THE GLOBAL CLIMATE & HEALTH ALLIANCE

Tackling climate change could be the greatest global health opportunity of the 21st century

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Key findings

- **Climate change and the collapse of biodiversity are the biggest global health threats of the 21st century.** Direct climate change impacts are expected to cause ~ 250,000 additional deaths a year between 2030 and 2050, with the health costs estimated at USD 2-4 billion a year by 2030. This could increase up to 24 million deaths a year if mitigation and adaptation measures are not taken. The drivers of climate change – principally fossil fuel emissions – pose a heavy burden, contributing to the seven million deaths from air pollution annually. By 2070, between two and three-and-a-half billion people are predicted to reside in areas unlivable due to heat.
- **Climate change will make heatwaves and other extreme events more deadly.** It will also make air pollution worse, increase the spread of infectious diseases and lead to the breakdown of food systems. The Global South will continue to be hit hardest by infectious disease, while communities in Europe are highly vulnerable to heatwaves due to an ageing and urban population.
- **By the end of the century, the health and well-being of billions could be impacted.** By 2050, 80 million more people could face hunger, particularly in sub-saharan Africa, and by 2100 projected sea level rise of one metre could threaten to displace up to 565 million people. Meanwhile, nearly one billion people could face heat stress and almost 90% of the population could be at risk of exposure to malaria and dengue. There is a great need for health professionals to become trusted voices in support of global efforts to reduce emissions and protect people from the threat of climate change. Health professionals, like climate scientists, can help design climate policies that improve health outcomes and human well-being, adapt to climate impacts, and communicate the need for an accelerated response.

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- **Integrating health into climate change policies offers a major opportunity to reduce emissions and improve public health.** Health and science professionals are well placed to act as a bridge between policymakers and society, working together to push for more ambitious climate policies on everything from the energy to the land sectors. Mitigation policies to limit temperature rise to 1.5°C, for example, could prevent ~150 million premature deaths over the course of the century.

- **Health cost savings from well-designed climate mitigation and adaptation policies can substantially offset the costs of climate action.** Globally, the health co-benefits from decarbonisation alone will more than offset the entire costs of implementation. Meeting the goals of the Paris Agreement could save over one million lives a year worldwide by 2050 from air pollution alone. Following multiple crises, as the world faces a critical juncture, there is an opportunity to align and deliver a triple win — one that improves public health, creates a sustainable economy and protects the environment.

Introduction

The world has already warmed by an average of 1.1°C compared with pre-industrial levels, making climate change the biggest global health threat of the 21st century. Its harmful effects spread across every country and income group, threatening the food, air, water and shelter that society depends on. The health of more vulnerable, marginalised and disempowered people tends to be harmed first and worst.

Over the years, climate scientists have warned that without transformational action, temperatures will keep rising and impacts will worsen. The most comprehensive estimate by WHO predicts that, between 2030 and 2050, climate change could cause approximately 250,000 additional deaths each year, of which more than half are projected for Africa. The direct health costs could be USD 2-4 billion a year by 2030. However, the death figure is likely to be much higher, because it fails to account for other climate-related factors.[1] For example, climate change can reduce food production, leading to a total of 529,000 adult deaths between 2010-2050. Similarly, up to 130 million people will be pushed into extreme poverty by climate change by 2030, making them more vulnerable to its health impacts. Countries are already estimating the cost to health to be much higher, for example USD 820 billion annually in the US.

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There is a great need - and an extraordinary opportunity - for health professionals to become trusted voices in support of global efforts to reduce emissions and protect people from the threat of climate change. Health professionals are increasingly engaged on the issue - from working with communities impacted by extreme weather events to taking steps to reduce emissions from health systems. A survey of 4,654 health professionals found that "most of them felt a responsibility to bring the health effects of climate change to the attention of the public (86% somewhat or strongly agreed) and policymakers (90% somewhat or strongly agreed)". Health professionals, like climate scientists, can help design climate policies that improve health and human well-being, reduce emissions and adapt to climate impacts.

Coordinated and transformational action is key to reducing the burden of ill health, enhancing resilience and addressing global inequality. Following compounding crises, the world faces a critical moment to align and deliver a triple win - one that improves public health, creates a sustainable and equitable economy, and protects the environment.

[1] Such as population displacement, disruption of healthcare services and reductions in farmers productivity.

Climate change will damage health

Climate change impacts human health both directly - through extreme weather - and indirectly, for example by worsening air pollution, increasing vector-borne and other infectious diseases, and undernourishment. While no one is immune, vulnerable, marginalised and disempowered communities tend to suffer the most.

Because climate change affects many of the social and environmental determinants of health, climate change will continue to undermine public health. To tackle the exacerbating crises, we need to build in more health system resilience. The health community will play a critical role in the response to climate change, according to the WHO, which points to major risks including the severity and frequency of extreme weather, potential food system breakdowns, drought, and increased risk of violent conflict associated with resource scarcity.

1. Climate change will make heatwaves and other extreme weather events more deadly.

- **The frequency, duration and intensity of heatwaves are increasing at an alarming rate.** There have been more and longer heatwaves and they are now one of the key causes of weather-related deaths. High temperatures also raise ozone levels and other pollutants in the air, which can increase the risk of cardiovascular, respiratory and renal diseases.
- **Heat extremes reinforce existing health inequalities.** Exposure and heat-related deaths among vulnerable populations are growing, particularly for women, young children and elderly people. In 2021, adults older than 65 years and children younger than one were exposed to 3.7 billion more heatwave days than on average annually in 1986-2005. Heat-related deaths for elderly people also increased by 68% in the last 20 years. The threat is worse in disadvantaged communities. For example, a study done in Southern California found that residents in low-income areas were less likely to use air conditioners when temperatures got hot, putting them at heightened risk. Losses from human-caused extreme heat were estimated at USD 5-29 trillion between 1992-2013, amounting to a 6.7% reduction in GDP in low-income countries and a 1.5% decline in high-income countries. The financial cost of global heat-related mortality was estimated to be USD 144 billion in 2021, equivalent to the average income of 12.4 million people. Communities in Europe are highly vulnerable to heat-related deaths due to Europe's ageing and urban population, with projections that the number of people at high risk of mortality will triple at 3°C compared to 1.5°C warming.

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- **Extreme heat and drought increase the risk of wildfires**. In the last decade, on average almost 47% of global land area was affected by at least one month of extreme drought each year - an increase of 29% from the period 1951-60. Some areas of the Middle East and North Africa experienced more than 10 extra months of extreme drought. Exposure to very high or extreme fire danger increased in 110 (61%) of 181 countries, with people experiencing an average of nine more days of exposure globally in the last 20 years. Wildfires not only cause deaths and environmental devastation, but their smoke increases heart and lung damage as well as the displacement of communities.
- **Heat stress affects people's ability to work outdoors, reducing productivity and economic output.** In 2021, heat-related reduction in labour capacity resulted in earnings losses equivalent to an estimated 5.6% of GDP in the lower-middle-income countries tracked. At least 470 billion hours of potential labour capacity were lost, marking a 37% increase from the past 30 years, with 87% of the losses in low human

development index countries occuring in the agricultural sector. The International Labour Organisation (ILO) warned in 2019 that heat stress from climate change could destroy the equivalent of 80 million jobs worldwide, with construction and agriculture workers - mostly women - primarily affected. Just in India, the equivalent of 34 million full-time jobs could be lost due to heat stress by 2030. High heat can also threaten health by reducing opportunities for physical activity. Compared to 1991–2000, the number of annual hours of high-risk of heat stress during light outdoor physical activity increased globally in 2012–21 by an average of 238 (42%) hours per person.

- **Occurrence of extreme heat and other weather events is also taking a growing toll on mental health**, particularly on children and adolescents. A recent national poll found more than half of Australians who experienced a climate change-fuelled disaster since 2019 feel their mental health has been impacted.
- **In the future, each additional unit of warming is projected to increase heat-related mortality.** Even if warming is limited to 1.5°C, twice as many megacities (such as Lagos and Shanghai) are likely to become heat stressed, exposing upward of 350 million more people by 2050. With warming of 2°C, it's likely that one billion people will be affected by extreme heat stress - a fifteenfold increase from today.
- Since the 1990s, weather-related disasters have increased. **In 2021, these events caused economic losses of USD 253 billion.** In the future, climate change will lead to more extreme weather events with increasingly widespread health impacts. By the end of the century, for example, a projected sea level rise of one metre could displace up to 565 million people, exacerbating the risk of death, injury, ill-health, water contamination and the disruption of livelihoods in low-lying coastal regions and small islands.

2. Climate change can worsen air pollution, leading to more deaths and respiratory diseases.

- **Air pollution is the fourth main contributor to death, cardiovascular and respiratory diseases worldwide.** The WHO estimates that every year nearly seven million people die from exposure to outdoor and household air pollution. In 2019, 99% of the world's population lived in areas where WHO air quality guideline levels were not met. Premature mortality from air pollution cost USD 2.3 trillion in 2020, equivalent to 2.7% of gross world product.
- **Air pollution disproportionately affects vulnerable populations**. Eighty-nine per cent of deaths from ambient air pollution occur in low-income and middle-income countries. In the US, communities of colour and other minorities bear a disproportionate burden from air pollution - more than 72% of African Americans live in areas that violate federal air pollution standards, and Hispanic people in the US are exposed to 63% more air pollution than White people. Children are especially vulnerable, as exposure to air pollution in early childhood can lead to reduced lung capacity and disease.
- **Increase in wildfire frequency and severity due to climate change can further impact health.** Exposure to wildfire smoke increases the risk of respiratory and cardiovascular disease, particularly for those with pre-existing conditions. A recent study found that exposure to wildfire smoke drove up respiratory hospitalisations as much as 10% in Southern California from 1999 to 2012. The elderly and young children are most vulnerable, with the particles in wildfire smoke being 10 times more harmful to children than particulate matter from other sources.

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- **Air pollution and climate change often share the same causes** (e.g. burning of fossil fuels, wildfire smoke and emissions from agriculture). Burning fossil fuels releases greenhouse gases (GHG) that warm the atmosphere, and ambient particulate matter (PM2.5), causing 3.6 to 8.7 million deaths every year.
- **Climate change can also worsen air pollution.**[2] For example, ozone-related deaths are projected to increase, and with a rise in warming to 1.5°C, could increase from 382,000 deaths in 2000 to over 1.9 million globally by 2100. Climate change also contributes to increased levels of plant and fungal allergens, triggering more asthma attacks.

[2] Particulate Matter-related mortality could increase or decrease depending on climate projections and emissions assumptions.

3. Disease transmission is likely to increase.

- **Climate change drives changes in weather patterns and extreme weather events, creating the conditions for infectious diseases to** emerge and spread**.** For example, in 2015-2019, climate suitability for the transmission of malaria increased by 39% and 150% for regions in Africa and the Western Pacific, respectively, compared to the 1950s. From 1951-60 to 2012-18, the global climate suitability for the transmission of dengue fever increased by 11.5%-12% for mosquito species Aedes aegypti and Aedes albopictus. These mosquitoes are also the principal vectors for Chikungunya, Yellow Fever and Zika virus. Climate change has already exacerbated 58% of infectious diseases.
- **The higher the warming, the greater the health risks.** Climate change has already contributed to the spread of some vector-borne diseases. Vector-borne diseases, such as malaria, dengue, chikungunya, yellow fever, Zika virus disease, affect mainly tropical and subtropical low- and middle-income countries, but, developed countries will also be increasingly affected. In the future, climate change will make conditions even more suitable for diseases to spread, reaching previously unaffected areas. By 2080, under high emission scenarios an additional 4.7 billion people could risk exposure to malaria and dengue fever under extreme global warming. The range of West Nile, Lyme disease and other tick-borne diseases are expected to increase in parts of North America and Europe.
- **Health inequities are also clear in deaths caused by vector-borne diseases** (those spread by other animals). Deaths are about 300 times higher in developing countries than in developed countries.
- **Climate change is likely to cause substantial future pandemic risk** by driving movement and contact between people, wildlife, reservoirs and vectors, plus the spread of their pathogens. The COVID-19 pandemic is not directly driven by climate change, but it has shown the world how pandemics can wreak havoc on the world's healthcare systems, economies and people's lives. The chance of experiencing a similar pandemic could triple in the coming decades, in part due to climate change.

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4. Climate change exacerbates the risk of food insecurity and the breakdown of food systems.

- **Rising temperatures and extreme weather events are decreasing yields**, making it harder to increase or even maintain global food production. A recent study found that climate change decreased the productivity of the global agricultural system by 21% since 1961. Growth seasons in 2020 were on average nine days shorter for maize and six days shorter for wheat than in 1981-2010. The global yield potential for major crops declined by an estimated 1.8%-6% during the same period. Countries in the subtropics and tropics are most vulnerable to crop yield declines with women, the young, elderly and poor most at risk from the consequences. Nutrition levels of food (e.g. protein, zinc, iron) are also expected to decline, putting countries at very severe risk of increased hunger and malnutrition, especially low-income nations.

- **In the future, for every degree celsius of additional temperature rise, global crop yields will decline and become more variable.** As extreme weather events become more frequent, multi-breadbasket failures - i.e. simultaneous shocks to production in a number of key food producing regions affecting global production - could happen every 10 years. Supply chain disruption paired with extreme weather in multiple countries over the past year has already contributed to a projected doubling of the number of food insecure people, to 345 million.

- **Declining food availability and nutritional content is likely to further increase costs globally, with low-income consumers particularly at risk from higher food prices.** This can lead to hunger, micronutrient deficiencies and increased diet-related mortality. For example, in the 2°C scenario, by the end of the century there would be between 20-40 million more people undernourished compared to a 1.5°C scenario.[3] Also, according to the IPCC modelling, there could be an increase in the population at risk of insufficient energy intake of between 6%-12% in 2050.[4] All models project an increase in the risk of hunger with rising temperature scenarios.

The health benefits of climate action are a win-win for society and the planet

As human and environmental systems are inextricably linked, integrating health to climate change policies offers a major opportunity to reduce emissions while creating many near-term and local health benefits. A health-centred response to the current crises could provide the opportunity for a low-carbon future that delivers on climate and health. In this context, health and science professionals are well-placed to act as a bridge between the evidence on climate and health, policymakers, and society, working together to push for more ambitious climate policies. Some examples are:

1. **Mitigation policies to limit a temperature rise to 1.5°C could prevent ~**150 million premature deaths **over the 21st century.** Among these, transitioning away from fossil fuels and adopting clean energy could be one of the greatest public health opportunities stemming from reduced emissions and air pollution, plus increased energy access and security. The more stringent these mitigation measures, the greater the public health benefits - from improvements in air quality to reductions in school absenteeism, hospitalisations, premature births, cardiovascular illness and deaths. A recent study estimated that if nine countries adopted climate policies consistent with the Paris agreement and the sustainable development goals, it would lead to an annual reduction of 1.18 million deaths due to air pollution, 5.86 million deaths due to diet-related risk factors, and 1.15 million deaths due to physical inactivity by 2040.[5,6] Adopting a scenario that takes explicit steps to benefit health in climate change policies would result in a further reduction of 462,000, 572,000, and 943,000 annual deaths attributable to air pollution, diet,and physical inactivity, respectively.[7] Combined with increased numbers of low carbon jobs (up to 65 million by 2030), the transition of employment from fossil fuel to low-carbon industries can also improve occupational health of employees in the energy sector. Investing in already low-carbon intensive industries, like the care sector, which employs many female, ethnically diverse and migrant workers, could both strengthen social and health infrastructure as well as lower carbon emissions.

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2. **Building local, healthy and sustainable food systems is crucial to keep warming below 2°C.** Food production causes a third of the world's GHG emissions. In 2019, imbalanced diets were related to 11.5 million deaths, 17% of which were associated with consumption of red/processed meat and dairy. With livestock being particularly emissions intensive, making up 55% of agricultural emissions, increasing policies and awareness campaigns to enable people to eat more healthily and sustainably (more plant-based, fewer processed foods and appropriate calories) and reduce food waste could reduce emissions between 0.7-8 billion tonnes of CO2 a year. It could also lower many diet-related diseases and deaths, particularly if people eat less red meat, which has led to 72% more deaths over the last 30 years. One

[3] Projected global undernourished population is 530-550 million at 1.5°C and 540-590 million at 2°C .
[4] Based on modelling for SSPs 1, 2 and 3 respectively compared to a no climate change reference scenario.
[5] Brazil, China, Germany, India, Indonesia, Nigeria, South Africa, the UK, and the USA
[6] Compared with the current pathways scenario. See study for more details.
[7] These benefits were attributable to the mitigation of direct GHG emissions and the actions that reduce exposure to harmful pollut ants, improved diets and safe physical activity.

study found that a dietary shift from animal-based to a greater proportion of plant-based foods in high-income nations could reduce annual agricultural emissions by up to 61%, while reducing agricultural land by an area larger than Europe. If combined with policies to reduce food waste and improve farming methods, more food can be produced using fewer resources, safeguarding supply, improving soil health, protecting ecosystems and reducing environmental footprint, while increasing resilience to food price shocks and supply chain issues.

3. **Adaptation policies that are context-dependent can improve human well-being in all countries.** Morbidity and mortality could be reduced at the same time as helping people cope with climate impacts. For instance, heat early-warning systems help lower injuries, illnesses and deaths, with positive impacts for sustainable development. Increasing green spaces in cities can reduce the urban heat island effect and lower anxiety, depression and stress. Conservation of nature provides health benefits by protecting against natural disaster, improving water quality and reducing the emergence of novel zoonotic disease. Adapting the healthcare system is also vital in order to strengthen its resilience, especially as the COVID-19 pandemic has highlighted the level of ability to cope with future health shocks. Ensuring universal health coverage is key in enabling people to adapt to a changing climate. It is important to note that while adaptation policies are essential, there is a limit to our ability to adapt. Even modest climate change could expose many people to unprecedented heat stress, and climate change may make some areas unlivable.

4. **Health cost savings from climate action can offset costs of action.** Recent estimates show that climate action could cost around USD 25 trillion globally, but the resulting savings are five to six times larger. Keeping global temperatures below 1.5°C could yield a global net economic savings of USD 145 trillion, a value that does not account for the many trillions of dollars saved by improving public health and avoiding climate damages. In fact, other studies show that the value of the health gains would be approximately twice the cost of the policies enacted to meet the goals of the Paris Agreement. China and India could generate even larger net benefits by pursuing the 1.5°C target - up to USD 2.3 trillion and 8.4 trillion, respectively. The health gains of limiting warming by 2.0°C would also offset the costs in other regions, such as the EU (7%–84%) and the USA (10%–41%). Already in the US, every dollar invested in air pollution control since 1970 has resulted in USD 30 of health cost savings. In the 15 countries with the highest greenhouse gas emissions, the health impacts of air pollution are estimated to cost more than 4% of GDP while actions to meet the Paris goals would cost ~1% of global GDP.

Conclusion

With increasing temperature and extreme weather events, the health impacts of climate change are increasingly being felt across the world. More people are dying from extreme heat, the transmission of infectious diseases is increasing and crop yields are falling, causing a rise in food insecurity.

Health and climate professionals understand the urgency, there have already been several calls to action in the health community, but more work has to be done in order to push for public and political engagement towards tackling both climate change and health. There is now a window of opportunity to take action together, aligning climate change action and economic recovery to deliver improved public health for generations to come. ■

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The Global Climate and Health Alliance is an alliance of health and development organizations from around the world united by a shared vision of an equitable, sustainable future, in which the health impacts of climate change are kept to a minimum, and we reap the maximum health benefits of climate change solutions.