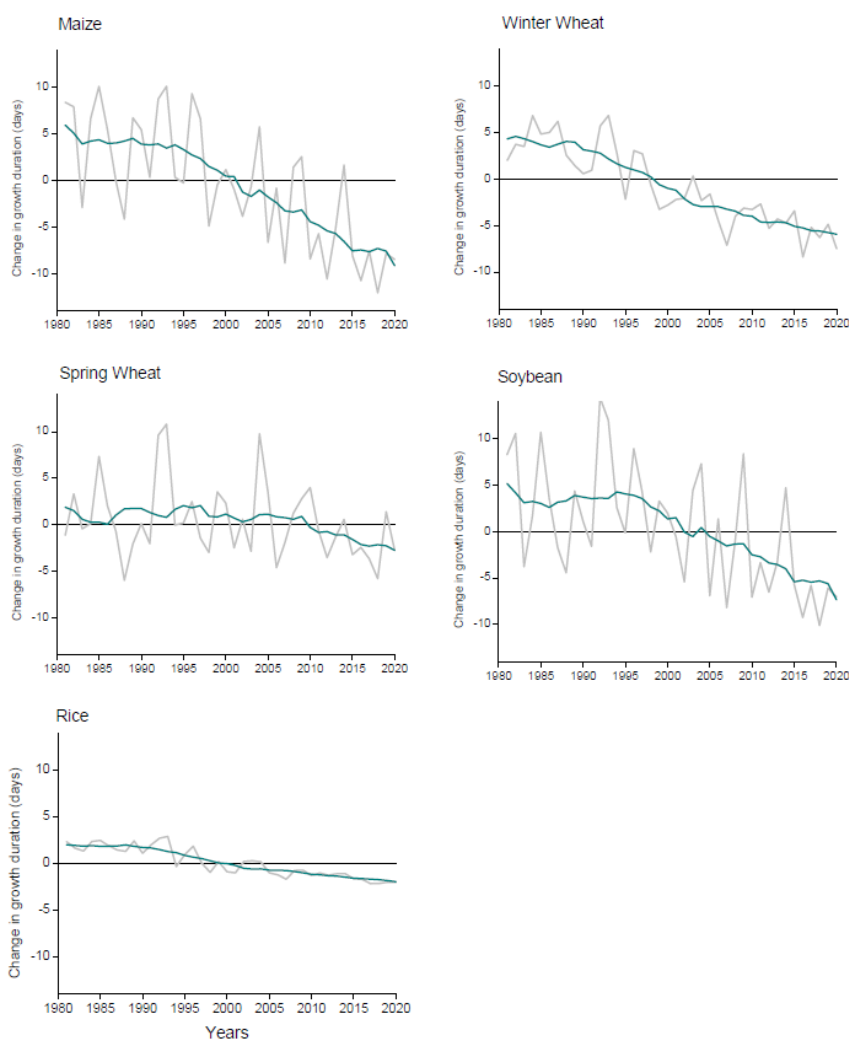
### 623 Indicator 1.4.1: Terrestrial Food Security and Undernutrition

624 *Headline finding: crop yield potential continues to follow a downward trend, with 6.0%*  
625 *reduction in the crop yield potential of maize; 3.0% for winter wheat; 5.4% for soybean, and*  
626 *1.8% for rice, relative to 1981-2010 levels*

627 Food insecurity is on the rise and affected 2 billion people in 2019.<sup>111</sup> Climate change  
628 threatens to exacerbate this crisis, which will disproportionately affect the most vulnerable  
629 and those already facing undernutrition. Due to socially defined gender roles and lower  
630 empowerment, food insecurity disproportionately affects rural women, reinforcing their  
631 disadvantaged position through reduced educational attainment, income and socioeconomic  
632 status.<sup>112</sup>

633 This indicator tracks the change in crop yield potential resulting from rising temperatures  
634 using the same methods as for the 2020 report. Rising temperatures shorten the time taken  
635 for crops to reach maturity, thereby leading to reduced seed yield potential.<sup>113</sup> A reduction in  
636 crop yield potential can be considered an indicator of future crop yield reductions due to  
637 higher growing season temperatures (and therefore a shortened growing season). Crop yield  
638 potential continues to follow a consistently downward trend, adding extra pressure to already  
639 strained food systems around the world. Reductions in time to maturity are observed in all  
640 staple crops tracked, amounting to 6.0% reduction for maize, 3.0% for winter wheat, 5.4% for  
641 soybean, and 1.8% for rice, relative to 1981-2010 levels (Figure 9).

642 Data from the Food Insecurity Experience Scale of the United Nations' Food and Agriculture  
643 Organization (FAO) was used to assess self-reported experience of 'severe food insecurity',  
644 defined as a situation in which an individual went at least one whole day without eating as a  
645 result of lack of resources in the prior 12 months, in 83 countries. A fixed-effects, time-varying  
646 regression showed that every 1°C of temperature increase was associated with 1.4% increase  
647 in the probability of 'severe food insecurity' (95% CI: 1.3 to 1.47; p-value: <0.001) in 2014 and  
648 1.64% (95% CI: 1.6 to 1.65; p-value: <0.001) in 2019, globally.



649  
 650 *Figure 9. Change in crop growth duration relative to the 1981–2010 baseline. The grey line*  
 651 *represents the annual global area-weighted change. The blue line represents the running mean over*  
 652 *11 years (5 years forward and 5 years backward).*

653

654 **Indicator 1.4.2: Marine Food Security**

655 *Headline finding: in 2018-2020, nearly 70% of countries showed increases in average sea*  
 656 *surface temperature in their territorial waters compared to 2003-2005, reflecting an*  
 657 *increasing threat to their marine food productivity and marine food security*

658 Per-capita fish consumption has increased steadily since the 1960s.<sup>114</sup> About 3.3 billion people  
 659 depend on marine food, with coastal populations in low and medium HDI countries, SIDS, and  
 660 indigenous people in particular, relying on it for their nutrition and livelihoods.<sup>114,115</sup> Climate  
 661 change is driving shifts in marine fish capacity and capture through increases in sea water

662 temperatures (and the associated reduced oxygenation), ocean acidification, and coral reef  
663 bleaching. As a result of this, coastal tropical countries are facing the biggest reductions in  
664 marine yield potential, while also being the most vulnerable to the associated socioeconomic  
665 impacts.<sup>115-117</sup>

666 This indicator expands its geographical scope for 2021, tracking sea surface temperature in  
667 territorial waters of 136 countries to reflect the changing threats of climate change on marine  
668 productivity, and therefore on marine food security. It is complemented by reporting the  
669 changes in marine capture based-per-capita fish consumption, using data collected by FAO  
670 (see appendix pp 50-70).

671 Average sea surface temperature increased in the territorial waters of 95 out of 136 studied  
672 countries (70%) in 2018-2020 compared to 2003-2005, posing threats to marine food  
673 productivity. Marine capture-based fish consumption was also reduced since the 1990s,  
674 coupled with an increase in the consumption of farm-based fish products of lower nutritional  
675 quality and omega-3 content.<sup>118</sup> These trends expose the threats of climate change poses on  
676 marine food security around the world.

677

## 678 [1.5 Migration, Displacement, and Rising Sea Levels](#)

679 *Headline finding: there are currently 569.6 million people settled below 5 metres above sea*  
680 *level, who could face risks from the direct and indirect hazards posed by the rising sea levels*

681 Between 1902 and 2015, the global mean sea level increased by 0.12–0.21 metres.<sup>15</sup> If  
682 unabated, sea level rise is projected to reach up to 2 metres above current levels within 80  
683 years, or even more in certain locations if considering ice sheet collapse, waves, and tidal  
684 contributions and other factors.<sup>119-122</sup> This indicator tracks the population settled in areas at  
685 risk of global mean sea level rise, based on coastal elevation and population distribution,<sup>123,124</sup>  
686 and national policies connecting climate change, human mobility, and health.

687 There are currently 146.6 million people living in coastal areas less than 1 metre above current  
688 sea levels, 27.3% of which reside in areas with low HDI levels. Further, the 569.6 million  
689 people settled below 5 metres above current sea levels could face rising risks of increased  
690 flooding, more intense storms, soil and water salinification,<sup>125</sup> and local emergence of  
691 infectious diseases,<sup>126</sup> as sea levels continue to rise; 26.6% of these people live in areas with  
692 low HDI levels. Where erosion occurs, dwellings and other infrastructure can be damaged.

693 Migration and mobility could be a response, which might be exacerbated through other  
694 impacts of climate change, like those described in other indicators in this section. This would  
695 affect livelihoods, access to essential services, and psychosocial wellbeing.<sup>127-129</sup> Up to  
696 December 31, 2020, 45 policies connecting climate change and migration were identified in  
697 37 countries (see appendix pp 72-77), all of which mentioned health or wellbeing, but

698 typically related to climate change impacts rather than to the potential health impacts of  
699 forced migration. Although they commonly accepted that mobility could be domestic and  
700 international, immobility was rarely acknowledged. National policies that recognise and  
701 respond to the health risks and health benefits of different mobility patterns will, in part,  
702 shape the overall health outcomes.<sup>130</sup>

703

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704 *Panel 2. Gender, Health and Climate Change*

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705 The health impacts of climate change are both underpinned and amplified by gender norms and gender  
706 inequities, with numerous examples cited throughout this report.<sup>131</sup> Gender also influences who sets the agenda  
707 and drives responses to climate change. Evidence shows that greater representation of women in parliament is  
708 associated with stronger climate change policies.<sup>132-134</sup> However, only 21% (41 out of 196) of the heads of  
709 delegation to the UNFCCC Conference of Parties in 2019 were women, and women headed just 29% of national  
710 delegations to the UNFCCC intersessional in June 2019. Moreover, of the 1,000 scholars listed by Reuters as the  
711 most influential on climate change, only 122 were women.<sup>135</sup>

712 There is an urgent need for gender-sensitive responses to the health dimensions of climate change. This must  
713 be underpinned by the collection and reporting of data that is sufficiently disaggregated, granular and  
714 intersectional to reveal local inequities – for example data disaggregated not only by gender but also by  
715 geography, age, ethnicity, class, and other markers of marginalisation and vulnerability.<sup>136-140</sup> However, in many  
716 cases a severe lack of standardised, gender-disaggregated data hampers these efforts,<sup>141-145</sup> and it is the very  
717 social structures that shape how gender is perceived and prioritised that undermine progress: cultural norms  
718 often translate into weak political and financial support, and limit the capacity of researchers to engage with  
719 gender inequities.<sup>143,146</sup> Only 6% of all scientific articles covering climate change and health in 2020 also  
720 considered gender (indicator 5.3), and despite a workstream established for this purpose, only 6 of the 44  
721 indicators in the 2021 report of the *Lancet* Countdown provide data by sex or gender.

722 Starting to reverse this, the United Nations Entity for Gender Equality and the Empowerment of Women (UN  
723 Women) is leading global efforts to increase the availability of information on gender through its “Making Every  
724 Woman and Girl Count” flagship programme. Through this programme, UN Women supports countries with the  
725 development of priority indicators to capture gender inequities – both through indicator selection and through  
726 data collection.<sup>147</sup> A model questionnaire has been developed for that purpose, and several countries, including  
727 Bangladesh, Mongolia and several Pacific Island countries, have either begun (or are currently preparing for)  
728 their rollout. With the purpose of helping countries understand the connections between the environment and  
729 gender equality, the programme also supports data reprocessing, and the integration of geospatial information  
730 with demographic and health surveys. The importance of this work is already materialising: preliminary analysis  
731 demonstrates the accentuation of gender inequities as a result of weather events, including drought episodes  
732 driving spikes in child marriage for girls in almost all Asian countries analysed.

733 Gender, as a social construction, affects everyone in society.<sup>9-13</sup> A gender-sensitive response to climate change  
734 would generate benefits for the whole of society. Ensuring gender is represented in national statistical strategies  
735 and regular data collection processes will expose the true dimensions of the challenge. This, along with more  
736 diverse leadership, will inform and drive a commensurate response.

---

## 737 Conclusion

738 In this fifth iteration of the *Lancet* Countdown indicators, section 1 of the 2021 report  
739 highlights a continuous increase in the impacts of climate change on all monitored aspects of  
740 human health, providing further evidence that climate change is having quantifiably and  
741 increasingly negative impacts on human health.

742 While its health impacts are felt across the world, climate change disproportionately affects  
743 disadvantaged populations, exacerbating their vulnerabilities. The stratification of indicators  
744 by HDI groups reveals the higher risks faced by low and medium HDI countries, particularly  
745 with regards to labour capacity and livelihoods, food security, and vector-borne disease  
746 transmission. Capturing the health impacts on disadvantaged groups, necessary for  
747 adaptation responses (described in the following section), represents a major challenge,  
748 exacerbated by the lack of disaggregated data.<sup>38</sup> With respect to gender, this is further  
749 explored in panel 2. Moreover, although this section considers the impact of heat on  
750 sentiment, the difficulties of capturing the mental health impacts of climate change still  
751 remain. Work will continue to focus on addressing this gap.

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

753 The past year affirmed the centrality of health and wellbeing to socioeconomic development,  
754 illustrating how health risks can compound and cascade across other sectors and nations, and  
755 dramatically highlighting the potential consequences of chronic, limited investments into  
756 climate-resilient and environmentally sustainable health systems.<sup>148,149</sup> The COVID-19  
757 pandemic also exposed stark differences in the capacity of health systems and the resilience  
758 of populations to health emergencies,<sup>4,5</sup> identifying the urgent need for health authorities to  
759 increase national and international coordination and preparedness. This should include  
760 integrated surveillance and monitoring of emerging health threats, developing and deploying  
761 early warning and response systems, and financially supporting low-resource nations and  
762 communities.<sup>150</sup> Importantly, for the public health response to be effective, it must address  
763 the needs of the most vulnerable – with the benefits of reduced inequities for the whole of  
764 society.

765 Building climate-resilient and environmentally sustainable health systems would not only  
766 help reduce the health impacts of climate change explored in the previous section, but also  
767 contribute to minimising the risk of future pandemics. This section reports eight indicators of  
768 adaptation, planning, and resilience, closely linked with the components of the WHO  
769 Operational Framework for Building Climate Resilient Health Systems: planning and  
770 assessment (indicators 2.1.1–2.1.3); information systems (indicator 2.2); delivery and  
771 implementation (indicators 2.3.1–2.3.3); and funding and spending (indicator 2.4). Each of  
772 these indicators provide insights into inequities. Data on health adaptation funding from  
773 global financing mechanisms – necessary to help low and medium HDI countries adapt to the  
774 worsening health impacts of climate change – have been reintroduced into this year’s report  
775 (indicator 2.4).

776 A remaining challenge within section 2 is the scarcity of clear metrics to monitor adaptation  
777 progress. While efforts were made to validate the indicators, self-reported data for  
778 adaptation plans, assessments, and services may be subject to reporting bias, particularly  
779 where COVID-19 resulted in redeployment of public health resources, and where surveys  
780 experienced a decline in participation.

781

### 782 2.1: Adaptation Planning and Assessment

#### 783 Indicator 2.1.1: National Adaptation Plans for Health

784 *Headline finding: in 2021, 37 countries out of 70 reported having national health and climate*  
785 *change strategies or plans in place*

786 Health systems are under pressure to respond to the acute and long-term threats from  
787 climate change, while simultaneously facing other critical public health risks. Comprehensive,

788 implemented health adaptation plans can not only improve health resilience to climate  
789 change, but also contribute to broader health systems strengthening, and catalyse effective  
790 collaboration with other health-determining sectors.

791 Data for indicators 2.1.1 and 2.1.2 are sourced from the 2021 WHO Health and Climate  
792 Change Global Survey,<sup>151</sup> that provides self-reported data on health sector response to  
793 climate change from 70 governments (described in the appendix pp 78-79). This indicator  
794 tracks the development of national health and climate change strategies and plans and  
795 barriers to implementation.

796 In the 2021 survey just over half of countries (37 out of 70) reported to have a national health  
797 and climate change strategy or plan in place, comparable to the proportion reported in 2018.  
798 Implementation remains a challenge for countries from all HDI levels with less than a quarter  
799 of these countries reaching high or very high levels of implementation. Insufficient financing  
800 was identified as a main barrier to reaching full implementation by 73% of all responding  
801 countries with one-fifth (8 out of 37) reporting to have no current sources of funding available  
802 for taking action on priorities set out in their strategies/plans. Other key barriers to  
803 implementation were insufficient human resource capacity (59%), COVID-19 related  
804 constraints (54%), and a lack of research and evidence (49%).

805 A desktop review of National Adaptation Plans (NAPs) submitted to the UNFCCC found that  
806 four of the 19 NAPs considered gender in health adaptation actions. However, although NAPs  
807 may mention the principles of gender equality, they often fail to demonstrate mainstreaming  
808 gender in a way that challenges gender norms, power, and structures. The recommendations  
809 in the *WHO Guidance for Mainstreaming Gender in Health and Climate Change Programmes*  
810 provide countries with guidance for achieving gender mainstreaming, including through  
811 national health and climate change plans.<sup>152,153</sup>

812

813 [Indicator 2.1.2: National Assessments of Climate Change Impacts, Vulnerability, and](#)  
814 [Adaptation for Health](#)

815 *Headline finding: 36 out of 70 countries in 2021 reported having conducted a climate change*  
816 *and health vulnerability and adaptation assessment*

817 Evidence-based policy development and planning require a comprehensive evaluation of the  
818 climate change-associated health risks faced by populations and health systems. This  
819 indicator monitors the number of countries who report having conducted a climate change  
820 and health vulnerability and adaptation assessment. These assessments are critical, because  
821 they not only allow countries to establish and re-evaluate health risks, but also consider the  
822 vulnerabilities contributing to health outcomes.

823 While 36 out of 70 countries disclosed they had conducted a climate change and health  
824 vulnerability and adaptation assessment, only about one-third of these reported that the  
825 findings influenced the allocation of human and financial resources. However, 56% (20 out of  
826 36) reported that the findings informed the development of their national health and climate  
827 change strategy/plan, suggesting evidence-based policy setting. Over two-thirds of countries  
828 specifically considered vulnerable population groups in their assessments, including children,  
829 women, the elderly, workers, rural/urban populations, those living in poverty and, to a lesser  
830 extent, indigenous groups, migrant or displaced populations. However, the  
831 comprehensiveness of these assessments varied widely.

832 As explored in section 1, health vulnerabilities to climate change are unevenly distributed and  
833 can exacerbate existing health inequities. As health vulnerability and adaptation assessments  
834 inform national health and climate change plans and programmes, it is essential that data  
835 gathered for these assessments are disaggregated according to social determinants of health.  
836 This will enable public health interventions to actively identify and support the most  
837 vulnerable communities, and proactively reduce sub-national health inequities relating to  
838 climate change.

839

#### 840 [Indicator 2.1.3: City-level Climate Change Risk Assessments](#)

841 *Headline finding: in 2020, 546 of 670 cities reported having completed or being in the process*  
842 *of undertaking climate change risk assessments. Heat-related illness was the most common*  
843 *climate-related health concern, identified by 169 out of 308 cities*

844 The COVID-19 pandemic revealed the persistent health inequities and vulnerabilities of cities  
845 and urban sub-populations.<sup>154,155</sup> Home to over half the world's population (a proportion  
846 projected to increase to 70% by 2050), cities play a crucial role in leading local health  
847 adaptation to climate change.<sup>156</sup> Using data from the CDP's 2020 survey of global cities, this  
848 indicator captures the number of cities that report having completed a climate change risk or  
849 vulnerability assessment; and the climate-related health impacts and vulnerabilities that  
850 cities identified.

851 In 2020, 546 of 670 cities (81%) reported they had completed or were currently undertaking  
852 climate change risk assessments. For those cities who responded in both 2019 and 2020, an  
853 additional 45 (9%) reported having completed a climate change risk assessment in 2020.  
854 Importantly, however, 94% of responding cities belonged to countries with high or very high  
855 HDI, meaning that cities and countries of low and medium levels of HDI were  
856 underrepresented in the data. 308 cities identified that climate change poses a threat to one  
857 or more health areas. The most prominent perceived health concern pertained to heat-  
858 related illness, with 169 (55%) cities reporting this concern. The most vulnerable groups  
859 identified were the elderly (reported by 213 [69%] cities), children and youth (180 [58%]), and



860 low-income households (170 [55%]), while 94 cities (31%) identified women as vulnerable to  
861 climate-related health impacts.

862

## 863 Indicator 2.2: Climate Information Services for Health

864 *Headline finding: in 2020, national meteorological and hydrological services of 86 countries*  
865 *reported providing climate information to the health sector; only five out of the 86 indicated*  
866 *these climate services guide health sector policy and investment plans*

867 Health adaptation to climate change relies on accurate meteorological data and forecasts for  
868 the integrated surveillance and monitoring of emerging health threats, the development and  
869 deployment of early warning and response systems, and the implementation of adaptation  
870 interventions. This indicator monitors the extent to which national health and meteorological  
871 services provide climate information services to the health sector, using data reported to the  
872 World Meteorological Organization (WMO).

873 In 2020, 86 national meteorological and hydrological services reported providing climate  
874 services to the health sector. In very high HDI countries, 50% of those providing services to  
875 the health sector reported that they were co-designing or providing tailored climate  
876 information services or products, in contrast with 36% of low HDI countries.

877

## 878 2.3: Adaptation Delivery and Implementation

### 879 Indicator 2.3.1: Detection, Preparedness and Response to Health Emergencies

880 *Headline finding: 124 out of 166 countries reported medium-to-high implementation of a*  
881 *national health emergency framework in 2020; an increase of 14% compared to 2019*

882 The International Health Regulations (IHR) are legally-binding instruments defining countries'  
883 rights and obligations in handling public health events and emergencies that could cross  
884 national borders.<sup>11</sup> Under the IHR, State Parties are required to provide self-evaluations of  
885 emergency response preparedness against 13 core capacities published in the State Party  
886 Annual Report (SPAR). Limitations of the IHR in ensuring an effective response to the COVID-  
887 19 pandemic were identified and continue to be evaluated, and reviews currently underway  
888 are discussed in the appendix (pp 89-90). Notwithstanding, countries with higher SPAR scores  
889 had lower incidence and mortality per 100,000 population within 30 days from first COVID-  
890 19 diagnosis, stressing the relevance of the IHR.<sup>157</sup>

891 This indicator tracks the degree to which countries have implemented a national health  
892 emergency framework under IHR core capacity eight, which includes emergency

893 preparedness and response planning, emergency management structures, and mobilisation  
894 of resource. This assesses whether countries are prepared and operationally ready to respond  
895 to all public health events, including climate-related emergencies. In 2020, 166 (85%) of State  
896 Parties to the IHR completed the relevant section of the SPAR relating to capacity eight, and  
897 75% of countries reported medium-to-high degrees of implementation of a national health  
898 emergency framework – a 14% increase compared to 2019. Importantly, however, only 37%  
899 of countries reported high implementation, indicated by a capacity score of 75% or greater.  
900 The level of implementation varied greatly by HDI, with 89% of very high HDI countries  
901 reporting medium-to-high implementation, compared to 55% of low HDI countries.

902 In preparing for future health crises, it is essential that global institutions improve emergency  
903 response preparedness, using lessons learned during the pandemic. The ongoing review of  
904 the IHR is an important step in this direction to ensure that the IHR is effective when faced  
905 with health emergencies associated with climate change.

906

#### 907 [Indicator 2.3.2: Air Conditioning: Benefits and Harms](#)

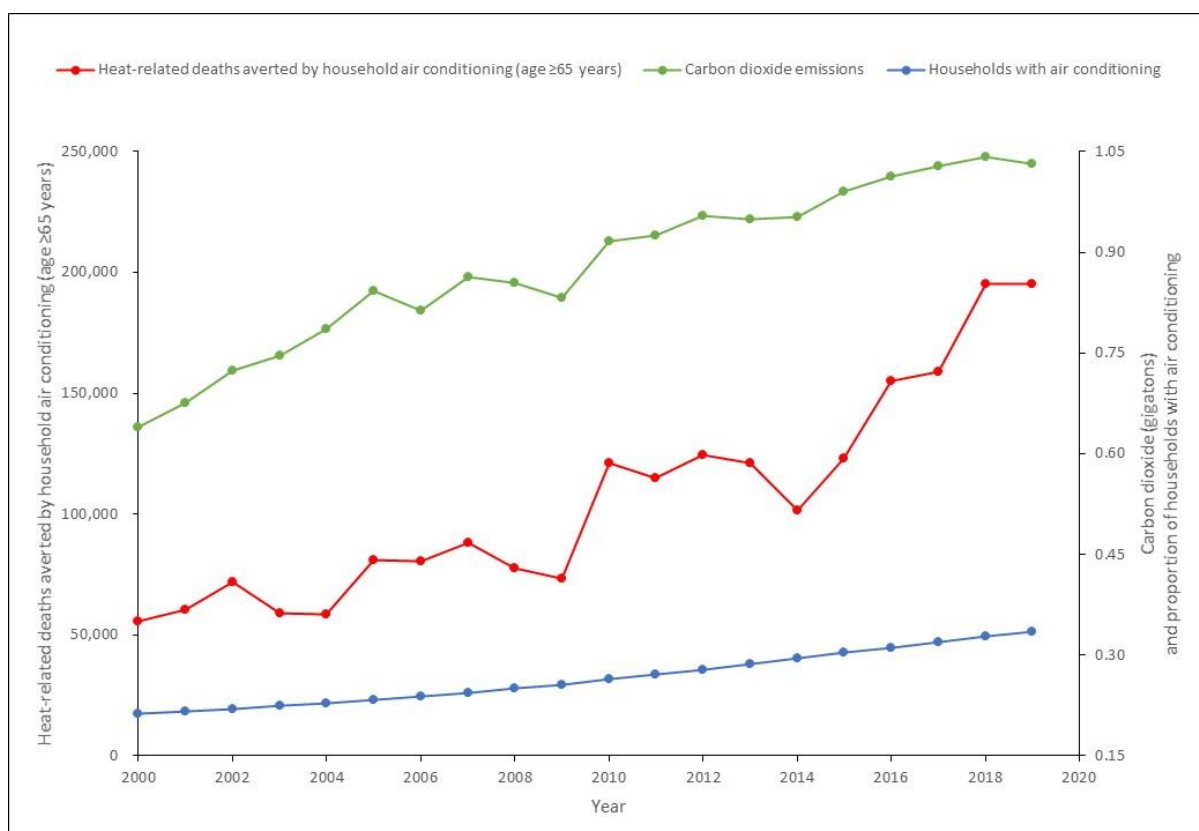
908 *Headline finding: use of air conditioning, a widespread technology for indoor cooling in some*  
909 *regions of the world, averted an estimated 195,000 heat-related deaths among people ≥65*  
910 *years of age in 2019. However, it also contributed to greenhouse gas emissions, air pollution,*  
911 *peak electricity demand, and urban heat islands*

912 Indoor cooling represents an effective strategy for preventing heat-related mortality.<sup>158</sup> In  
913 this year's report, this indicator combines the prevented fraction<sup>159</sup> and heat-related death  
914 estimates from indicator 1.1.6, to track the number of heat-related deaths averted by air  
915 conditioning in the 65-and-older population (methods described in appendix pp 91-101).

916 Applying country- and region-specific prevented fractions to the data from indicator 1.1.6  
917 revealed that, in the absence of air conditioning, an estimated 195,400 heat-related deaths  
918 would have occurred globally in the 65-and-older population, in addition to the 345,000 heat-  
919 related deaths that are estimated to have occurred in 2019. In this age group, air conditioning  
920 averted an estimated 69,500 deaths in China (where 72,000 deaths attributable to heat  
921 exposure are estimated to have occurred; 65% of households had air conditioning), 47,800 in  
922 the USA (where 20,500 deaths are estimated to have occurred; 92% of households had air  
923 conditioning), 30,400 in Japan (where 12,400 deaths are estimated to have occurred; 93% of  
924 households had air conditioning), but only 2,400 in India (where 46,600 deaths are estimated  
925 to have occurred; 6% of households had air conditioning). These figures demonstrate the  
926 power of indoor cooling to prevent mortality, as well as the inequities in access to indoor  
927 cooling across countries.

928 Current air conditioning technology is unsustainable, and leads to adverse health outcomes  
 929 from increased air pollution, urban heat, and greenhouse gas emissions (see panel 3).<sup>160</sup> In  
 930 2019, the number of premature deaths from PM<sub>2.5</sub> exposure attributable to fossil-fuel  
 931 powered electricity used for air conditioning is estimated (using the same approach as in  
 932 indicator 3.3) to have been 21,000 globally. Between 2000 and 2019, the global proportion of  
 933 households with air conditioning rose 57% and CO<sub>2</sub> emissions from air conditioning use rose  
 934 61% (Figure 10).

935 Sustainable indoor cooling approaches are urgently needed, including strong, enforced codes  
 936 that mandate energy-efficient buildings,<sup>160</sup> a return to traditional tropical and sub-tropical  
 937 building designs in these regions and elsewhere,<sup>160</sup> use of fans in climate zones where they  
 938 provide effective cooling,<sup>161</sup> stringent minimum energy performance standards for air  
 939 conditioners,<sup>160</sup> cool roofs (see panel 3), and increased urban green space (Indicator 2.2.3).



940  
 941 *Figure 10. Global heat-related deaths averted by household air conditioning in the 65-and-older*  
 942 *population (red line), proportion of households with air conditioning (blue line), and carbon dioxide*  
 943 *emissions from air conditioning (green line), 2000-2019*

944

---

945 *Panel 3. The Urban Heat Island and the Impact of Cool Roofs*

---

946 As a result of human activity and the urban fabric, cities tend to be hotter than surrounding rural or suburban  
947 areas, a phenomenon known as the urban heat island (UHI) effect.

948 With increasing temperatures and urbanisation, the demand for cooling mechanisms is on the rise. While  
949 offering protection from life-threatening extreme heat exposure, the use of air conditioning contributes to  
950 climate change through its energy consumption and its leakage of hydrofluorocarbons that act as powerful  
951 greenhouse gases; contributes to intensifying the urban heat island through its waste heat emissions; and  
952 contributes to increasing peak electricity demand and urban air pollution (see indicator 2.3.2).<sup>162-164</sup>  
953 Furthermore, its high costs are amplifying the energy poverty gap.<sup>164,165</sup> The development of sustainable and  
954 affordable cooling alternatives is therefore crucial to protect the health of urban populations, while keeping the  
955 world on track to meeting the Paris Agreement goals.

956 This case study explores the use of 'cool' (reflective) roofs as sustainable cooling mechanisms, ranging from  
957 specially designed roofing materials, to affordable alternatives such as light-coloured paint. Focusing on  
958 Birmingham and the West Midlands region of the UK, urban air temperatures were simulated at 1 km x 1 km  
959 horizontal resolution by combining detailed land use data with a building energy parameterisation scheme in a  
960 regional climate model (WRF).<sup>166</sup> To estimate the impact of the UHI, temperatures are compared with those  
961 from a simulated counterfactual scenario, with urban surfaces replaced by rural types.

962 The UHI intensity was found to be around 3°C during summer, and up to 9°C during heatwaves in this region.  
963 The resulting overheating was estimated to contribute to approximately 40% of mortality associated with UHI  
964 over a summer season, and up to 50% during heatwaves.<sup>167-169</sup> Spatial analysis further revealed that the most  
965 underserved population groups were particularly exposed to urban heat.<sup>169</sup>

966 Simulations introducing reflective surfaces found that cool roofs could reduce maximum daytime air  
967 temperatures by 0.5°C on average, and up to 3°C during heatwaves. This has the potential of reducing heat-  
968 related mortality due to the UHI by 18% over a summer season, and 23% during a heatwave.<sup>170</sup> Considering this  
969 assessment was done in a country with relatively cool climate, the impact of cool roofs might be even greater if  
970 applied in warmer parts of the world. Moreover, while the UHI can reduce cold-related mortality by around 15%  
971 in the winter, cool roofs were shown to have negligible effects in winter months, suggesting they would not  
972 contribute to increased mortality in the winter.<sup>171,172</sup>

973 Because roofs may affect other factors such as precipitation, their use must be assessed on a case-by-case  
974 basis.<sup>173</sup> However, with a net annual benefit on temperature-related mortality, adoption of cool roofs in the face  
975 of a warming world could provide a low-carbon cooling alternative, with health benefits to the whole urban  
976 population.

---

977 Indicator 2.3.3: Urban Green Space

978 *Headline finding: globally in 2020, 27% of urban centres were classified as being moderately*  
979 *green or above, an increase from 14% in 2010. This level of greenness varied between 17% of*  
980 *urban centres in the low Human Development Index country group and 39% of urban centres*  
981 *in the very high country group*

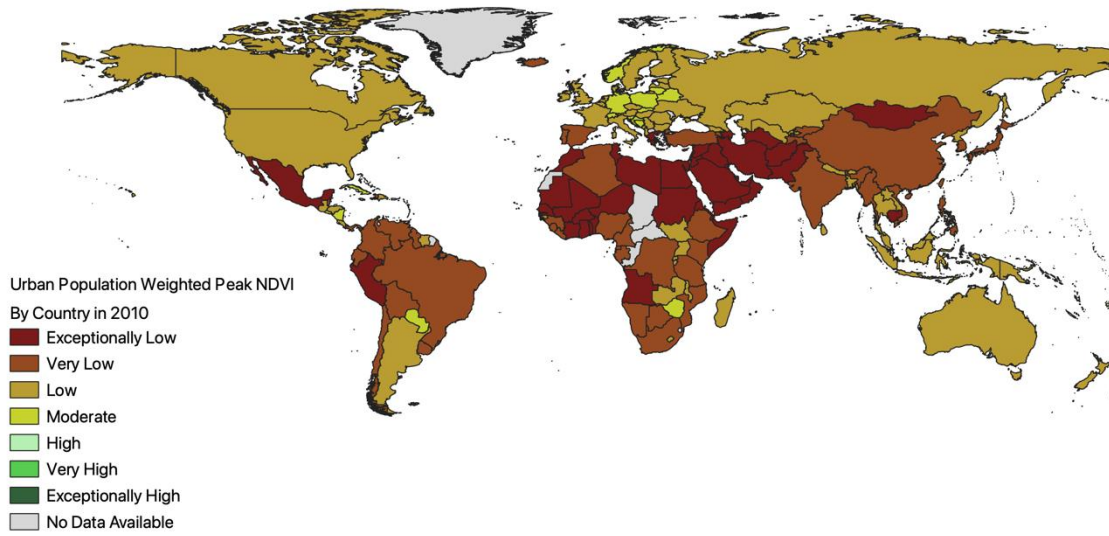
982 There is increasing evidence that access to urban green spaces provides benefits to human  
983 physical and mental health. This includes reducing exposures to air pollution, relieving stress,  
984 and increasing social interaction and physical activity, with overall improved general health  
985 outcomes and lower mortality risk.<sup>174,175</sup> Green space also helps climate change mitigation  
986 and adaptation by sequestering carbon and delivering local cooling benefits. However, urban  
987 green spaces must be carefully designed and managed to conserve biodiversity, and ensure  
988 they do not provide habitats and breeding sites for vectors of human diseases, or contribute  
989 to increased gender and other social inequities.<sup>176-182</sup>

990 Indicator 2.3.3 provides an estimate of the magnitude of green vegetation in urban centres,  
991 using the satellite-based Normalized Difference Vegetation Index (NDVI), with higher values  
992 indicating higher greenness levels. In the 2021 report, the sample size was increased to  
993 include 1,029 urban centres across 139 countries. These encompass all urban centres of over  
994 500,000 inhabitants, as well as the most populated one in those countries that had no urban  
995 centre above this threshold. Full details are in the appendix (pp 102-106).

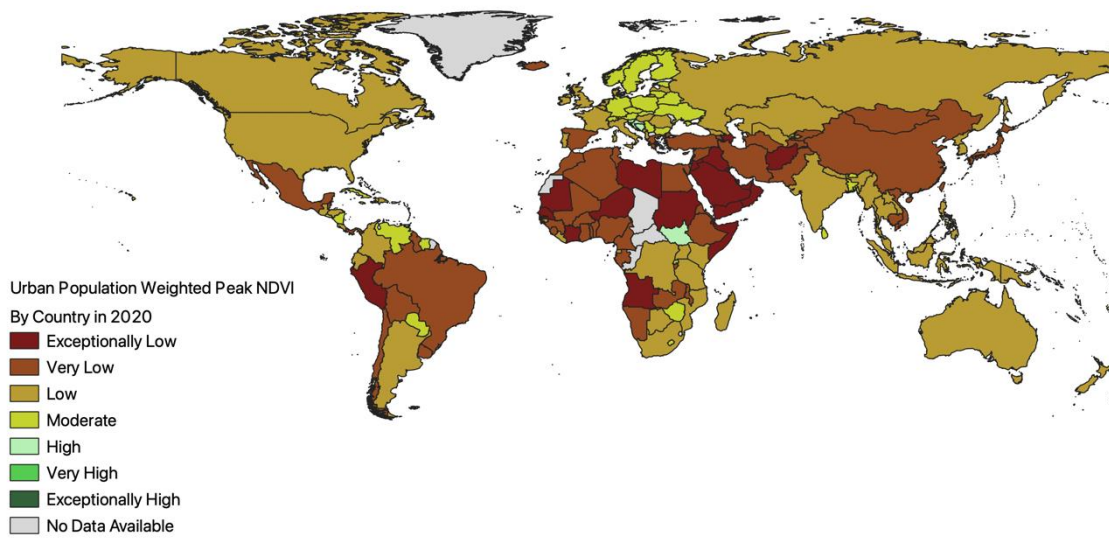
996 Averaged across all urban centres sampled, population-weighted peak NDVI increased 23%  
997 from 2010 to 2020 (mean NDVI 0.26 to 0.32), with 27% of urban centres being classified as  
998 moderately green or above (an NDVI  $\geq 0.40$ ) in 2020 (Figure 11). The level of greenness varies  
999 greatly by HDI level. In the very high HDI country group, 39% of urban centres have at least  
1000 moderate levels of greenness (mean NDVI 0.34) in 2020, compared to 17% (mean NDVI 0.27),  
1001 36% (mean NDVI 0.33), and 15% (mean NDVI 0.30) in low, medium and high HDI country  
1002 groups, respectively. This highlights the inequities in the availability of green spaces across  
1003 urban centres.

1004 With their potential to simultaneously improve health outcomes, reduce health inequities,  
1005 and facilitate climate mitigation and adaptation, urban green space design must involve  
1006 interdisciplinary experts to ensure the health and environmental benefits are maximised.<sup>183</sup>  
1007 More broadly, with health at the centre of planning in areas such as housing, transport,  
1008 energy, and water and sanitation, urban centres can be places that are safe, comfortable, and  
1009 enjoyed by everyone.<sup>184</sup>

A



B



1010 *Figure 11. Average urban population-weighted peak Normalized Difference Vegetation Index (NDVI)*  
1011 *in urban centres of >500,000 inhabitants by country, for 2010 (A) and 2020 (B). For countries without*  
1012 *an urban centre of >500,000 inhabitants, the most populated urban centre was used in the analysis.*

1013

## 1014 Indicator 2.4: Health Adaptation-Related Global Funding and Financial Transactions

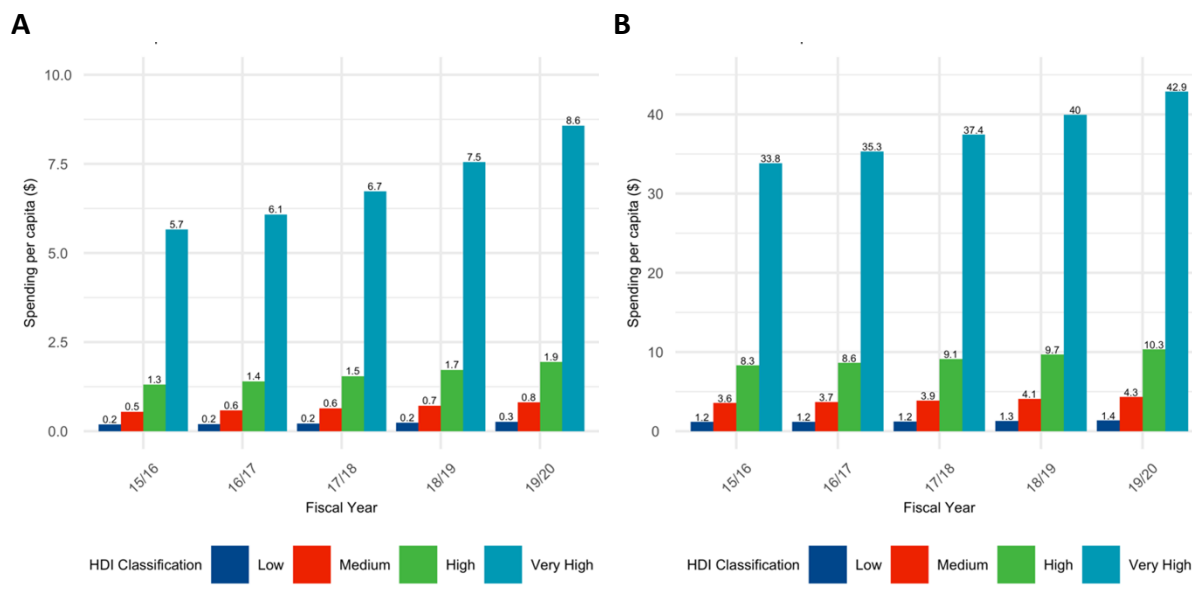
1015 *Headline finding: globally, adaptation funding directed at health systems represents a small*  
1016 *portion of total climate change adaptation funding (0.3%), and only 5.6% of all transactions*  
1017 *with adaptation potential were relevant to health in 2019/20*

1018 This indicator monitors two elements of spending that could provide adaptation for health:  
1019 1) the global funding approved for health-related adaptation projects through multilateral  
1020 funds, and 2) global financial transactions with the potential to deliver adaptation in the  
1021 health and care sector, as well as in other sectors that are relevant to the determinants of  
1022 health. The former draws on data from the Climate Funds Update Data Dashboard, while the  
1023 latter uses the Adaptation and Resilience to Climate Change (A&RCC) dataset produced by  
1024 kMatrix.<sup>185,186</sup> These complementary elements provide an evaluation of proactive adaptation  
1025 funding potentially related to health, and of the global size of all economic transaction that  
1026 can offer climate change adaptation potential for health.

1027 Between 2018 and 2020, \$5.1 billion of multilateral climate change adaptation funding was  
1028 approved globally. Only \$711 million (13.9%) was related to health. This consisted of \$14.0  
1029 million (0.3%) of approved funding directed specifically at health systems, and \$697 million  
1030 (13.6%) with potential secondary benefits for health identified.

1031 Meanwhile, the value of all financial transactions with the potential to deliver adaptation for  
1032 health (adaptation-relevant transactions within the dataset-defined “health and healthcare”  
1033 sectors) increased by 14.0% in 2019/20 compared with 2018/19, reaching 5.6% of total  
1034 adaptation spending. Spending in other sectors that could be relevant to health (including in  
1035 the waste and water management, built environment, or agricultural sectors, for example) is  
1036 estimated to have increased by 7.6%, representing 28.6% of total transactions. Grouped by  
1037 HDI, \$234 million (1%) of spending was within low HDI countries (Figure 12). This compares  
1038 to \$1.8 billion (8%) in medium HDI countries, \$5.7 billion (27%) in high HDI countries, and  
1039 \$13.3 billion (64%) in very high HDI countries. For spending in health-relevant economic  
1040 sectors, a similar narrative emerges: \$1.2 billion (1%) of spending occurred in low HDI  
1041 countries, compared with 62% in countries with very high HDI. As the data covers financial  
1042 years, the data up to 31<sup>st</sup> of March 2020 presented in this indicator are unlikely to reflect the  
1043 anticipated economic impact of the COVID-19 pandemic on adaptation spending.

1044 These findings highlight a growing global market for health-relevant adaptation transactions,  
1045 but this has yet to translate into sufficient targeted health adaptation funding. As world  
1046 economies recover from COVID-19, sufficient resources must be redirected towards health  
1047 adaptation to build resilience to the increasing health threats of climate change.



1049

1050 *Figure 12. Per capita potential adaptation transactions in the health and health care sector (A) and*  
 1051 *health-relevant sectors (B) for financial years 2015/16 to 2019/20, by 2019 Human Development*  
 1052 *Index country group*

1053

## 1054 Conclusion

1055 The indicators in this section paint a complex landscape of adaptation, planning, and  
 1056 resilience for health in the past 12 months, where the small global improvements to  
 1057 adaptation planning and assessment (indicators 2.1.1, 2.1.2, and 2.1.3) and intersectoral  
 1058 collaboration (indicator 2.2) are overshadowed by slow progress in implementation  
 1059 (indicators 2.3.2, 2.3.3) and insufficient investment (indicator 2.4). A key theme across all the  
 1060 indicators is inequities, and while these indicators largely track inequities between countries,  
 1061 within-country inequities are significant for moving towards resilience and sustainability.

1062 While the world economy and health systems are on the road to recovery from a significant  
 1063 acute global health crisis, climate change poses a much greater health threat in the coming  
 1064 decades. It is crucial that organisations and institutions capitalise on the insights generated  
 1065 from the pandemic to improve adaptability and resilience. Research is needed to identify  
 1066 current and future vulnerabilities; project risks from climate change at scales relevant for  
 1067 decision-making under different climate and development scenarios; and identify and  
 1068 evaluate adaptation options to prepare for and protect health in a changing climate.  
 1069 Adaptation plans should be reviewed and updated to consider medium and long-term risks  
 1070 of climate change for health, and to further build resilience. Greater collaboration and



1071 coordination are necessary across public and private sectors and global institutions, along  
1072 with increasing investments in adaptation.  
1073

## 1074 Section 3: Mitigation Actions and Health Co-Benefits

1075 Global atmospheric CO<sub>2</sub> levels passed 415 ppm in January 2021 – continuing an unbroken  
1076 upward trend – and for the first time, the concentrations for much of 2020 are expected to  
1077 be 50% higher than the 1750-1800 average.<sup>42</sup> Total emissions of all greenhouse gases in 2019  
1078 were 59.1 GtCO<sub>2</sub>e (±5.9) including those generated by land-use changes. To limit warming to  
1079 1.5°C, annual global emissions must be reduced to 25 GtCO<sub>2</sub>e by 2030.<sup>16</sup>

1080 COVID-19 and associated lockdowns across the globe have had profound impacts on the  
1081 global economy – most significantly in the surface and air transportation, and industrial  
1082 sectors.<sup>187</sup> Emissions from very high HDI countries, which account for 48% of the global total,  
1083 were around 10% lower than 2019 levels.<sup>187</sup> However, without targeted intervention,  
1084 emissions will rebound as the world recovers from the pandemic. Indeed, the 5.8% drop in  
1085 energy-related CO<sub>2</sub> emissions seen in 2020 is forecast to be matched with an unprecedented  
1086 4.8% rise in 2021.<sup>22</sup>

1087 The necessity of steering the economic recovery to a lower-emissions pathway has been well  
1088 publicised but has yet to be well-integrated into recovery plans (see panel 4).<sup>188</sup> Nevertheless,  
1089 the COVID-19 recovery presents the challenge and simultaneous opportunity to encourage  
1090 action that yields benefits to health.

1091 Tracking this global challenge, section 3 covers the relationships between climate change  
1092 mitigation actions and health. It provides an overview of the global energy system (indicator  
1093 3.1) alongside associated global exposure to ambient PM<sub>2.5</sub> air pollution and its health impacts  
1094 (indicator 3.3). Energy use in the home is also reported, with new detail on fuels used and  
1095 estimates of indoor air pollution concentrations (indicator 3.2). Following this, individual  
1096 sectors are examined: transport (indicator 3.4); food and agriculture (indicators 3.5.1 and  
1097 3.5.2); and the global healthcare sector (indicator 3.6). Where possible, the ways in which  
1098 relationships between health and climate change mitigation both influence and are  
1099 influenced by societal inequities are explored.

1100

### 1101 Indicator 3.1: Energy System and Health

1102 *Headline finding: from 2014 to 2018, despite strong growth in renewables in very high Human*  
1103 *Development Index countries, the carbon intensity of the global energy system has seen an*  
1104 *annual average decline of just 0.6% - a rate incompatible with meeting the ambitions of the*  
1105 *Paris Agreement*

1106 Fossil fuel combustion within the energy system is the largest single source of greenhouse gas  
1107 emissions, with a global share of 65%.<sup>16</sup> The rapid shift from coal to renewable energy use is  
1108 crucial, not only to mitigate these emissions, but also to prevent deaths due to ambient air

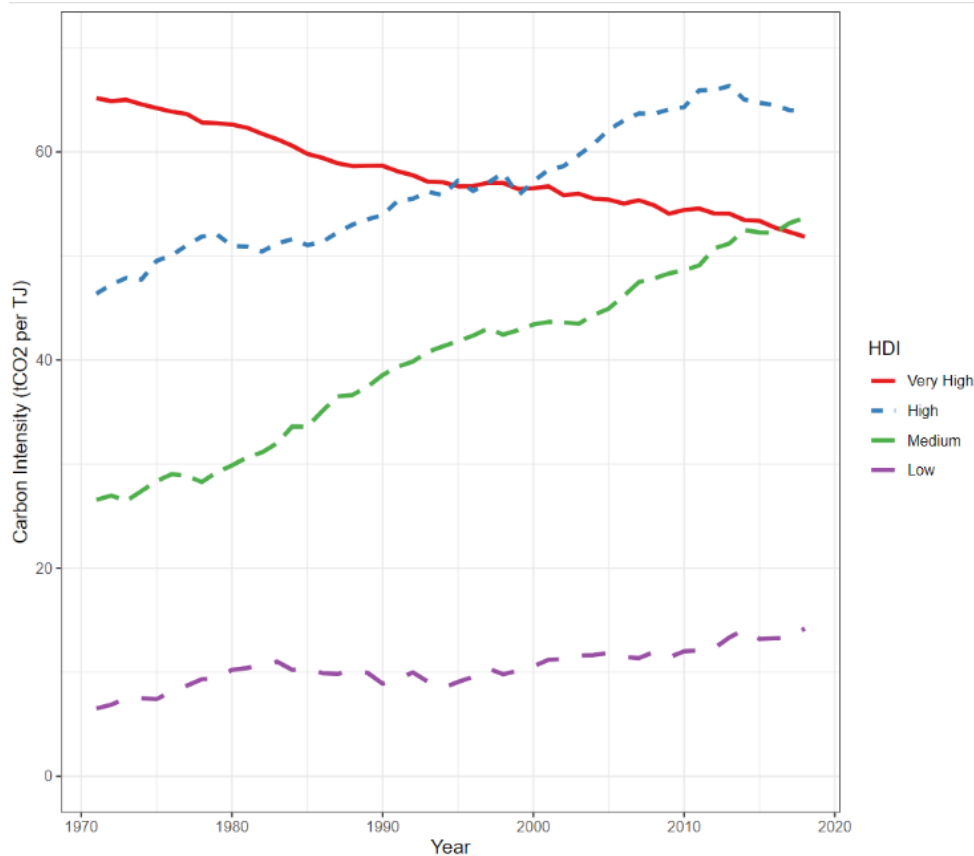
1109 pollution (indicator 3.3) and eliminate other harmful pollutants related to coal mining and  
1110 combustion.<sup>189</sup> Drawing data from the IEA, this indicator tracks three components: the carbon  
1111 intensity of the global energy system; coal phase-out; and zero-emission electricity. Full  
1112 details are described in the appendix (pp 110-115).

1113 The carbon-intensity of the global energy system fell slightly for the fifth year in a row, to 56.0  
1114 tCO<sub>2</sub>e/TJ (excluding land use emissions) in 2018. However, progress remains very limited, with  
1115 an annual rate of decline of just 0.6% from 2014 to 2018. At this rate it would take over 150  
1116 years to fully decarbonise the energy system – far from the 2040 deadline required to keep  
1117 temperature rise to 1.5°C.<sup>190</sup> Progress has been made in the very high HDI country group since  
1118 1970 and carbon intensity in the high HDI country group could be at a possible peak. However,  
1119 driven by the need to develop, the low and medium HDI country groups have shown sustained  
1120 growth in emissions per unit of energy over the period (Figure 13).

1121 China continues to dominate global coal consumption – although it represents 18.1% of the  
1122 world's population, it accounted for 53% of global coal use in 2019. While global coal use for  
1123 all activities fell 1.2% in 2019, including a fall of 13.4% in the USA and 21% in Europe, China's  
1124 usage grew by 1.1%.

1125 For the five years until 2018, electricity generation from renewable wind and solar increased  
1126 by an annual average of 17%, with its global share of electricity generation reaching 7.2% in  
1127 2018. While energy demand for coal, gas, oil and nuclear fell in 2020, renewables demand  
1128 grew by a small amount (0.9%).<sup>191</sup>

1129 Concerningly, global coal demand is expected to rise by 4.5% in 2021, although at the same  
1130 time demand for renewables is set to expand by over 8%.<sup>22</sup> A redirection of efforts towards  
1131 the decarbonisation of the energy system (see panel 4), could put the world on track to meet  
1132 the 1.5°C temperature goal and prevent deaths associated with climate change and air  
1133 pollution.



1134

1135

1136 *Figure 13. The carbon intensity of the energy system for 1970-2018, by 2019 Human Development*  
 1137 *Index country group*

1138

1139 **Indicator 3.2: Clean Household Energy**

1140 *Headline finding: in 2019, only 5% of rural households in countries in the low Human*  
 1141 *Development Index country group relied primarily on clean fuels and technologies for cooking*  
 1142 *(up from just 2% in 2000) – putting them at risk of morbidity and mortality due to exposure to*  
 1143 *household air pollution*

1144 Around 10% of the world’s population, three quarters of whom live in sub-Saharan Africa,  
 1145 lack access to electricity for any service provision, and 2.6 billion people continue to lack  
 1146 access to clean fuel for cooking.<sup>191,192</sup> COVID-19 poses further impediment to achieving the  
 1147 energy access goal (SDG7), with 2020 seeing a 2% rise in lack of access to electricity in sub-  
 1148 Saharan Africa,<sup>193</sup> driving low-income communities in places such as Nairobi, Kenya to  
 1149 increase their usage of wood and kerosene.<sup>194</sup> Energy poverty remains a concern even in high  
 1150 and very high HDI countries – around 7% of people in the EU struggle to afford sufficient heat  
 1151 for their homes,<sup>195</sup> putting them at risk of cold-related adverse health outcomes.<sup>196</sup> Here, and

1152 around the world (as highlighted in panel 3), energy poverty related to excess heat is also an  
1153 important issue.<sup>197</sup>

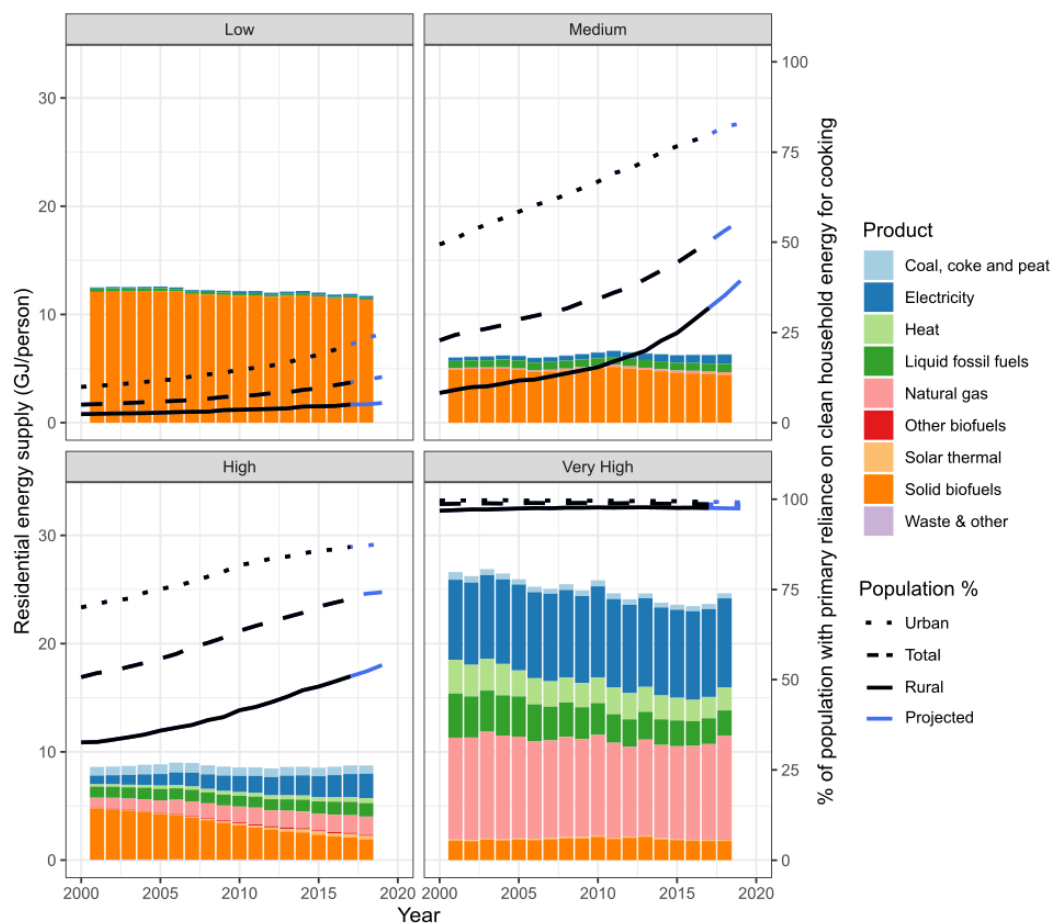
1154 This indicator tracks energy usage in the home, using data from both the IEA and the  
1155 WHO.<sup>192,198-200</sup> The WHO household energy database compiles data from national surveys,  
1156 collected up to 2017 and projected to 2019, presenting information on fuels and technologies  
1157 used for cooking, heating, and lighting. Using these data, this indicator also presents an  
1158 estimation for household air pollution concentration for 29 countries. A full description of the  
1159 methods, data, and caveats is given in the appendix (pp 116-119).

1160 In the low HDI country group, domestic energy use is dominated by bio-fuels. Primary reliance  
1161 on clean fuels and technologies for cooking in households in the low HDI country group is  
1162 estimated at only 12% in 2019. The share is even lower in rural households of this HDI group,  
1163 with only 5% relying on clean fuels and technologies – a marginal increase from 2% in 2000  
1164 (Figure 14). In homes in the medium and high HDI country groups, the share of solid biofuel  
1165 use has fallen more rapidly, and clean cooking fuel and technology use has risen substantially  
1166 – although in rural areas it remains at 54% for the high HDI group and 39% for the medium  
1167 HDI group.

1168 These patterns of energy use, as well as the infiltration of air from outside, have implications  
1169 on household air pollution concentrations. In rural households in several low and medium  
1170 HDI countries the average PM<sub>2.5</sub> concentration in the main indoor cooking area is estimated  
1171 to be above 500µg m<sup>-3</sup>. In Ethiopia it is over 1200 µg m<sup>-3</sup> – 120 times the WHO threshold of  
1172 10 µg m<sup>-3</sup>.<sup>201</sup> Exposure to these harmful air pollutants in the home results in an estimated 2.31  
1173 million deaths per year.<sup>202</sup>

1174 While gender-differentiated impacts might change across different geographies and  
1175 cultures,<sup>203</sup> exposure to household air pollution is estimated to be around 40% higher for  
1176 women than for men.<sup>204</sup> In many places women are also at higher risk of musculoskeletal  
1177 injuries and violence that result from their domestic role in collecting and using fuels for  
1178 cooking and heating, which further poses risks to their physical and mental wellbeing.<sup>205-208</sup>  
1179 Thus, progress towards meeting the SDG7 would improve health and reduce gender  
1180 inequities.

1181



1182  
 1183 *Figure 14. Residential energy supply by 2019 Human Development Index country group for 2000 to*  
 1184 *2019. Primary axis: per capita fuel type (coloured bars). Secondary axis: percentage of population*  
 1185 *with primary reliance on clean fuels and technology for cooking. Data taken from the WHO and IEA.*  
 1186 *198-200*

1187

1188 **Indicator 3.3: Mortality from Ambient Air Pollution by Sector**

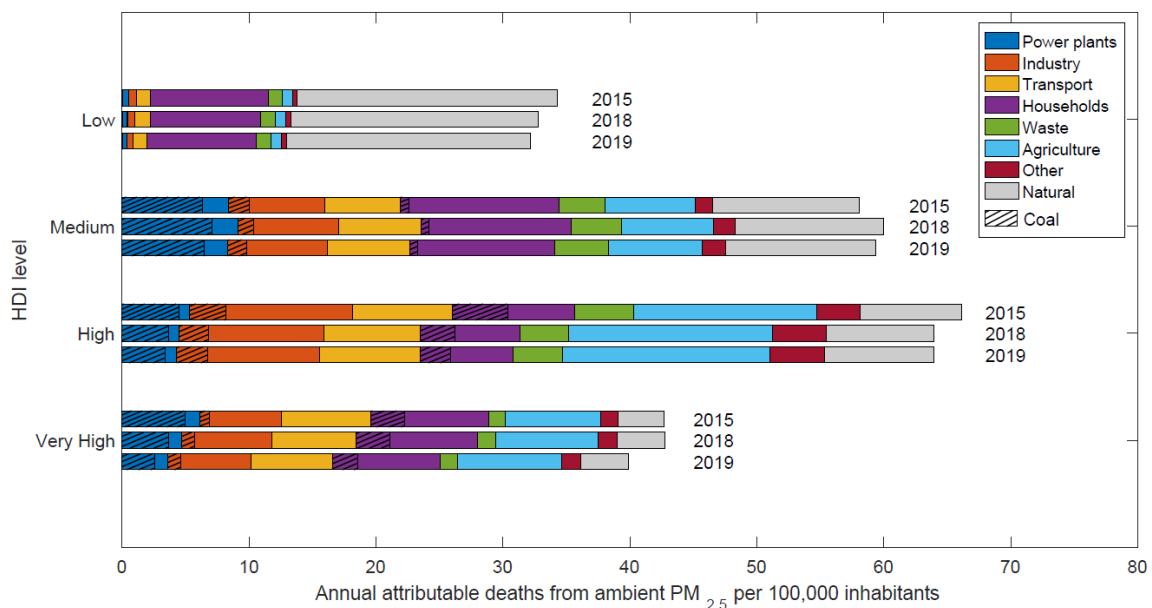
1189 *Headline finding: 3.3 million deaths were attributable to ambient PM<sub>2.5</sub> pollution from human*  
 1190 *sources in 2019 – a third of which were directly related to fossil fuel combustion. The medium*  
 1191 *and high Human Development Index country groups suffered the highest mortality rates*

1192 Awareness of the health impacts of air pollution has increased over the past years, with  
 1193 legislation shifts such as the proposed revision of the EU Ambient Air Quality Directives<sup>209</sup> and  
 1194 a landmark ruling on the death of nine-year-old Ella Adoo-Kissi-Debrah in 2020 in the UK  
 1195 thought to be the first time air pollution was listed as a cause of death in a death certificate.<sup>210</sup>  
 1196 This indicator estimates ambient PM<sub>2.5</sub> exposure and the resulting attributable deaths from

1197 different economic sectors. For the 2021 report, the methods have been updated to use the  
 1198 integrated exposure-response functions (MR-BRTs) used by the 2019 GBD study.<sup>211</sup>

1199 In total, 4.0 million deaths were estimated to be attributable to exposure to ambient PM<sub>2.5</sub> in  
 1200 2019 – 3.3 million of which were from anthropogenic sources and 1.1 million were directly  
 1201 related to fossil fuel combustion. Deaths due to coal combustion have decreased from  
 1202 620,000 in 2015 to 507,000 in 2019, largely due to strict air pollution control measures in  
 1203 China, including the reduction of coal for residential heating.

1204 Ambient concentrations of PM<sub>2.5</sub> differ strongly across world regions and between urban and  
 1205 rural areas. As a result of higher industrial activity, poorer emissions controls, and the  
 1206 continuing use of solid fuels in the domestic sector, countries in medium and high HDI groups  
 1207 face the highest rates of air pollution-related mortality (60 deaths per 100,000 inhabitants,  
 1208 and 65 deaths per 100,000 inhabitants, respectively) (Figure 15). Deaths are lower in both the  
 1209 low and very high HDI country groups (at 34 deaths per 100,000 inhabitants, and 40 deaths  
 1210 per 100,000 inhabitants, respectively). This is due to lower industrial activity and younger  
 1211 populations in low HDI countries; and cleaner electricity generation, industrial production,  
 1212 and end-of-pipe emission controls in very high HDI countries.



1213  
 1214 *Figure 15. Mortality attributable to ambient PM<sub>2.5</sub> in 2015, 2018 and 2019 by source and by 2019*  
 1215 *Human Development Index country group.*

1216

## 1217 Indicator 3.4: Sustainable and Healthy Road Transport

1218 *Headline finding: electricity use in transport rose by 15% from 2017 to 2018 and the global*  
1219 *electric vehicle fleet topped 7.2 million cars in 2019. However, emissions from road transport*  
1220 *also continued to increase*

1221 With road transport accounting for nearly 18% of global CO<sub>2</sub> emissions in 2019, the shift to  
1222 electric vehicles is an important mitigation measure.<sup>212</sup> Beyond this, the promotion of walking  
1223 and cycling (active travel) could not only cut emissions, but also provide enormous health  
1224 dividends through the increase of physical activity.<sup>28</sup> The mode share of cycling varies greatly  
1225 between and within countries of different levels of HDI – ranging from 0.3% and 0.6% of all  
1226 trips in São Paulo and Cape Town, to 1.1-1.9% in USA and Australian cities, to 4.8% in Delhi,  
1227 to 14.1-28.7% in cities in Germany, Japan and the Netherlands – with a higher mode share  
1228 being associated with more equal gender representation in cycling.<sup>213</sup> Unless active travel  
1229 infrastructure is rolled out with consideration of sociocultural inequities, the benefits may not  
1230 be equally manifested across all groups.<sup>214-218</sup>

1231 This indicator uses data from the IEA to monitor fuels used for transport and electric vehicles,  
1232 with full details provided in the appendix (pp 122-123).<sup>219-221</sup> The global number of electric  
1233 vehicles (EVs) rose from 5.1 million in 2018 to 7.2 million in 2019. However, EVs still only  
1234 represent 1% of global car stock, and road transport emissions also increased in 2019, as  
1235 demand for larger vehicles grew in the USA, Europe, and Asia, in tandem with increasing  
1236 demand for transport in low and medium HDI countries. Overall, total direct use of fossil fuels  
1237 for road transport increased by 0.7% whereas the use of electricity in transport rose by 15%  
1238 from 2017 to 2018, although it remains just 0.27% of total road transport energy use.

1239 With respect to the same period in 2019, the COVID-19 pandemic led to a nearly 50%  
1240 decrease in global road transport demand by the end of March 2020.<sup>222,223</sup> However, while  
1241 the use of fossil fuels for road travel has largely rebounded, many public transport networks  
1242 now face critical decreases in ridership.<sup>224</sup> City governments around the world implemented  
1243 measures to promote active travel during their lockdowns, many of which are intended to be  
1244 permanent.<sup>222,223</sup> As cities emerge from the COVID-19 crisis, implementing policies to  
1245 reinforce positive shifts in travel modality presents a triple opportunity to promote physical  
1246 activity, reduce urban air pollution, and mitigate climate change.<sup>225</sup>

1247

## 1248 3.5: Food, Agriculture, and Health

### 1249 Indicator 3.5.1: Emissions from Agricultural Production and Consumption

1250 *Headline finding: mostly driven by high levels of red meat consumption, per capita emissions*  
1251 *from food consumption are considerably greater in of the very high Human Development*



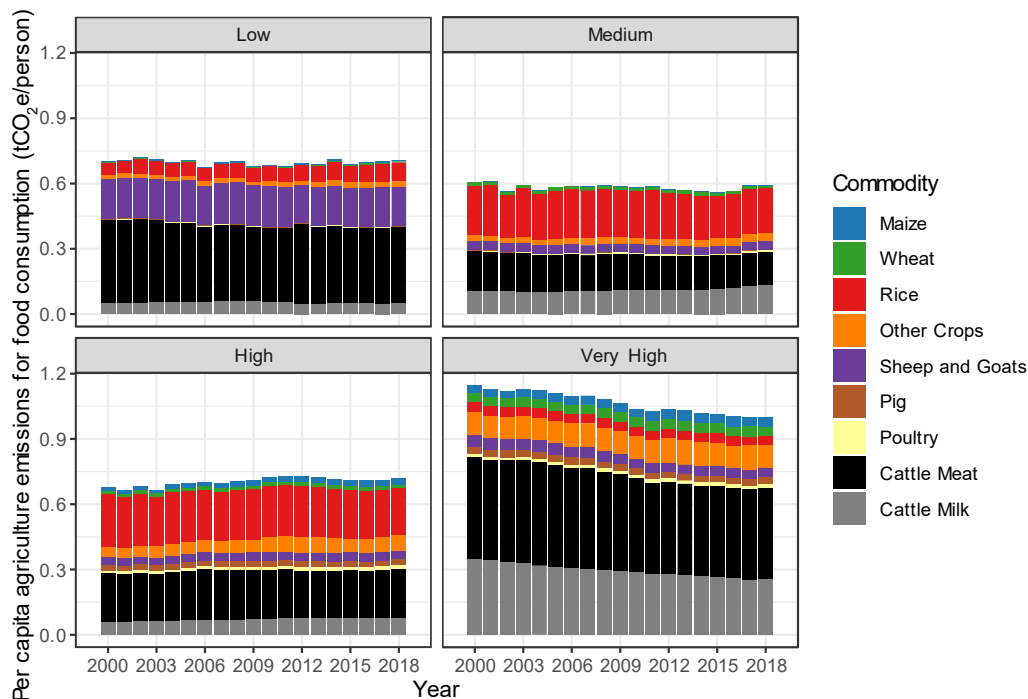
1252 *Index country group – 61% higher than in those in the low Human Development Index group*  
1253 *in 2018*

1254 Food systems, including agricultural production, are responsible for 21-37% of all greenhouse  
1255 gas emissions, while also holding high carbon sequestration potential.<sup>10</sup> This makes them key  
1256 to limiting global warming to 1.5°C. This indicator tracks emissions from agricultural  
1257 production and consumption of food products, combining modelling and FAO data.<sup>226</sup>

1258 Despite moderate improvements in efficiency, total agricultural production emissions  
1259 continued to grow, reaching 5.6 GtCO<sub>2</sub>e in 2018 (1.5% higher than in 2017). Of this total, cattle  
1260 products (mainly meat and milk) contributed 52% of global agricultural production emissions.

1261 Data reveal stark differences in per-capita consumption-based agricultural emissions across  
1262 countries in different levels of HDI: per capita emissions in the very high HDI country group  
1263 are 39% above those of the high HDI group, and 45% higher than those of the low HDI group  
1264 (Figure 16). This is despite a high emission-intensity for beef products in the low HDI group  
1265 (around three times higher than in the very high HDI group), which is mitigated by a much  
1266 lower per capita consumption of beef. Importantly, 68% of the total consumption-based  
1267 agricultural emissions in the very high HDI country group are attributable to cattle products,  
1268 mainly beef production, which is slightly down from 71% in 2000.

1269 Progress towards zero hunger (SDG2) will likely be associated with increases in consumption-  
1270 based agricultural emissions in low and medium HDI countries. In order to meet emission  
1271 reduction goals, consumption of red meat should be safely reduced in relevant population  
1272 groups, especially in very high HDI countries.<sup>227</sup> This would also deliver substantial health co-  
1273 benefits, as indicator 3.5.2 shows. Further scope to reduce emissions from the food  
1274 production system comes from waste reduction, deforestation curtailment and yield  
1275 improvement.<sup>228</sup>



1276

1277

1278 *Figure 16. Per capita yearly greenhouse gas emissions associated with consumption of agri-food*  
 1279 *products, by 2019 Human Development Index country group and commodity, 2000-2018.*

1280

1281 **Indicator 3.5.2: Diet and Health Co-Benefits**

1282 *Headline finding: between 2017 and 2018, estimated deaths due to excess red meat*  
 1283 *consumption rose by 1.8% to 842,000*

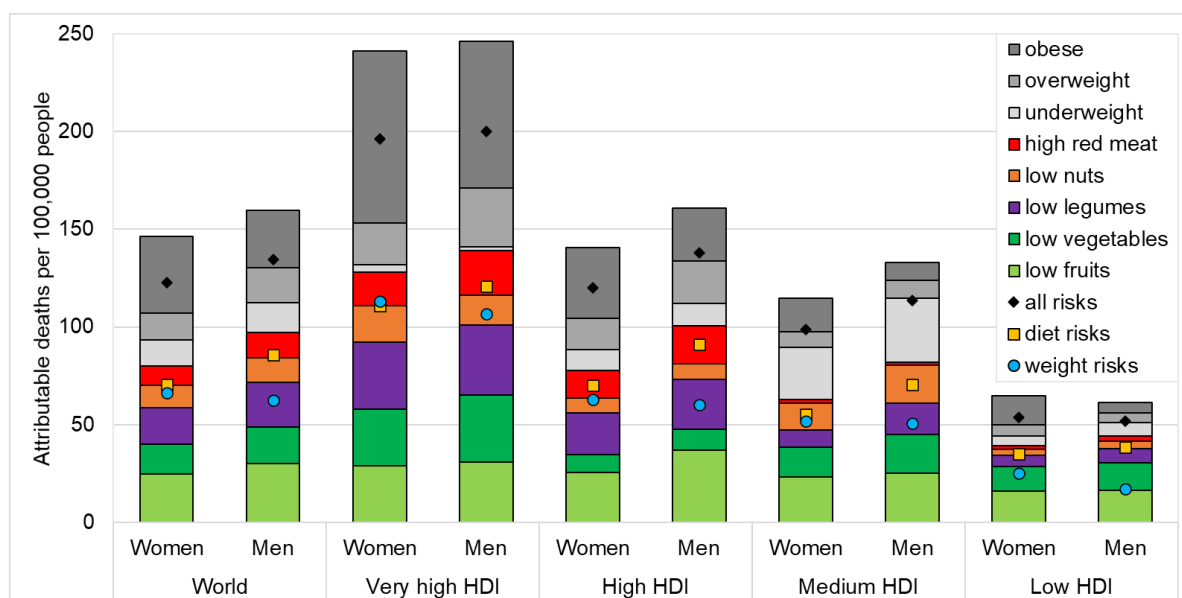
1284 With current production efficiency interventions failing to curb or reduce agricultural  
 1285 greenhouse gas emissions, dietary shifts – greatly reducing red meat and increasing plant-  
 1286 based foods – are necessary, particularly in the very high and high HDI countries.<sup>28</sup> For the  
 1287 low and medium HDI countries, sustainable farming and agricultural practices will help keep  
 1288 agricultural emissions low while efforts are made to meet the nutritional requirements of  
 1289 populations.<sup>229</sup> Monitoring this dietary transition, this indicator models deaths attributable  
 1290 to dietary risk factors, using updated data on food consumption and mortality rates by sex,  
 1291 age and country.<sup>230,231</sup>

1292 In 2018, 9.6 million deaths were attributable to imbalanced diets (both dietary composition  
 1293 and caloric intake). Although dietary risks and baseline mortality rates declined, there was an  
 1294 overall increase compared with 2017 (see appendix, pp 130-138). Diets in the high and very

1295 high HDI country groups contain 4 to 7 times more red meat than in the low and medium HDI  
 1296 groups. Together with greater non-communicable disease-related mortality rates, this  
 1297 translates to a rate of red meat-related mortality almost nine times greater in the very high  
 1298 HDI country group (19 deaths per 100,000) compared with the low HDI group (2 deaths per  
 1299 100,000).

1300 Diets and the associated health impacts differ across sexes. In general, male diets tend to be  
 1301 less healthy than those of females, containing fewer fruits (-6% on average globally),  
 1302 vegetables (-1%), and legumes (-10%), and more red meat (+4%).<sup>232-235</sup> The differences in  
 1303 risks resulted in an estimated 455,000 (10%) more men dying from preventable, diet-related  
 1304 diseases than women – a pattern reflected across each of the HDI country groupings (Figure  
 1305 17).

1306



1307  
 1308 *Figure 17. Deaths attributable to imbalanced diets and weight in 2018 by risk factor, sex, and 2019*  
 1309 *Human Development Index country group. The size of each component in the stacked bar represents*  
 1310 *its individual contribution to attributable deaths. Since these contributions cannot be summed*  
 1311 *directly, the overall contribution by diet and weight components are represented by the dots as given*  
 1312 *in the key.*

1313

1314 **Indicator 3.6: Healthcare Sector Emissions**

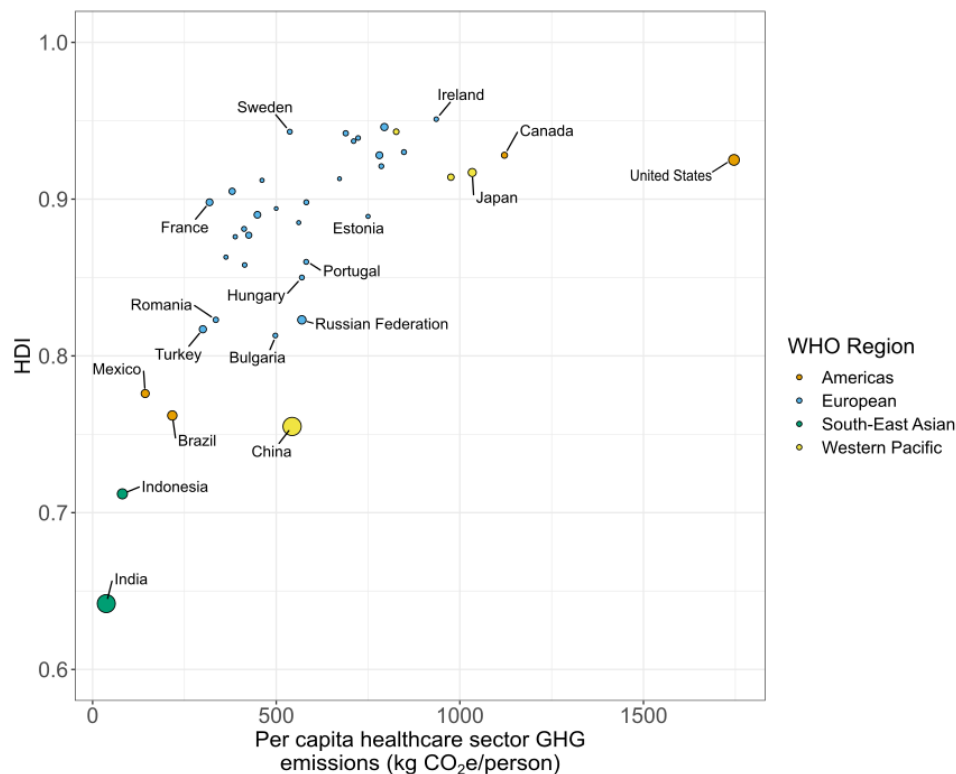
1315 *Headline finding: in 2018, emissions from the healthcare sector increased slightly to 4.9% of*  
 1316 *global greenhouse gas emissions. Healthcare emissions are positively associated with Human*  
 1317 *Development Index levels, largely through health spending, but minimal association is seen*  
 1318 *after 400 kg CO<sub>2</sub>e per capita*

1319 The healthcare sector is central to improving human development. In providing services,  
1320 healthcare systems mobilise a vast array of products and use energy in various forms, all of  
1321 which result in emissions of greenhouse gases and other pollutants that can be calculated  
1322 throughout global supply chains. With this contribution to greenhouse gas emissions and  
1323 their important leadership role in improving patient care in the face of climate change,<sup>236</sup>  
1324 healthcare institutions are beginning to seriously commit to reducing emissions.<sup>237</sup>

1325 In this indicator, both direct and indirect emissions from the global healthcare sector are  
1326 modelled using environmentally extended multi-region input-output (EE-MRIO) models,  
1327 combined with annual WHO data on national healthcare expenditure, with a full description  
1328 in the appendix (pp 139-140).

1329 In 2018, the global healthcare sector contributed approximately 4.9% of global GHG  
1330 emissions, a rise of 5.2% from 2017. Expansion of healthcare services in China was responsible  
1331 for more than half of this global increase. Although its national healthcare emissions are now  
1332 35% greater than those of the USA, on a per-capita basis, China ranks 21<sup>st</sup> among all major  
1333 economies assessed.

1334 Per-capita comparisons do not account for differences in healthcare access and quality,  
1335 specifically measured through health outcomes, such as life expectancy, which is one of the  
1336 components of the HDI. Plotting per capita healthcare emissions against HDI (Figure 18)  
1337 reveals that emissions are positively associated with HDI, an association strongest for lower  
1338 emissions levels. A wide range of HDI levels are associated with per capita healthcare  
1339 emissions of 500-600 kgCO<sub>2</sub>e, reflecting both differences in health system efficacy and other  
1340 development indicators, but also in emissions intensities. Above these levels, additional  
1341 emissions are not associated with improved HDI.



1342  
 1343 *Figure 18. National per capita healthcare greenhouse gas emissions for 2018 against 2019 country*  
 1344 *Human Development Index level. Dot size is proportional to population*

1345  
 1346 **Conclusion**

1347 Prior to the pandemic, the rapid rate of growth in renewable electricity generation was  
 1348 insufficient to counteract the sluggish decline in coal use. The result of this was that the  
 1349 carbon intensity of the global energy system remained virtually unchanged. At the same time,  
 1350 there has been very little progress in increasing the use of clean household energy. These  
 1351 delays are costing millions of lives each year, from both household and ambient air pollution.  
 1352 Food-related agricultural emissions continue to rise and so too do deaths attributable to  
 1353 dietary risk factors.

1354 Across this section, many inequities can be highlighted. Low HDI countries have the highest  
 1355 use of dirty fuels in the home, putting them at greater risk of morbidity and mortality from  
 1356 exposure to household air pollution. Countries of medium and high levels of HDI have the  
 1357 highest carbon intensity of energy and the greatest burden of deaths due to ambient air  
 1358 pollution, as a result of higher industrial activity and inadequate emissions controls. People  
 1359 in very high HDI countries have the most carbon intensive diets, and, with high levels of red  
 1360 meat consumption, they also have the most to gain from a shift towards more plant-based  
 1361 foods.

1362 Although the impacts of the COVID-19 pandemic are not yet fully captured, there was a  
1363 temporary, but significant drop in emissions due to lockdowns, and the associated reductions  
1364 in economic activities and international travel. However, emissions are already rebounding.  
1365 The challenge moving forward will be to adopt measures that provide near-term economic  
1366 relief, whilst building towards long-term emission reductions and protecting future health –  
1367 a challenge further explored in the following section.

## 1368 Section 4: Economics and Finance

1369 Avoiding the worst of the climate change impacts described in section 1 will require both  
1370 sustained adaptation efforts (section 2), as well as a rapid transformation of the world's  
1371 economies to cut greenhouse gas emissions (section 3). Section 4 examines the economic and  
1372 financial implications of this transition.

1373 First, this section explores the economic impact of climate change and its mitigation  
1374 (indicators 4.1.1 to 4.1.4). The indicators use a range of methods to estimate some of the  
1375 costs that climate change may already be imposing on society through its impacts on human  
1376 health. Then, the economics of the transition to zero-carbon economies (indicators 4.2.1 to  
1377 4.2.5), which are fundamental to the improvement of human health and wellbeing are  
1378 investigated. The indicators consider whether investments and jobs are beginning to move  
1379 away from fossil fuels, and if the appropriate economic signals are encouraging this. A new  
1380 indicator for this year's report (indicator 4.2.5) explores the effect of global trade on  
1381 greenhouse gas and PM<sub>2.5</sub> emissions associated with economic activities, highlighting that  
1382 harms may occur in countries different from the demands that drive them.

1383 Achieving the required investments in the low-carbon transition requires clear and  
1384 committed action from both governments and private sector actors and could result in both  
1385 health and economic benefits. Aiming for a green global recovery from COVID-19 over  
1386 'business as usual' economic growth will ensure that the economy recovers through the  
1387 generation of new jobs in low-carbon industries, as well as accelerate progress towards the  
1388 Paris Agreement goals and the SDGs – yielding health gains through the prevention of further  
1389 climate change and through the co-benefits of climate change mitigation.<sup>238</sup> International  
1390 economic cooperation will be essential to ensure global emission targets are met, and to  
1391 prevent the widening of inequity gaps.<sup>25</sup> This section also therefore reflects on the extent to  
1392 which post-COVID-19 recovery spending has prioritised green investment (panel 4), and the  
1393 alignment of fossil fuel companies' strategies with the requirements of the transition (panel  
1394 5).

1395

### 1396 4.1 The Economic Impact of Climate Change and its Mitigation

#### 1397 Indicator 4.1.1: Economic Losses due to Climate-Related Extreme Events

1398 *Headline finding: when normalised by GDP, economic losses from climate-related extreme*  
1399 *events in 2020 were collectively three times greater in with the medium Human Development*  
1400 *Index country group compared with the very high Human Development Index group*

1401 The loss of physical infrastructure and resulting economic losses due to climate-related  
1402 extreme events can further exacerbate the health impacts described in section 1. This  
1403 indicator tracks the total annual economic losses (insured and uninsured) that result from  
1404 climate-related extreme events, using data provided by Swiss Re, with methods described in  
1405 the appendix (pp 141-143).<sup>239,240</sup>

1406 In 2020 there were 242 recorded climate-related extreme events, with absolute economic  
1407 losses totalling US\$178 billion. Although two-thirds of these losses occurred in very high HDI  
1408 economies, when normalised by GDP, losses the medium HDI country groups are around  
1409 three times greater. Importantly, while two-thirds of losses in the very high HDI country group  
1410 are insured, almost 93% of losses were uninsured in the high HDI group. This number rises to  
1411 97% and 100% of measurable losses in the medium and low HDI country groups, respectively  
1412 – creating a bigger economic burden for these disadvantaged countries, as uninsured losses  
1413 are either not replaced, or are replaced through out-of-pocket expenses, reinforcing  
1414 inequities.

1415

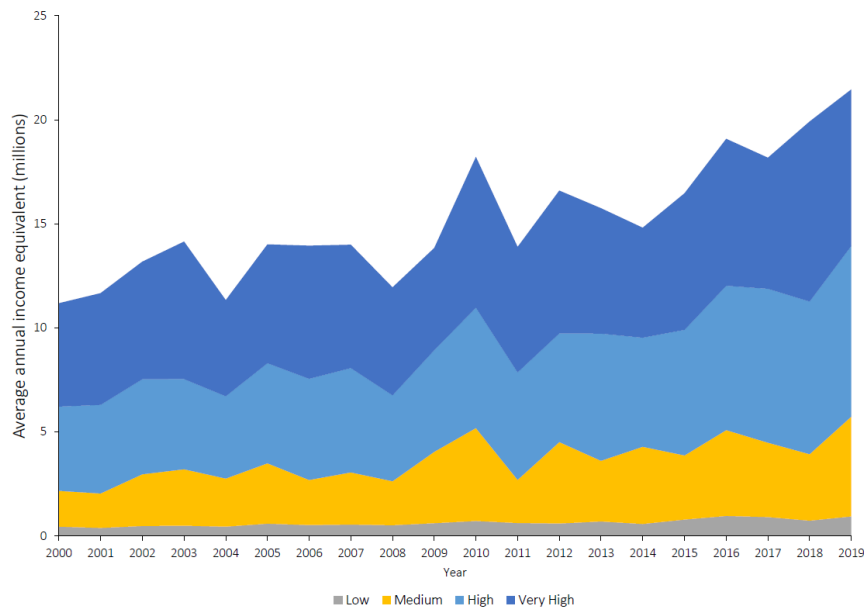
1416 [Indicator 4.1.2: Costs of Heat-Related Mortality](#)

1417 *Headline finding: the monetised value of global heat-related mortality increased by 6.7% from*  
1418 *0.27% of gross world product in 2018, to 0.28% in 2019. Europe continued to be the worst*  
1419 *affected region, facing costs equivalent to the average income of 6.1 million of its citizens*

1420 The increase in morbidity and mortality due to extremes of heat represents a high cost to all  
1421 of society. This indicator uses data on years of life lost due to extremes of heat from indicator  
1422 1.1.6 to provide a measure of the costs of global deaths attributable to heat.<sup>96</sup> Improved in  
1423 the 2021 report, it combines a value of statistical life-year (VSLY) with years of life lost (YLLs),  
1424 to monetise the loss caused by premature mortality. The valuation of life across varying HDI  
1425 levels presents a methodological and ethical challenge, which this indicator addresses by  
1426 presenting costs as the proportion of GDP and the equivalent annual average income.

1427 The monetised value of global heat-related mortality in the 65-and-over population increased  
1428 by 6.7%, from 0.27% of gross world product in 2018 to 0.28% in 2019 (Figure 19). Reflecting  
1429 the distribution of impacts found in indicator 1.1.6, the costs of heat-related mortality for the  
1430 low, medium, high, and very high HDI country groups, were found to be equivalent to the  
1431 average income of 0.94, 4.80, 8.20, and 7.52 million of their citizens, respectively. As in  
1432 indicator 1.1.6, the WHO's European region was the worst affected in 2019, with costs equal  
1433 to the average income of 6.1 million of its citizens and 0.66% of regional GDP. However, the  
1434 costs were lower than the year before, due to fewer estimated heat-related deaths in 2019  
1435 compared to 2018 in this region (indicator 1.1.6). On the other hand, costs increased in other  
1436 regions, especially the WHO's South-East Asia region.





1437  
 1438 *Figure 19. Monetised cost of heat-related (in terms of expressed as the number of people whose*  
 1439 *average income the loss is equivalent to) by 2019 Human Development Index country group for 2000-*  
 1440 *2019*

1441

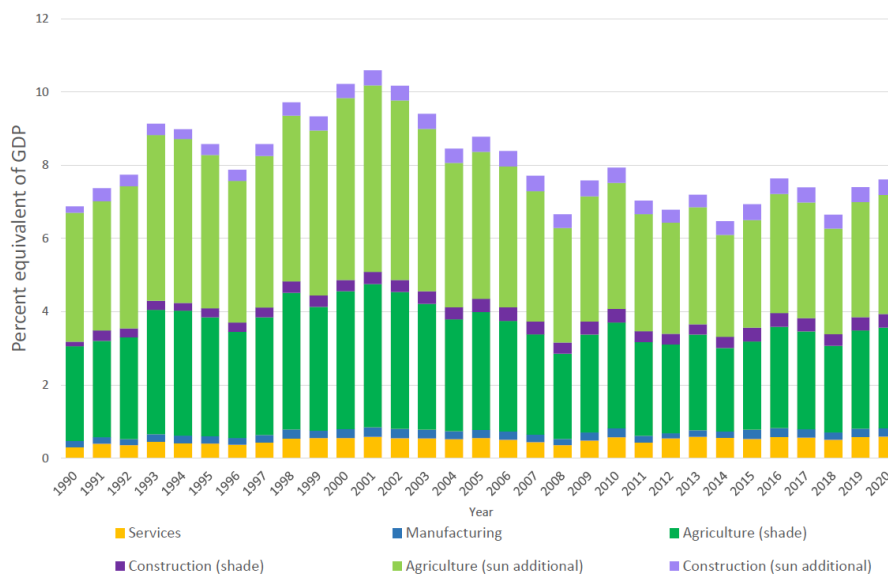
1442 **Indicator 4.1.3: Loss of Earnings from Heat-Related Labour Capacity Reduction**

1443 *Headline finding: working in conditions of extreme heat is a health risk. Such conditions could*  
 1444 *reduce the capacity for paid labour, with an impact on workers' earnings equivalent to 4-8%*  
 1445 *of GDP in the low Human Development Index country group in 2020*

1446 As reflected in indicator 1.1.4, higher temperatures, driven by climate change, are affecting  
 1447 people's ability to work. This indicator considers the loss of earnings that could result from  
 1448 such reduced capacity, Such earnings losses could further compound the health impacts  
 1449 through effects on the socioeconomic determinants of good health.<sup>241</sup> It combines the  
 1450 outputs of indicator 1.1.4 with data on average earnings by country and sector held in the  
 1451 International Labour Organization (ILO) databases, with methods and additional analysis  
 1452 described in the appendix (pp 146-151).<sup>242</sup> In this year's report, the number of countries  
 1453 covered in this indicator has been increased from 25 to 183.

1454 Indicators 1.1.6 and 4.1.2 found Europe to be the region most affected by heat-related  
 1455 mortality in populations aged 65 and over. In contrast, this indicator focusses on working age  
 1456 populations and, in alignment with the outputs of indicator 1.1.4, finds that greater loss of  
 1457 earnings due to labour capacity loss occur in low and medium HDI countries. Countries with  
 1458 lower HDI levels tend to experience greater proportional losses of earnings, emphasising the  
 1459 impact of climate change on deepening inequities. In the low HDI country group, potential

1460 income losses in 2020 were equivalent to 4-8% of GDP, depending on the degree of shade or  
 1461 sun exposure during agricultural and construction work (Figure 20). The ranges for the  
 1462 medium, high, and very high HDI country groups in 2020 were 2-4%, 1-2% and 0.3-0.5% of  
 1463 GDP, respectively. The impacts will mainly affect men in sectors such as construction, where  
 1464 they represent more than 90% of the workforce globally, and in manufacturing and  
 1465 agriculture where, where they represent more than 60% of the workforce.<sup>84</sup> However, the  
 1466 data does not account for informal or unpaid domestic and agricultural work, in which women  
 1467 are often overrepresented.<sup>243-245</sup> The indirect economic impacts from reduced labour capacity  
 1468 extend well beyond the loss of earnings. For example, modelling both direct and indirect  
 1469 impacts, the heat-related economic cost of labour loss in 2020 was estimated at 1.36% of  
 1470 China's GDP and 6.75% of GDP in Hainan Province.<sup>51</sup>



1471  
 1472 *Figure 20 Average potential loss of earnings in the low Human Development Index country group as a*  
 1473 *result of potential labour loss due to heat exposure. Losses are presented as share of GDP, by sector*  
 1474 *of employment,. The agriculture and construction (sun additional) blocks represent the losses that*  
 1475 *would have been incurred in addition to those from agriculture and construction (shade) if all of the*  
 1476 *activities in these sectors had been carried out in direct sunlight.*

1477

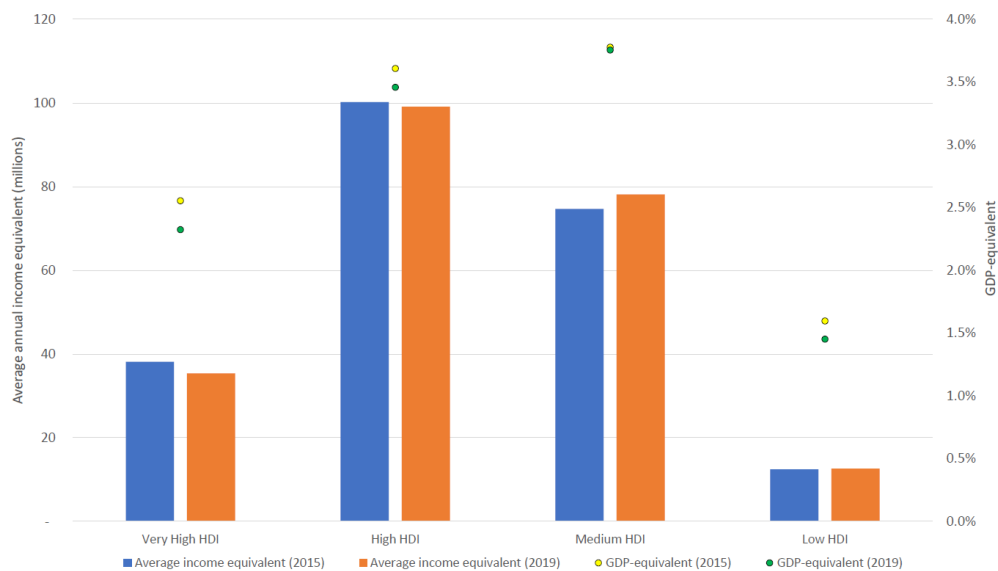
1478 **Indicator 4.1.4: Costs of the Health Impacts of Air Pollution**

1479 *Headline finding: equivalent to the annual income of 71.1 million and 99.1 million people, the*  
 1480 *greatest economic costs of mortality due to air pollution fall on countries in the medium and*  
 1481 *high Human Development Index country groups. Costs relative to GDP decreased between*  
 1482 *2015 and 2019 globally, with the exception of costs in South-East Asia*

1483 As described in indicator 3.3, global mortality due to ambient PM<sub>2.5</sub> pollution has increased.  
 1484 This indicator captures the cost of this mortality by placing an economic value on the YLLs  
 1485 that result from exposure to anthropogenic ambient PM<sub>2.5</sub>. This indicator has been expanded  
 1486 for the 2021 report, from a European-only focus to global coverage, and with a revised  
 1487 definition of YLLs. The methods, data and further analysis are described in full in the appendix  
 1488 (pp 152-154).

1489 Figure 21 presents the economic value of YLLs in 2015 and 2019 by country HDI groups,  
 1490 relative to both total GDP and the annual income of the average person in these categories.  
 1491 The greatest relative costs fall on the medium and high HDI country groups, equivalent to the  
 1492 annual income of 74.6 million and 99.1 million people, respectively. Costs relative to average  
 1493 income increased between 2015 and 2019 in the low and medium HDI country groups.  
 1494 However, with rates of growth of GDP outpacing those of population, costs relative to total  
 1495 GDP have decreased in all HDI groups.

1496



1497

1498 Figure 21. Economic cost of YLLs in 2015 and 2019, relative to the annual  
 1499 person and total GDP, by 2019 Human Development Index country group

## 1500 4.2 The Economics of the Transition to Zero-Carbon Economies

1501

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### 1502 *Panel 4. Recovering from Covid-19: Stimulus Measures for a Sustainable Economy*

1503 The COVID-19 pandemic, and measures to tackle it, triggered a global recession of a depth only exceeded in the  
1504 last 150 years by two World Wars and the Great Depression of the 1930s.<sup>246</sup> Governments with the fiscal capacity  
1505 have responded with massive spending packages; by the end of 2020, the world's 50 largest economies had  
1506 committed USD 14.6 trillion in fiscal measures (many times higher than the value of global stimulus measures  
1507 following the 2008-09 financial crisis). Although 87% of this was designed to prevent an even deeper health and  
1508 economic crisis (USD 12.7 trillion), rather than encourage recovery (USD 1.9 trillion),<sup>247</sup> as time goes by and  
1509 further measures are announced, promoting recovery will come to the fore.

1510 How these measures are designed and targeted will determine whether this spending entrenches existing  
1511 technical, economic, and social structures and systems, or promotes those that are more sustainable, healthy,  
1512 and equitable. Evidence from stimulus measures introduced following the 2008-09 financial crisis shows that  
1513 'green' stimulus measures often have advantages over 'brown' or 'colourless' measures.<sup>238</sup>

1514 So far, the signs are not encouraging. Of the USD 1.9 trillion directed toward recovery by the end of 2020, just  
1515 18% is expected to reduce greenhouse gas emissions (or 2.5% of the value of all fiscal measures), while the  
1516 overall impact on air pollution, and particularly on natural capital – through the expansion of road transport and  
1517 defence services in particular – is likely to be negative. Positive measures are highly concentrated in just a few  
1518 nations, particularly in Europe,<sup>247</sup> although measures announced so far in 2021 indicate some movement  
1519 towards greater consideration of sustainability in other countries.<sup>248,249</sup> However, despite global CO<sub>2</sub> emissions  
1520 dropping by a record 6% in 2020 overall, they have rebounded quickly, with global CO<sub>2</sub> emissions in December  
1521 2020 around 2% higher than in December 2019.<sup>250</sup> The urgency with which the trillions of dollars for stimulus  
1522 measures yet to be announced must be oriented toward a green and healthy recovery is therefore great.

1523 In May 2020, the WHO published six prescriptions for a healthy and green recovery: (1) Protect and preserve  
1524 the source of human health: Nature; (2) Invest in essential services, from water and sanitation to clean energy  
1525 and healthcare facilities; (3) Ensure a quick, healthy energy transition; (4) Promote healthy, sustainable food  
1526 systems; (5) Build healthy, liveable cities; and (6) Stop using taxpayers money to fund pollution (particularly  
1527 through fossil fuel subsidies).<sup>251</sup> If governments are serious about their commitments under the Paris Agreement  
1528 and SDGs, they must take note of these priorities, plan ahead, and learn from both their own previous  
1529 experience and from that generated elsewhere, to implement them using well-designed and context-  
1530 appropriate policy. Where necessary, multilateral institutions, processes and instruments should be galvanised  
1531 in support of a global recovery that is both sustainable and equitable.<sup>247</sup>

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1532

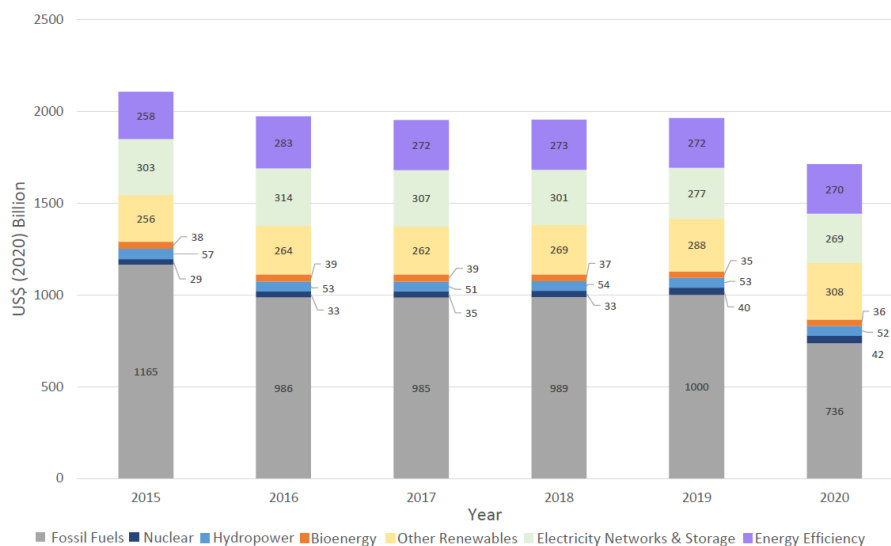
1533 Indicator 4.2.1: Coal and Clean Energy Investment

1534 *Headline finding: global investment in energy supply and energy efficiency reduced 13%*  
1535 *between 2019 and 2020. Investment in renewable energy and energy efficiency increased by*  
1536 *3%, but investment in new coal capacity reduced by 13%*

1537 Coal combustion has been responsible for over 30% of the global average temperature  
1538 increase above pre-industrial levels and for 491,000 deaths from PM<sub>2.5</sub> exposure in 2019  
1539 (indicator 3.3).<sup>252</sup> Therefore, coal phase-out is essential for both mitigating climate change  
1540 and for reducing premature mortality due to air pollution. At the same time, it is necessary to  
1541 invest in renewables, energy efficiency, and the electricity grid in order to reduce the carbon  
1542 intensity of energy supply, as described in indicator 3.1. Taking data from the IEA, this  
1543 indicator tracks global investment in energy supply and energy efficiency, and highlights  
1544 ongoing capital spending in new coal-fired power generation, globally and for key countries  
1545 and regions. The data, presented as an index, represents ongoing capital spending.

1546 Between 2019 and 2020 investment in global energy supply and energy efficiency reduced  
1547 from nearly \$2 trillion to around \$1.7 trillion, almost entirely due to declining investment in  
1548 fossil fuels, following reduced demand as a result of the pandemic (investment in coal power  
1549 capacity declined by 13%). In parallel, investment in renewables and energy efficiency  
1550 increased by 3%, with their share of total investment in global energy supply increasing from  
1551 33% to 39%. However, for a pathway consistent with 1.5°C of warming this century, annual  
1552 investments in clean energy must at least triple over the 2020s.<sup>253</sup>

1553



1554

1555 *Figure 22. Economic value of annual investment in renewable and fossil fuel energy supply and*  
1556 *energy efficiency, 2014-2020*

1557

1558 [Indicator 4.2.2: Employment in Low-Carbon and High-Carbon Industries](#)

1559 *Headline finding: direct employment in fossil fuel extraction declined by 14% from 13.1 million*  
1560 *in 2019 to 12.7 million in 2020*

1561 Evidence suggests that employees in some fossil fuel extraction industries, particularly coal  
1562 mining, and their local communities, suffer a greater incidence of cardiovascular and  
1563 cerebrovascular disease, respiratory disease and cancers.<sup>254</sup> Investments in renewable  
1564 energies and energy efficiency are estimated to create almost three times more jobs per unit  
1565 of spend than those in fossil fuel industries.<sup>255</sup> Along with strong labour and environmental  
1566 standards, investment and employment in renewables present an opportunity to improve  
1567 health and livelihoods. This indicator tracks global direct employment in fossil fuel extraction  
1568 industries and direct and indirect (supply chain) employment in renewable energy, with a full  
1569 description available in the appendix (pp 158-159).

1570 Around 11.5 million people globally were employed directly or indirectly by the renewable  
1571 energy industry in 2019, representing an increase of 4.2% from 2018. At the time of writing  
1572 data for 2020 was unavailable, although due to the pandemic, the extent to which such data  
1573 will be indicative of a long-term trend is currently unclear. Fossil fuel extraction industries  
1574 continue to employ more people globally than all renewable energy industries combined,

1575 although the number of jobs in 2019 are slightly lower than in 2018, at 12.7 million compared  
1576 with 13.1 million.

1577 While men are still overrepresented in the energy sector, the field of renewable energy  
1578 employs a considerably higher share of women (32%) than the oil and gas industry (22%).<sup>256</sup>  
1579 With adequate policies in place, the transition to a low carbon economy therefore represents  
1580 an additional opportunity to reduce gender inequities and empower women.

1581 With trillions of dollars earmarked for COVID-19 recovery, investments in the renewable fuel  
1582 industry could offer a triple gain in terms of better health through safer jobs and improved  
1583 livelihoods, climate change mitigation, and more employment opportunities.

1584

1585 [Indicator 4.2.3: Funds Divested from Fossil Fuels](#)

1586 *Headline finding: the global value of funds committing to fossil fuel divestment between 2008*  
1587 *and 2020 is US\$14.52 trillion, with health institutions accounting for US\$42 billion*

1588 By reducing financial interests in the fossil fuel industry, divestment both reduces the ‘social  
1589 licence to operate’ of fossil fuel companies, and hedges against investors’ risk of losses due  
1590 to ‘stranded assets’ in an increasingly decarbonising world (panel 5).<sup>257,258</sup> Investors can also  
1591 effect change through shareholder action, exemplified recently by activist hedge fund Engine  
1592 No 1 taking seats on ExxonMobil’s board.<sup>259</sup> Concerned with the immediate and long-term  
1593 damages of continued fossil fuel use, health institutions have the imperative to lead the way  
1594 in divesting, to ensure they ‘first, do no harm’. This indicator tracks the total global value of  
1595 funds divested from fossil fuels, and the value of funds divested by health institutions, using  
1596 data provided by 350.org.<sup>260</sup>

1597 From 2008 until the end of 2020, 1,398 organisations, with assets worth at least US\$14.52  
1598 trillion, have committed to divestment. Of these, only 25 are health institutions, with assets  
1599 totalling US\$42 billion. The value of new funds committed to divesting in 2020 was US\$2.5  
1600 trillion, with health institutions accounting for US\$47 million of these.

1601

1602

1603 *Panel 5. Compatibility of fossil fuel company strategies with well below 2°C-consistent emissions trajectories*

---

1604 Globally, carbon dioxide (CO<sub>2</sub>) from the combustion of fossil fuels represents 65% of total greenhouse gas  
1605 emissions.<sup>16</sup> In the 2015 Paris Agreement, countries agreed to reduce their emissions to keep global warming to  
1606 ‘well below 2°C’ with respect to pre-industrial levels. The carbon budget for a 66% probability of limiting global  
1607 warming to 1.5°C has been estimated at 420 GtCO<sub>2</sub>.<sup>37</sup> However, the potential CO<sub>2</sub> emissions from reserves held  
1608 by the 200 largest public fossil fuel companies is at least 1,541 GtCO<sub>2</sub>,<sup>261</sup> whilst the carbon contained in global  
1609 resources of fossil fuels is estimated at about 11,000 GtCO<sub>2</sub>,<sup>262</sup> well beyond the maximum that can be used if the  
1610 world is to meet the Paris Agreement goals. A third of oil reserves, half of gas reserves and over 80 per cent of  
1611 coal reserves worldwide should remain unused to keep global warming below 2°C,<sup>262</sup> representing stranded  
1612 assets and unburnable carbon.<sup>249,263</sup> Future energy system scenarios with strict carbon constraints, low fossil  
1613 fuel demand, high capital costs projects and carbon-intensive reserves increase the risk of stranding assets,<sup>264</sup>  
1614 with considerable financial consequences for their owners and industry stakeholders.<sup>265</sup>

1615 Although the fossil fuel industry has begun to acknowledge that the energy system is transitioning away from  
1616 unabated oil, gas and coal, countries’ fossil fuel production plans to 2030 could exceed levels consistent with  
1617 limiting warming to 2°C by 50%, and by 120% in relation to 1.5°C.<sup>266</sup> Companies are following diverging business  
1618 strategies,<sup>267</sup> with most of them falling short of what is required to mitigate transition risks. While an increasing  
1619 number of oil and gas companies are announcing net-zero commitments, for these to be consistent with climate  
1620 ambitions they must be framed on the basis of their total emissions rather than on their emission intensities,  
1621 cover scope 1, 2 and 3 emissions, and account for activities based on a company’s full equity share.<sup>83,268</sup> Those  
1622 companies who better understand systemic risks, stress-test potential scenarios, and develop business  
1623 strategies with interim targets and investments that align adequately with well below 2°C targets (and preferably  
1624 1.5°C) are likely to become more resilient over the coming years, as climate-risk scrutiny from investors and  
1625 financial regulators increases.

---

1626

1627 [Indicator 4.2.4: Net Value of Fossil Fuel Subsidies and Carbon Prices](#)

1628 *Headline finding: 77% of the 84 countries reviewed had a net-negative carbon price in 2018.*  
1629 *The resulting net loss of revenue was in many cases equivalent to substantial proportions of*  
1630 *the national health budget*

1631 Placing a carbon price on fossil fuel use helps to reflect more accurately its negative  
1632 externalities, including its impact on health, and to encourage the transition away from fossil  
1633 fuels. However, not all countries set carbon prices, and where they are imposed, they can be  
1634 undermined by subsidies provided for fossil fuels.

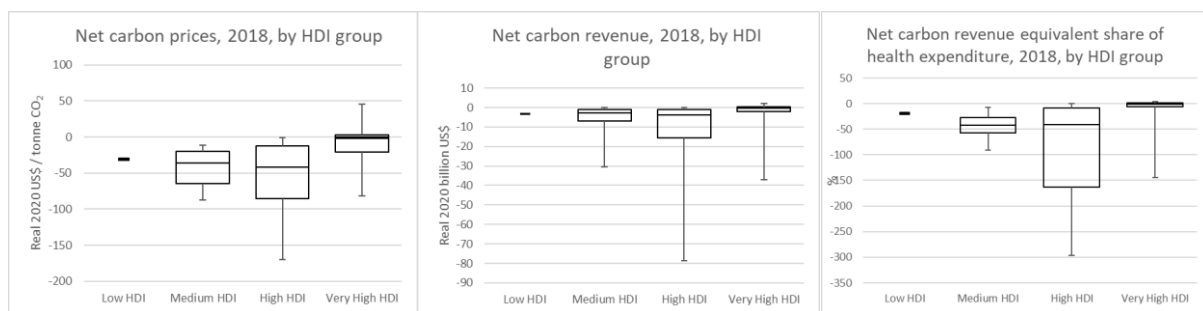
1635 This indicator compares carbon prices and fossil fuel subsidies to calculate ‘net’ economy-  
1636 wide average carbon prices and revenues. It covers 84 countries, which are responsible for  
1637 around 92% of global CO<sub>2</sub> emissions. The indicator is based on data from the IEA,<sup>269</sup> OECD,<sup>270</sup>



1638 the World Bank,<sup>271</sup> and the WHO, with methods and further analysis in the appendix (pp 162-  
1639 165).<sup>272</sup>

1640 In 2018, 65 out of the 84 countries analysed (77%) had net-negative carbon prices, reflecting  
1641 an overall subsidising of fossil fuels. The median value of the subsidy in these countries was  
1642 US\$1 billion, with some countries providing net subsidies to fossil fuels in the tens of billions  
1643 of dollars each year. 42 countries had a carbon pricing mechanism in place, but only 19  
1644 succeeded in discouraging fossil fuels with net-positive carbon prices – all of which were very  
1645 high HDI countries. Nonetheless, most very high HDI countries still had net-negative carbon  
1646 prices (Figure 23). These net subsidies are equivalent to substantial proportions of national  
1647 health spending in many countries.

1648 With low-income populations vulnerable to energy costs, removing subsidies can be a  
1649 challenge, but redirecting spending from fossil subsidy to healthcare and health-related  
1650 services would most likely deliver net benefits to their wellbeing.<sup>273</sup> Furthermore,  
1651 international financing mechanisms to support low-income countries in their transition to  
1652 sustainable energy sources are essential to safeguard all dimensions of human health.<sup>274</sup>



1653  
1654 *Figure 23. Net carbon prices (left), net carbon revenues (centre), and net carbon revenue as a share*  
1655 *of current national health expenditure (right), across 84 countries in 2018, arranged by 2019 Human*  
1656 *Development Index country group: low (n=1), medium (n=7), high (n=23) and very high (n=53). Boxes*  
1657 *show the interquartile range (IQR), horizontal lines inside the boxes show the medians, and the*  
1658 *brackets represent the full range from minimum to maximum.*

1659

1660 [Indicator 4.2.5: Production- and Consumption-Based Attribution of CO<sub>2</sub> and PM<sub>2.5</sub> Emissions](#)

1661 *Headline finding: in 2019, 18% of CO<sub>2</sub> and 17% of PM<sub>2.5</sub> global emissions were embodied in*  
1662 *trades between countries of different Human Development Index levels*

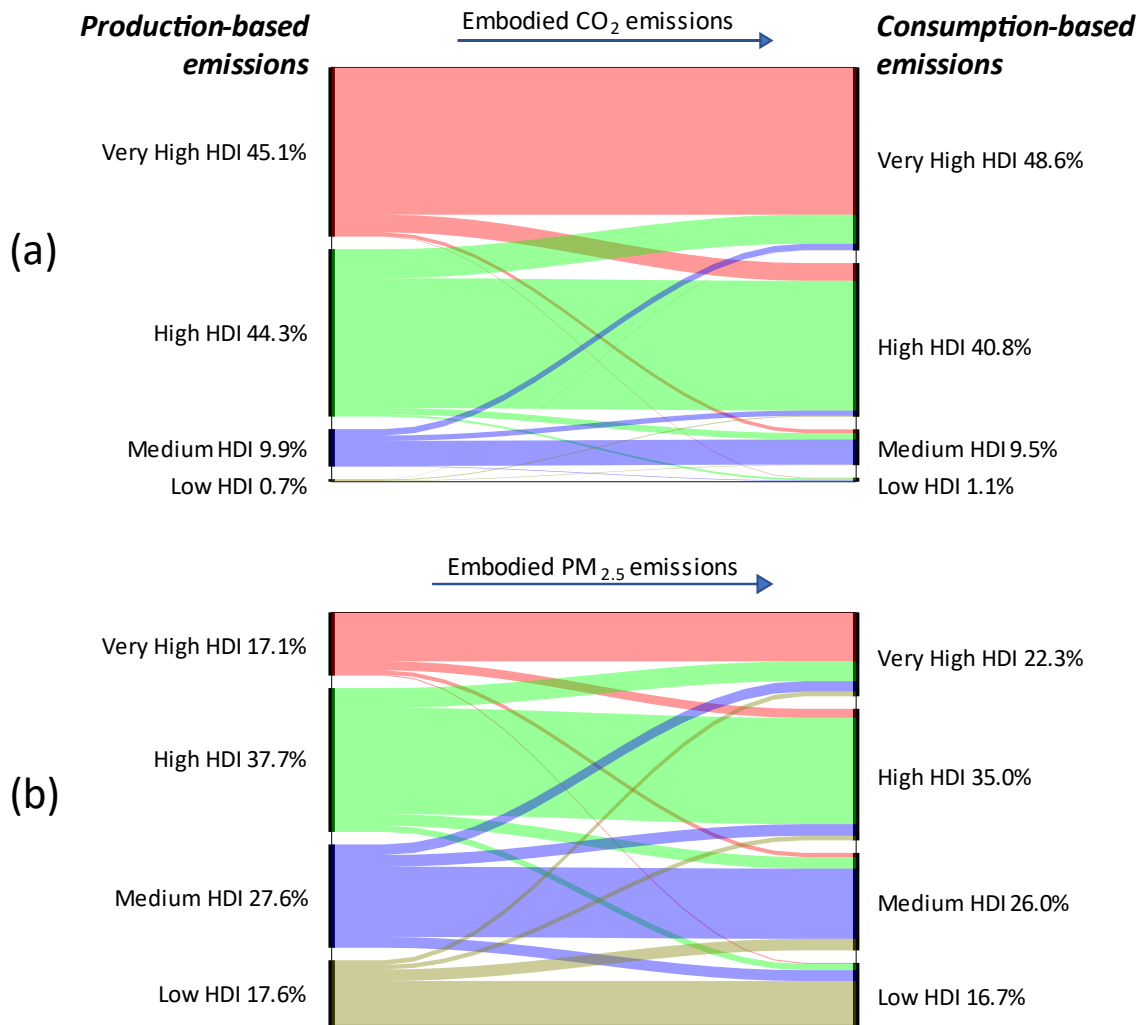
1663 The production of goods and services often drives both greenhouse gas and PM<sub>2.5</sub> emissions,  
1664 thus contributing to impacts on health and wellbeing. Emissions from local production  
1665 ('production-based emissions') occur within the geographical territories of nations through  
1666 the local production of goods and services. An alternative way of accounting for the burden

1667 of pollution is to assign the emissions to the country which is the final consumer of the  
1668 products that are made – known as ‘consumption-based emissions’. A comparison of  
1669 production- and consumption-based emissions gives a better understanding of how  
1670 emissions are embodied in global trade, which is essential to enable better international  
1671 policy formulation that protects human health in all geographies.

1672 This indicator captures the pollution burden from a country’s local production, as well as that  
1673 driven by a nation’s domestic final consumption, including the burden embedded in its  
1674 imports. It uses an EE-MRIO model and the EXIOBASE database, to estimate CO<sub>2</sub>  
1675 emissions,<sup>275,276</sup> and the GAINS model to produce a PM<sub>2.5</sub> emission inventory.<sup>277</sup> More details  
1676 on the methodology, and further analysis, can be found in the appendix (pp 166-172).

1677 In 2019, 18% of CO<sub>2</sub> (of 35.6 Gt world total) and 17% of PM<sub>2.5</sub> (of 37.4 Mt world total) global  
1678 emissions were embodied in trades among countries of different HDI levels. The largest  
1679 contributors to global consumption-based CO<sub>2</sub> and PM<sub>2.5</sub> emissions were China (28 % and  
1680 18%), the USA (17% and 5%), the EU (10% and 6%), and India (7 % and 16%). The USA did the  
1681 most ‘outsourcing’ of emissions, with 21% CO<sub>2</sub> (of 5.9 Gt total) and 49% PM<sub>2.5</sub> (of 1.7 Mt total)  
1682 emissions resulting from the production of goods it consumed, actually occurring in other  
1683 countries. In contrast, 16% of CO<sub>2</sub> (of 10.8 Gt total) and 13% of PM<sub>2.5</sub> (of 6.8 Mt total)  
1684 emissions that occurred in China resulted from the local production of goods that were  
1685 ultimately exported to consumers in other countries.

1686 The very high HDI country group contributed the most production-based (45%) and  
1687 consumption-based (49%) CO<sub>2</sub> emissions in 2019. However, the high HDI country group was  
1688 the biggest contributor to both production-based (38%) and consumption-based (35%) PM<sub>2.5</sub>  
1689 emissions (Figure 24), with the very high HDI country group the lowest emitter of PM<sub>2.5</sub>, partly  
1690 as a result of stricter local air pollution regulations. Importantly, the very high HDI country  
1691 group was the only group with higher consumption-based emissions than production-based  
1692 emissions, i.e. a net ‘outsourcing’ in terms of their consumption-related emissions.



1693  
 1694 *Figure 24. The flows of embodied CO<sub>2</sub> and PM<sub>2.5</sub> emissions among different Human Development Index*  
 1695 *country groups in 2019*

1696  
 1697 **Conclusion**

1698 The impacts of climate change on health are already having significant economic  
 1699 consequences and fall in different ways across countries of all levels of HDI. The economic  
 1700 losses of climate-related extreme events are three times higher in medium HDI countries than  
 1701 in very high HDI countries. However, the monetised value of global heat-related deaths is  
 1702 highest in Europe, and the greatest costs of premature mortality due to air pollution fall in  
 1703 countries with medium and high HDI levels. South-East Asia was the only region with  
 1704 increasing air pollution mortality costs between 2015 and 2019, relative to GDP. Extreme heat  
 1705 can create economic impacts by reducing labour capacity. In this case, those employed in low-  
 1706 wage, outdoor work in low HDI countries are likely to be most affected.

1707 Because of the potentially large and unequally distributed impacts of climate change on  
1708 human health, incomes and wellbeing, substantial and sustained investment in the low  
1709 carbon transition is required. Overall, global investments in coal power continue to decline,  
1710 although with worrying counter-trends in certain countries. Investments in renewables and  
1711 energy efficiency continue to grow, as do divestments from fossil fuel assets, however a  
1712 considerable increase in the pace of change is required.

1713 Both governments and the private sector have crucial roles to play in bringing about the  
1714 required transition. Governments across all HDI groups must address fossil fuels subsidies in  
1715 countries. Although withdrawing energy subsidies is challenging when it affects people on  
1716 low incomes, other forms of government spending, including on health services, can provide  
1717 better and more targeted support to decrease inequities and maximise wellbeing. The global  
1718 trade system means that almost a fifth of CO<sub>2</sub> and PM<sub>2.5</sub> emissions occur in the production of  
1719 goods that are subsequently traded between countries of different HDI levels. This underlines  
1720 the importance of inclusive global agreements that facilitate cooperation on policies for the  
1721 reduction of both production and consumption emissions.

1722 As governments begin to invest in recovery from COVID-19, there is a crucial window of  
1723 opportunity to reduce fossil fuel subsidies, invest more in clean energy, and support a green  
1724 recovery. Policies and regulations must be developed that subject fossil fuel companies to  
1725 greater scrutiny and ensure their alignment with a world well below 2°C.

## 1726 Section 5: Public and Political Engagement

1727 As the preceding sections make clear, climate change is damaging people’s health and  
1728 widening the fault lines of inequality, with the human costs amplified by COVID-19.<sup>9,278,279</sup>  
1729 Those least responsible for climate change are most exposed to impacts that are ‘hitting  
1730 harder and sooner’ than climate assessments indicated even a decade ago.<sup>280</sup> Action at the  
1731 speed and scale needed to meet the ambitions of the Paris Agreement requires public and  
1732 political engagement, particularly in industrialised countries where ‘the major part of  
1733 emissions originate’.<sup>281</sup> This section tracks engagement in health and climate change in the  
1734 media as well as by individuals, scientists, governments and the corporate sector.

1735 The mainstream media is a major platform for public engagement. It remains the most widely-  
1736 used source of information,<sup>282</sup> shaping public perceptions<sup>283-285</sup> and influencing the social  
1737 media agenda.<sup>286</sup> Indicator 5.1 tracks coverage of health and climate change in 67 newspapers  
1738 from 37 countries, including the *People’s Daily (Renmin Ribao)*, China’s longest-running  
1739 national newspaper and the official outlet of government.<sup>287,288</sup> The indicator also includes a  
1740 content analysis of coverage in India and the USA, focusing on ‘prestige’ newspapers with  
1741 influence on the countries’ political and economic elites.<sup>289-291</sup>

1742 Individual engagement (indicator 5.2) is tracked through individuals’ searches on Wikipedia,  
1743 the online information source with wider reach and coverage than traditional  
1744 encyclopaedias.<sup>292-294</sup> The third indicator (Indicator 5.3) tracks engagement in peer-reviewed  
1745 journals, the primary source of scientific evidence for the media, government, and the  
1746 public.<sup>295</sup>

1747 Government engagement (indicator 5.4) is tracked by statements made by national leaders  
1748 at the UN General Assembly, the policy-making body of the UN. The annual meeting opens  
1749 with the General Debate where heads of government, or their high-ranking representatives,  
1750 address the global community on issues they consider important.<sup>296,297</sup> Indicator 5.4 also  
1751 considers engagement with health in the enhanced NDCs, submitted in compliance with the  
1752 2015 Paris Agreement.<sup>298-300</sup> Panel 6 compares health engagement in the initial and enhanced  
1753 set of NDCs held on the UNFCCC NDC registry on 1 April 2021.

1754 Action by the corporate sector will be decisive in moving societies away from dependence on  
1755 fossil fuels.<sup>301-303</sup> Indicator 5.5 tracks engagement in health and climate change by companies  
1756 within the UN Global Compact, the world’s biggest corporate sustainability initiative.<sup>304,305</sup>  
1757 Companies commit to shared principles of sustainable behaviour and submit annual reports  
1758 on progress.

1759 With increasing acknowledgement of the need to recognise and investigate gender inequities  
1760 in the representation, communication, and governance of climate change,<sup>306-309</sup> engagement  
1761 with gender is incorporated where appropriate. Engagement with health, climate change and

1762 COVID-19, and analyses by WHO region and HDI country group are also included. Details of  
1763 data sources and methods for all indicators are provided in the appendix, along with  
1764 additional analyses.

1765

## 1766 [Indicator 5.1 Media Coverage of Health and Climate Change](#)

1767 *Headline finding: in 2020, the upward trend in coverage of health and climate change*  
1768 *continued, but failed to match the increase seen in 2019. In 2020, most of the coverage of*  
1769 *health and climate change referred to COVID-19*

1770 Newspapers provide an important forum for public engagement. They shape public  
1771 understanding of climate change, both through their influence on their readers and on the  
1772 wider political agenda.<sup>284,310</sup> This indicator tracks coverage of health and climate change from  
1773 2007, the year before the WHO World Health Assembly made a multilateral commitment to  
1774 protect people's health from climate change.<sup>311</sup> The indicator includes 66 newspapers  
1775 spanning 36 countries and four languages, together with an additional analysis of China's  
1776 People's Daily. The indicator also examines the content of 2020 coverage in newspapers in  
1777 India and the USA. Methods and further analysis are provided in the appendix (pp 172-195)

1778 Across the 36 countries, the upward trend in newspaper coverage of health and climate  
1779 change continued, reaching 11,371 articles in 2020. However, the rate of increase was lower  
1780 than that of 2019 – 6% from 2019 to 2020, compared with 96% from 2018 to 2019. As in 2019,  
1781 coverage was greatest in the WHO America and Europe regions and lowest in the African  
1782 region.

1783 Engagement with gender and with COVID-19 was examined in English language newspapers  
1784 across 23 countries. While the proportion of articles referring to gender increased between  
1785 2007 and 2020 (from 97 (2%) of 6,044 articles to 573 (6%) of 10,092), gender remains marginal  
1786 to the representation of health and climate change in the mainstream press. In 2020, over  
1787 60% (6,238) of the 11,371 articles referring to health and climate change also referred to  
1788 COVID-19; in April and May 2020, it was over 80%.

1789 In China's *People's Daily*, the limited coverage of health and climate change noted in earlier  
1790 *Lancet Countdown* reports was again evident in 2020. Of the 1,106 articles discussing climate  
1791 change, 2% were related to human health. Across the 2008-2020 period, no articles related  
1792 to health and climate change engaged with gender issues. In 2020, no articles discussed the  
1793 relationships between climate change and COVID-19, or how they together influenced health.

1794 Analysis of the content of coverage of health and climate change focuses on India (medium  
1795 HDI) and the USA (very high HDI). The selected newspapers, the *Times of India* and *Hindustan*  
1796 *Times* along with the *New York Times* and *Washington Post*, form part of the 'prestige' press,

1797 seen to exercise influence on political and economic elites and on the wider policy  
1798 agenda.<sup>291,312</sup>

1799 One set of themes related to the health impacts of climate-related hazards, including  
1800 heatwaves and wildfires. For example, the *New York Times* (18 June), noted that “people with  
1801 health issues, older people and young children are especially susceptible to the effects of  
1802 extreme heat [and...] it’s a threat that grows as climate change continues”.<sup>313</sup> Another set of  
1803 themes related to the spread of infectious disease, including COVID-19. For example, the  
1804 *Hindustan Times* (25 February) reported that “climate change may revert back successes of  
1805 controlling infectious diseases” with “consensus among scientists that there has been a rise  
1806 in zoonotic diseases - Nipah, Ebola, Zika, Corona viruses - in recent decades ... driven by  
1807 biodiversity loss and climate change”.<sup>314</sup> As this last comment indicates, climate change and  
1808 environmental change are often linked together; scientific reports (including the *Lancet*  
1809 Countdown reports) are cited as evidence that “we are close to running out of time —  
1810 approaching a point of no return for human health, which depends on planetary health” (*New*  
1811 *York Times*, 28 April).<sup>315</sup>

1812

## 1813 [Indicator 5.2: Individual Engagement in Health and Climate Change](#)

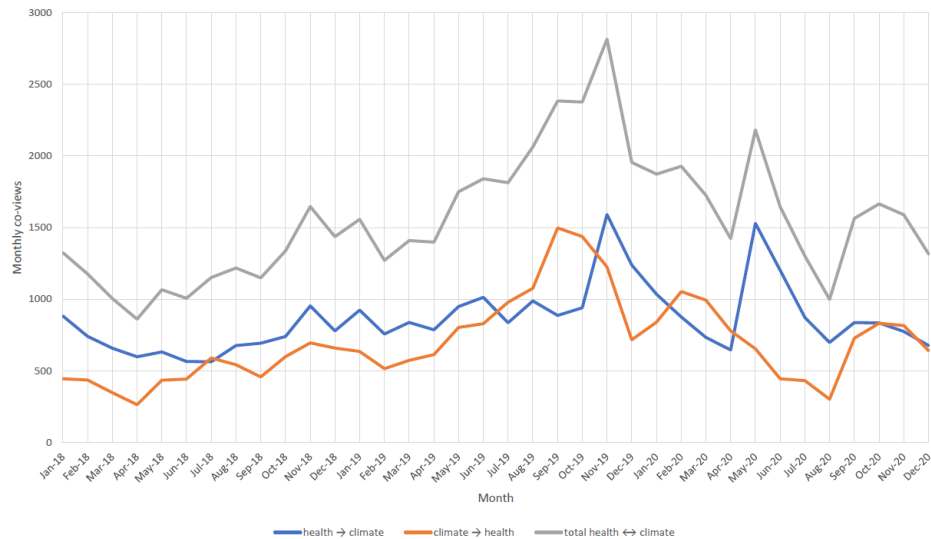
1814 *Headline finding: individual information-seeking about health and climate change decreased*  
1815 *overall by 15% from 2019 to 2020; spikes in engagement in mid-2020 were almost exclusively*  
1816 *due to interest in pandemic-related content*

1817 Individual engagement in climate change and health is tracked through the digital footprint  
1818 of users of the online encyclopaedia, Wikipedia. Wikipedia has outpaced traditional  
1819 encyclopaedias in terms of reach, coverage, and comprehensiveness and is one of the most-  
1820 visited websites worldwide.<sup>292,316,317</sup> The analysis is based on the English-language Wikipedia  
1821 which represents around 50% of global traffic to all Wikipedia language editions.<sup>318,319</sup>

1822 The indicator focuses on ‘clickstream’ activity, where an individual clicks between an article  
1823 on health and climate change (or vice versa). Because clickstream activity captures only pairs  
1824 of sequential visits, for the 2021 report, the set of articles was extended to include a wider  
1825 range of health and climate change articles. In 2020, as in previous years, individuals seldom  
1826 moved between health and climate change; instead, co-click activity was predominantly  
1827 within the set of articles on health or climate change.

1828 Figure 25 tracks co-click activity from 2018 to 2020, looking separately at the volume  
1829 generated by clicks on a climate-related link in a health-related page, vice versa, and the sum  
1830 of both. Overall numbers are very low, confirming that engagement in either climate change  
1831 or health rarely triggers engagement in the other topic. Further, the volume of health-climate  
1832 co-views fell in 2020 by 15%, reversing the upward trend evident in 2019. When co-clicks to

1833 an article relating to COVID-19 are excluded, the downward trend in 2020 becomes even  
 1834 more pronounced. The spike in co-clicks in mid-2020 was almost exclusively due to interest  
 1835 in pandemic-related content, which then sparked interest in climate change, whereas the rise  
 1836 over September/October was generated by an initial interest in climate change.



1837

1838 *Figure 25. Aggregate monthly co-clicks on Wikipedia articles related to human health and climate*  
 1839 *change, 2018—2020. Blue: co-click from health-related page to climate-related page. Orange:*  
 1840 *co-click from climate-related page to health-related page. Grey: sum of all health and climate co-click*  
 1841 *activity.*

1842

1843 **Indicator 5.3: Coverage of Health and Climate Change in Scientific Journals**

1844 *Headline finding: original research on health and climate change increased eleven-fold*  
 1845 *between 2007 and 2020, driven primarily by scientists in countries of the highest Human*  
 1846 *Development Index levels. Gender remained marginal to research on health and climate*  
 1847 *change across the period. In 2020, 7% of health and climate change articles referred to COVID-*  
 1848 *19*

1849 Scientific evidence is a key resource for the media, individuals and governments, and is  
 1850 playing a critical role shaping public and political engagement in health and climate  
 1851 change.<sup>294,320</sup> The indicator is based on searches in OVID Medline and OVID Embase, using  
 1852 references to health and climate change in article titles and abstracts, with methods and  
 1853 further analyses provided in the appendix (pp 218-231).

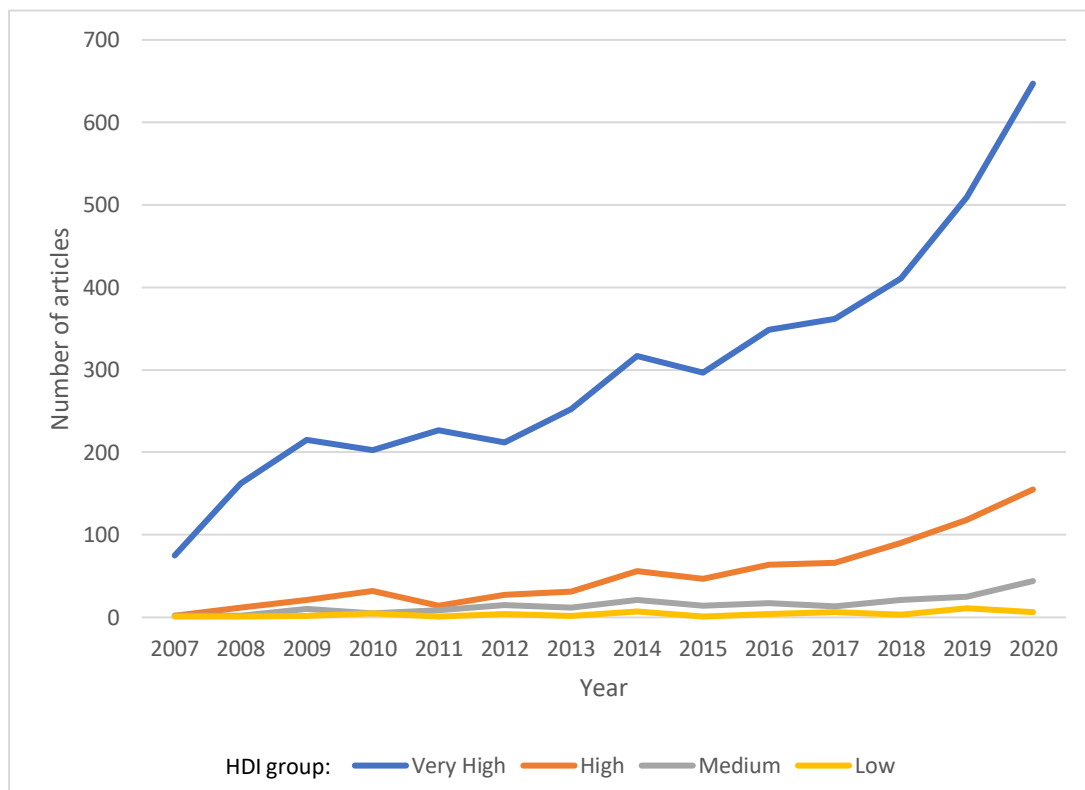
1854 The upward trend in scientific engagement in health and climate change noted in previous  
 1855 *Lancet* Countdown reports has been maintained, with the number of articles on health and  
 1856 climate change increasing by 28% between 2019 and 2020, to reach its highest recorded level



1857 of 858 articles. The trend is driven by the rapid increase in original research (primary studies  
1858 and systematic reviews), which increased by 32% between 2019 and 2020. Research-related  
1859 articles (e.g. evidence reviews, editorials, letters) also increased, but at a lower rate.

1860 Increasing scientific engagement in health and climate change is driven by very high HDI  
1861 countries (Figure 26); 76% of the total output in 2020 was led by researchers in this group. In  
1862 contrast, scientists in low HDI countries were lead authors of just 1% of journal articles.

1863



1864  
1865 *Figure 26. Scientific journal articles relating to health and climate change, 2007-2020, by 2019*  
1866 *country Human Development Index country group*

1867

1868 In 2007/08, under 2% of health and climate change articles engaged with gender in some way;  
1869 in 2020, the proportion was 6%. Similarly, 2020, only 7% of the articles on health and climate  
1870 change addressed COVID-19, suggesting this rise in scientific research in health and climate  
1871 change is independent of the concurrent global health crisis. Articles engaging with gender  
1872 and with COVID-19 were predominantly led by scientists in the very high HDI countries.

1873

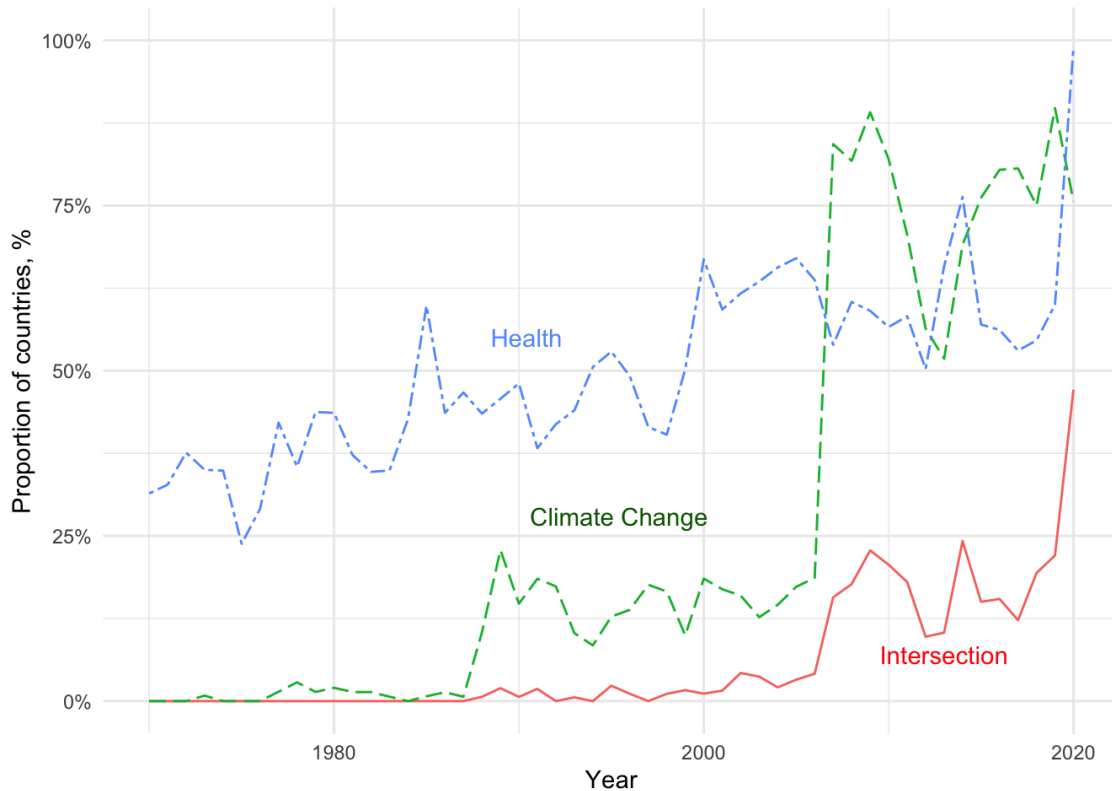
1874 Indicator 5.4: Government Engagement in Health and Climate Change

1875 *Headline finding: in 2020, 47% of government leaders engaged with the health dimensions of*  
1876 *climate change in their statements at the UN General Debate, more than double the*  
1877 *proportion in 2019. The increase was linked to engagement with the COVID-19 pandemic*

1878 Government leadership, backed by strong near-term policies, is required if the increase in  
1879 global temperature is to be halted.<sup>16</sup> This indicator examines government engagement with  
1880 health and climate change in the UN General Debate (UNGD). Engagement with health in  
1881 commitments to emissions reduction made by governments under the 2015 Paris Agreement  
1882 is also considered in panel 6.

1883 The UNGD opens each new session of the UN General Assembly. It provides all UN member  
1884 states with an opportunity to address the global community on priorities for action. Among  
1885 many global challenges, including economic recession and social conflict, the indicator  
1886 captures whether government leaders draw attention to health and climate change. Analysis  
1887 is based on the application of a key word search in the United Nations General Debate corpus  
1888 using natural language processing,<sup>321,322</sup> with 8,288 statements analysed across 1970-2020.

1889 Figure 27 tracks the proportion of countries referring to health and climate change in their  
1890 UNGD statements between 1970 and 2020. In 2020, the proportion of countries engaging  
1891 with the health dimensions of climate change reached the highest recorded level, increasing  
1892 from 22% (43 countries) in 2019 to 47% (91 countries) in 2020. Additionally, and for the first  
1893 time in the UNGD, every member state referred to health in their 2020 address – a reflection  
1894 of the ongoing global pandemic.



1895  
1896 *Figure 27. Proportion of countries referring to climate change, health, and the intersection between*  
1897 *the two in their UNGA statements, 1970-2020*

1898 Increased engagement in health and climate change is linked to discussion of the COVID-19  
1899 pandemic, represented by government leaders as both a threat and an opportunity. The  
1900 pandemic highlights “the vulnerabilities of our societies [to]...global disasters...lurking just  
1901 around the corner... [like] climate change” (Austria). It also presents an opportunity to tackle  
1902 the climate crisis: “our recovery from this pandemic must mark a transition to a decarbonized,  
1903 climate-resilient economic system” (Fiji).

1904 Engagement in health and climate change continues to be led by countries in the low HDI  
1905 group and, in particular, by the SIDS.<sup>299,300</sup> For the SIDS, COVID-19 has amplified the risks of  
1906 climate change: “our unique circumstances and consequent vulnerabilities have left us  
1907 exposed to the ravages of the twin crises of the pandemic and climate change” (St Lucia). In  
1908 2020, 75% of the SIDS discussed health and climate change in the 2020 UNGA. However, 2020  
1909 also saw greater engagement among higher-income countries. A key issue is whether this  
1910 pandemic-related increase in engagement among richer countries will be maintained in  
1911 future years.

1912 =====

1913  
1914 *Panel 6: The place of health in the enhanced NDCs*

1915 The 2015 Paris Agreement is the only global framework for reducing greenhouse gas emissions to protect  
1916 people’s health.<sup>1</sup> Countries committed to emissions reductions via Nationally Determined Contributions (NDCs),  
1917 to be enhanced every five years. In 2015/16, 185 countries, including an EU submission for 27 countries,  
1918 submitted initial NDCs. By July 2021, 87 countries, including an EU submission for 26 countries, had submitted  
1919 enhanced or new NDCs.<sup>323</sup>

1920 Compared with their initial NDCs, the proportion of countries referring to health increased, from 56% (49) to  
1921 91% (79). However, health engagement remained low. Overall, in both initial and enhanced NDCs, under 3% of  
1922 the text related to health; in the enhanced NDCs, this represented an average of 240 of 10466 words. Of the  
1923 references to health, 30% (249 references) noted health impacts, challenges or risks; for example, “the Kenyan  
1924 economy is dependent on climate-sensitive sectors, such as rain-fed agriculture, water, energy, tourism, wildlife,  
1925 and health, whose vulnerability is increased by climate change” (Kenya, updated submission). A further 25%  
1926 (210) related to health sector adaptation; for example, climate change “threatens the ability of health  
1927 institutions and organizations to maintain and improve health services into the future” (Marshall Islands, second  
1928 submission).

1929 The enhanced NDCs demonstrate an increased engagement with gender, health, and climate change with 9  
1930 (10%) NDCs making a meaningful connection compared with just 2 (2%) in their initial contributions. The  
1931 majority of these are references to the specific impact of climate change on women; for example, “further strain  
1932 on the workload of women and climate change related stress during pregnancy could contribute to low birth  
1933 weight, leading to increases in risks of undernutrition and non-communicable diseases” (Cambodia, updated  
1934 submission).

1935 In summary, while health engagement remains low, there is greater recognition that climate change takes a  
1936 disproportionate toll on women.

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1937 Indicator 5.5: Corporate Sector Engagement in Health and Climate change

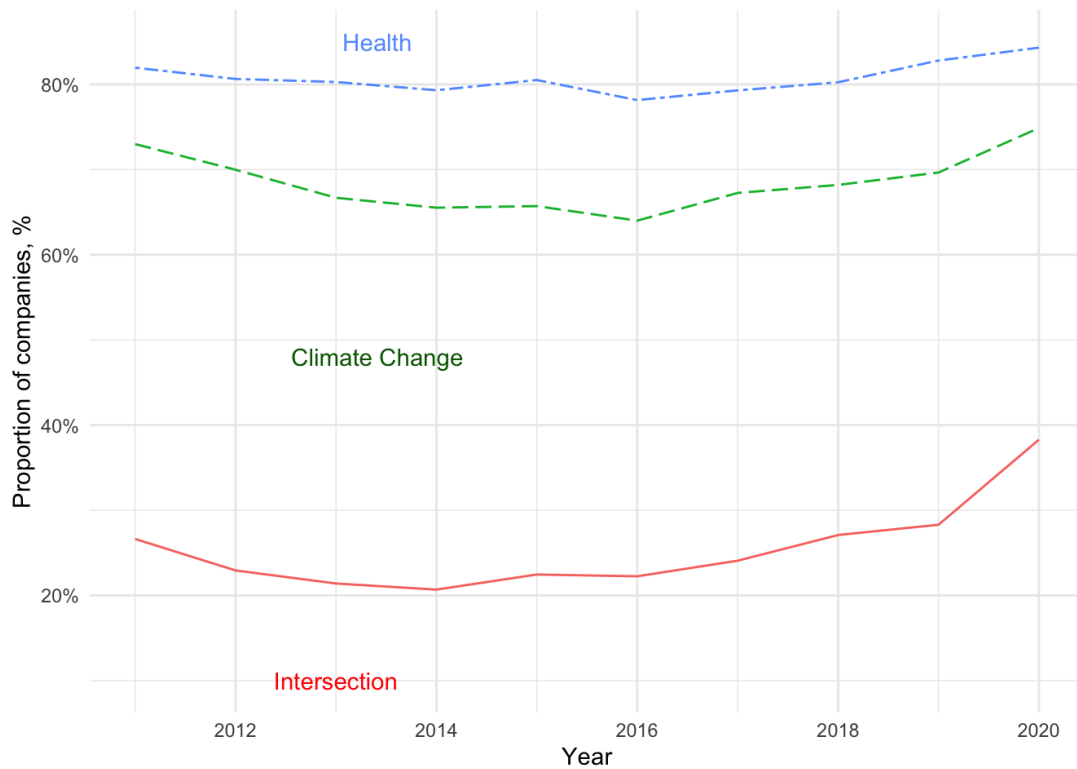
1938 *Headline finding: in 2020, engagement in health and climate change increased to its highest*  
1939 *level among companies in the UN Global Compact. Over a third (38%) of companies referred*  
1940 *to the health dimensions of climate change in their 2020 progress reports*

1941 The indicator tracks engagement in health and climate change among companies signed up  
1942 to the UN Global Compact, established to promote corporate social and environmental  
1943 responsibility,<sup>304</sup> although its effectiveness has been critiqued, with the suggestion that  
1944 membership could be a form of ‘greenwashing’ and ‘bluewashing’ for some companies.<sup>324</sup>  
1945 The Compact represents over 12,000 companies from 160 countries, with each submitting an  
1946 annual Communication on Progress (GCCOP) against a set of social and environmental  
1947 principles.

1948 The indicator is based on the application of a key word search in the text corpus of 17,984  
1949 GCCOP reports submitted in English between 2011 and 2020.<sup>304</sup> In the 2019 and 2020 *Lancet*  
1950 *Countdown* reports, the focus was on the healthcare sector. This report considers corporate  
1951 engagement across all sectors.

1952 Figure 28 tracks engagement in health and climate change in annual GCCOP reports from  
1953 2011 to 2020. As it indicates, the large majority of reports refer to health (84% of 2029 reports  
1954 in 2020) and climate change (75%) as separate topics. In contrast, only a minority made  
1955 reference to the health dimensions of climate change (38% in 2020). However, it represents  
1956 a large increase from 2014, the low point of engagement, when only 21% of corporations  
1957 made reference to the intersection between climate change and health. Three sectors stand  
1958 out for their high levels of engagement in health and climate change: food and drug retailers,  
1959 oil and gas producers, and alternative energy. In 2020, over 70% of corporations in these  
1960 sectors made reference to health and climate change; in the healthcare sector, the proportion  
1961 was only 37%.

1962 Additional analyses examined references to gender in the GCCOP reports engaging with  
1963 health and climate change. Only a minority additionally referred to gender. However, the  
1964 proportion increased from 2014 to 2019, with a particularly sharp rise (to 19%) in the 2019  
1965 report. In 2020, gender engagement fell to 13% (see appendix pp 249-264).



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Figure 28. Proportion of companies referring to climate change, health, and the intersection of health and climate change in their UN Global Compact Communication on Progress (GCCOP) reports, 2011-2020.

## Conclusion

Public and political engagement is essential if the ambitions of the Paris Agreement are to be realised.<sup>16</sup> Section 5 has focused on five areas of engagement: the media, the public, the scientific community, national government and the corporate sector. Three conclusions can be drawn.

Firstly, health and climate change are increasingly addressed together. The trend is particularly pronounced for indicators relating to the media, science, government and the corporate sector. In all these areas, engagement with health and climate change reached its highest recorded level in 2020. Gender is rarely integrated into engagement within the health-climate change nexus, although there is increased recognition in countries' enhanced NDCs.

Secondly, the COVID-19 pandemic appears to be a major driver of engagement in 2020. For example, over half of newspaper coverage of health and climate change was linked to COVID-19 and individual engagement in health and climate change was largely sustained by searches for articles related to COVID-19. Government engagement in the health dimensions of climate

1986 change was similarly underpinned by engagement in the pandemic. It remains to be seen if  
1987 the heightened engagement in health and climate change will be maintained if and when the  
1988 pandemic-related crises are contained.

1989 Thirdly, social inequities remain deeply etched into public and political engagement. In the  
1990 media and in science, coverage of health and climate change engagement is greatest in the  
1991 very high HDI countries, the group exerting the greatest pressure on the planet but relatively  
1992 protected from the health impacts of climate change. Meanwhile, medium and low HDI  
1993 countries have much smaller carbon and environmental footprints – yet, are shouldering the  
1994 immediate burden of climate change, and are far less represented in the scientific literature.  
1995 As in previous years, the SIDS are leading global engagement with the health impacts of  
1996 climate change at the UN General Debate. What is required is for their leadership to be  
1997 matched by a decisive break with ‘business as usual’ by countries and communities  
1998 contributing most to climate change.

## 1999 Conclusion: the 2021 Report of the *Lancet* Countdown

2000 The 2021 report of the *Lancet* Countdown finds a world overwhelmed by an ongoing global  
2001 health crisis, while it has made little progress to protect its population from the  
2002 simultaneously aggravated health impacts of climate change. The inequities of these impacts  
2003 and the response, including those of gender, are brought into sharp focus within each of the  
2004 indicators presented. This exposes the urgent need for collection of standardised data to  
2005 capture inequities and vulnerabilities (panel 2).

2006 Climate-sensitive infectious diseases are of increasing global concern and the environmental  
2007 suitability for the transmission of all infectious diseases tracked is rising (indicator 1.3.1). For  
2008 non-cholerae *Vibrio* bacteria, the environmental suitability for transmission in northern  
2009 latitudes increased by 56% since the 1980s. The number of months suitable for malaria  
2010 transmission has increased by 39% in highland areas of the low HDI country group and, over  
2011 the past 5 years, the environmental suitability for the transmission of emerging arboviruses  
2012 – dengue, chikungunya and Zika – was between 7% and 13% higher than in the 1950s.

2013 The high temperatures in 2020, a year that tied with 2016 as the hottest year on record,  
2014 resulted in extreme heat-related health impacts, affecting the emotional and physical  
2015 wellbeing of populations around the world (indicators 1.1.1-1.1.6). These higher  
2016 temperatures and altered weather patterns are also leading to more frequent extreme  
2017 weather events and increased wildfire exposure (indicators 1.2.1, 1.2.2 and 1.2.3), and are  
2018 putting years of progress on food and water security at risk in many parts of the world. The  
2019 five years with the greatest area of the world's surface affected by droughts have all occurred  
2020 since 2015 (indicator 1.2.2), the yield potential of all major staple crops continues to fall as a  
2021 result of the rising temperatures (indicator 1.4.1), and 79% of all potential work hours lost to  
2022 extreme heat in low HDI countries occurred in the agricultural sector in 2020 (indicator 1.1.4).

2023 However, measures to curb emissions have been grossly inadequate. Emissions are declining  
2024 too slowly or heading in the wrong direction in the highest emitting sectors (indicators 3.1,  
2025 3.4 and 3.5.1). This delay in progress is contributing to millions of deaths each year due to  
2026 exposure to indoor and ambient PM<sub>2.5</sub> pollution, and due to high-carbon, unhealthy diets  
2027 (indicators 3.2, 3.3 and 3.5.2). Importantly, these impacts manifest differently between HDI  
2028 country groups and genders, underscoring profound inequities.

2029 Despite years of scientific reporting on climate change impacts, efforts to build resilience have  
2030 been slow and unequal, with countries of low levels of Human Development Index the least  
2031 prepared to respond to the changing health profile of climate change, and funding remaining  
2032 a consistent challenge (indicators 2.1.1, 2.3.1, and 2.4). At the same time, 65 out of 84  
2033 countries reviewed continue to provide subsidies for fossil fuels that outweigh any revenue



2034 received from carbon pricing instruments. The resulting ‘net carbon subsidy’ is in many cases  
2035 equivalent to substantial proportions of countries’ national health budgets (indicator 4.2.4).

2036 Governments with the fiscal capacity have responded to the COVID-19 pandemic with  
2037 massive spending packages, to cushion the impacts of the crisis and start to bring about  
2038 economic recovery. But as the world approaches COP26, the response to climate change, and  
2039 commensurate investment, remains inadequate. The opportunity for the green recovery is in  
2040 danger of being missed. A fossil-fuel driven recovery, whilst potentially meeting narrow and  
2041 near-term economic targets, could push the world irrevocably off course for the ambitions of  
2042 the Paris Agreement, with enormous costs to human health.

2043 With government leaders more engaged with the health dimensions of climate change than  
2044 ever before (indicator 5.4), countries across the globe must pursue low carbon economic  
2045 recovery pathways, implementing policies that reduce inequities and improve human health.  
2046 The *Lancet* Countdown indicators show the evidence to support the urgency and opportunity  
2047 of this transition, and that none of us is safe until everyone is safe.

2048

## 2049 Contributors

2050 The Lancet Countdown and the work for this paper was conducted by five working groups,  
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2052 sections. All authors contributed to the overall paper structure and concepts, and provided  
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2063 We declare no competing interests.

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