Introduction

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Summary

Climate change is a global health crisis and has disproportionate effects on vulnerable groups. Building on their previous expertise, in 2023, the InterAcademy Partnership (IAP) and Save the Children initiated a project to identify and disseminate case studies of health adaptation solutions in response to the diverse climate change pathways of risk from around the world. The selected case studies employed systems-based approaches, used transdisciplinary research, and involved the producers and users of knowledge working together with a focus on underserved, marginalised populations.

Outputs from this project help to:

- Clarify complex interactions between human-driven environmental change and human health, whether by direct pathways (e.g. heat) or indirect, via ecosystems (e.g. food), or socio-economic systems (e.g. livelihoods).
- Highlight and assess climate-health policy priorities across multiple sectors, e.g. urban planning, transport and agriculture, in addition to the health sector itself.
- Advise on how research findings can be used by policy makers and other end-users, by building capabilities and trust at science-policy interfaces, while emphasising throughout the necessary focus on vulnerable, underserved groups.
- Derive generalisable lessons for health adaptation good practice to indicate how to measure impact, avoid maladaptation, understand limits to adaptation and underpin health system resilience.
- Evaluate issues for transferability and scale-up of adaptation solutions, together with enablers of and barriers to action and longer-term capacity building.
- Clarify the intersection between climate change and other health crises, e.g. the COVID-19 pandemic and other infectious diseases, and the implications for global health strategic priorities, e.g. universal health coverage.
- Show how systems-based thinking provides the conceptual framework and tools for integrating policy actions between sectors and between the various levels of governance, local, national, regional and global.

Climate change threatens health

The pace and extent of environmental changes caused by climate change threaten to reverse the gains in global health made over recent decades (Whitmee *et al.*, 2015). Human activities, principally the emissions of greenhouse gases (GHGs) have unequivocally caused global warming (IPCC, 2023). Climate change is thus a global

health crisis as well as an environmental and financial crisis. Among the world's environmental challenges, climate change is deemed the greatest threat (WHO, 2023).

Climate is one of the principal Earth system boundaries (see Rockstrom *et al*. 2023 for a recent update on safe and just Earth system boundaries) and climate change has the potential to increasingly disrupt health and wellbeing because, in addition to direct adverse effects on health, it affects the provision of food, safe water and clean air. Human and ecosystem vulnerability are interdependent (IPCC, 2023).

Therefore, countries' climate change adaptation and mitigation planning must not ignore health. Doing so could result in trade-offs and unintended consequences which could ultimately undermine well-intentioned efforts to improve health. In other words, actions to address climate change are opportunities to reduce and prevent risks to health (WHO, 2020). Addressing climate change and health together is appealing because of the potential win-win opportunities: achieving multiple benefits to human health and the climate (Frumkin and Haines, 2019).

Activities within and outside the health sector (e.g. industry, energy production, transport, agriculture) contribute to climate change and, at the same time, affect health. The relationship between climate change and health can be non-linear and involve time delays and feedback interactions among many factors (Whitmee *et al.*, 2015). This complexity can lead to health outcomes which are difficult to predict, including disproportionate adverse effects on children and other vulnerable groups. As a result, a multi-sectoral, systems-based[1], approach is needed to address climate, health and equity together.

The nature, distribution and timescale of the health impacts associated with climate risks differ between countries and within their populations, influenced by geography and socio-economic status, and are rooted in social inequalities. There are also commonalities in the deteriorating health outcomes that warrant shared approaches encompassing both climate mitigation and adaptation solutions. The largest adverse health impacts of climate hazards are felt in low- and middle-income countries (LMICs) and in economically and socially marginalised residents elsewhere, e.g. in urban areas (IPCC, 2023). To build resilience at many levels – individual, household, community and systems – health actions taken to identify and

1 A systems-based approach with cross-sector integration encompasses the complex interactions between natural and social systems and the integration of research outputs from across many disciplines throughout the processes for developing and implementing policy (IAP, 2022).

quantify solutions must concentrate on the most vulnerable groups. Actions must also address the current gaps in mobilizing scientific research findings to directly inform policy actions.

Pathways of risk and vulnerable groups

Health risk is a function of hazard, exposure and vulnerability. There are multiple pathways of direct and indirect risk and multiple physical and mental health consequences, as presented in Figure 1.

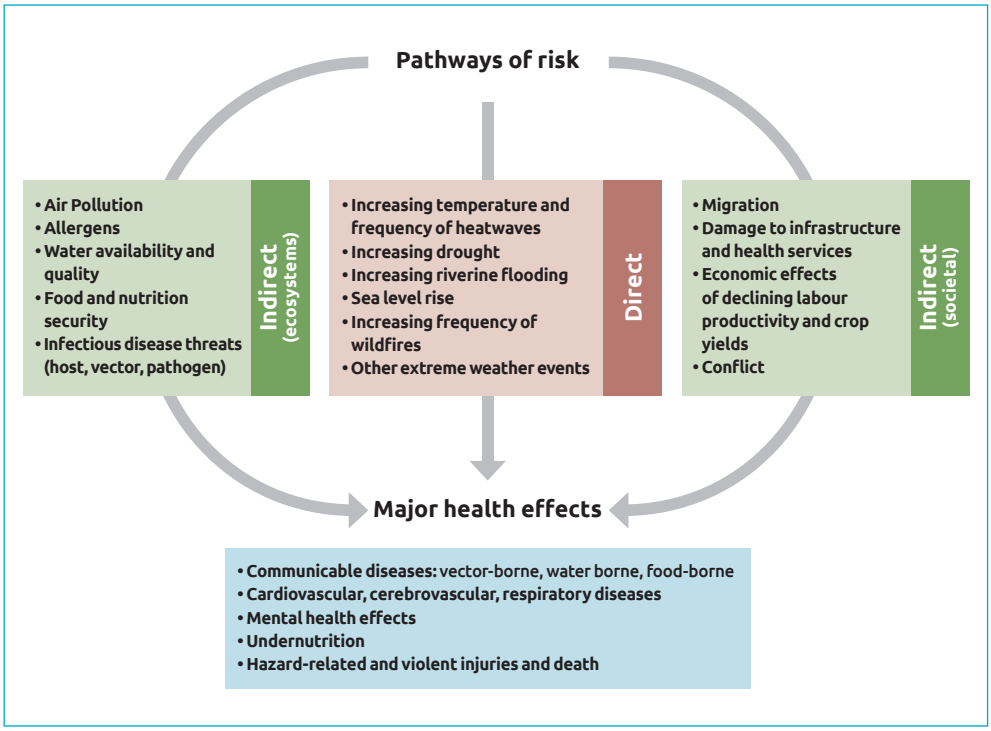

Figure 1: Multiple pathways of risk and health effects. Source: IAP (2022).

While there is still much to be done to quantify climate-sensitive health risks and their compound effects, there are major global initiatives underway generating an accumulating body of evidence on health effects (e.g. IPCC, 2023; Romanello *et al.* 2023), their interactions and attribution to climate change. Despite the accumulat-

ing evidence, it is still surprising to see how little has been done in the international political arena to combat the health threats posed by climate change (Mogwitz *et al.* 2022). There is still a significant gap between the recognition of the impacts of climate change on health and the actions taken to address it. Access to climate finance for health is a major barrier for building the evidence base and implementing action (Ebi *et al.*, 2019).

Previous work by IAP, using a regional-to-global model, incorporated evidence and perspectives from Africa, Asia, the Americas and Europe (IAP, 2022; Fears *et al.* 2023). The IAP work has helped to characterise how climate change is bringing serious threats to human health worldwide with the LMICs most vulnerable, and children and the elderly amongst the hardest hit and least protected within populations. There is also accumulating research literature on mental and physical health in children and the disproportionate burdens suffered by them[2]. However, there is much less research on interventions to protect children, and the climate crisis should be regarded as a child rights crisis (Save the Children, 2021). Indeed, the UN Committee on the Rights of the Child recently (UN OHCHR, 2023) called on states to take action to focus on climate change.

Innovative knowledge generation and utilisation

IAP (2022) has highlighted how rapid and decisive action could greatly reduce the risks to health in marginalised groups and populations more generally, and that many solutions are within reach using present knowledge. Both mitigation and adaptation approaches are needed, and multiple solutions must be better integrated across sectors, but action requires political will and sustained investment. The scientific community has important roles to play first in bringing existing knowledge that is relevant and actionable to the attention of end-users, and secondly in generating new transdisciplinary knowledge for feasible, equitable solutions. The widening social and health inequalities resulting from climate change could be reduced or prevented if the drivers and consequences of global environmental change were better understood and if this understanding was reflected in policy and planning.

2 For example, Clemens *et al.* 2020, Arpin *et al.* 2021, Hellden *et al.* 2021, Sahani *et al.* 2022, Bansal *et al.* 2023) and on neonatal health (e.g. in Africa, Nakstad *et al.* 2022) and maternal and foetal physiology (Bonell *et al.* 2022).

Mobilisation of both existing and new research outputs can be enabled by:

- Adopting a Planetary Health framework to encompass the health of human populations and the state of natural systems on which human health depends (Whitmee et al. 2015; Pongsiri *et al.* 2017);
- Executing systems-based research, integrated across sectors, to help clarify complex, dynamic interactions, some of which may contribute to unintended consequences, to guide towards improved health outcomes; and
- Co-producing solutions with end-users, for better understanding of context-appropriate actions, including their consequences and trade-offs for transformative change.

IAP-Save the Children case study project: focusing on adaptation

To build policy maker awareness of systems-based studies and policies, in 2023, IAP with support from Save the Children, opened a call seeking examples of health adaptation case studies of approaches to problem-solving which have been used to tackle the integrated challenges of climate and health.

Adaptation is defined by the Intergovernmental Panel on Climate Change (IPCC) as the process of adjustment in natural or human systems to actual and potential climate-led impacts, which moderates harm or exploits beneficial opportunities. Most observed adaptation responses are fragmented, incremental, sector-specific and unequally distributed across regions. Despite some progress, adaptation gaps across sectors and regions will continue to grow under current levels of implementation with the largest adaptation gaps among lower income groups (IPCC, 2023). Adaptation is not a substitute for mitigation. Rather mitigation increases the scope for adaptation (IAP, 2022). Climate change adaptation needs, as well as capacity to adapt, are unequally distributed around the world and this heterogeneity in societies' adaptive capacity is often overlooked (Andrijevic *et al.* 2023).

In this new IAP work supported by Save the Children, priority was given to:

- Food systems and agriculture;
- Energy, including production, distribution, access and efficiency;
- Urbanization, including urban planning; and
- Health systems strengthening;

particularly when focusing on underserved groups such as women and children and where a policy problem was addressed from the outset.

IAP invited case study proposals to:

- Describe the climate-health relationship of interest and the policy objective to inform solutions for sustainable development and public health;
- Specify the geographical location/spatial scale and population at risk;
- Help clarify the probable causal pathway by which climate variability affected health risk;
- Employ specific indicators to measure outputs, accounting for and, if possible, avoiding unintended consequences;
- Consider opportunities for the replicability of impacts, upscaling and generalisation to other contexts; exploring enabling factors and obstacles for policy application more widely;
- Take account of disproportionate impacts of climate change on vulnerable and underserved communities and embed study outputs into longer-term capacity building;
- Ensure robust study design (whether qualitative or quantitative), including multidisciplinary teams, systems-based approaches, recognition of uncertainties in databases, and engagement with end-users in production and application of findings;
- Address multisectoral impacts of climate change, potential policy synergies across sectors, and trade-offs among the array of effects of choices made.

The case studies submitted to IAP were peer-reviewed by a geographically balanced group of international experts and the successful proposers invited to a workshop hosted by IAP in Trieste, Italy, in September 2023, together with a sub-set of the peer-reviewers. Following the workshop, revised full-length case studies were edited for consistency of length and format and are now presented in this volume.

Emerging messages from the individual case studies presented in Trieste were assessed collectively to try to answer three general questions:

- What are the issues to consider when designing effective climate-health adaptation studies?
- What is the role of case studies as a basis for developing specific recommendations for adaptation policy and practice? and
- How can systems-based adaptation approaches help to build action at science-policy interfaces?

This collective assessment was used to prepare a Science Policy Brief, which was launched at COP28 (Dubai, 2 December 2023) (IAP, 2023). The individual case stud-

ies now published in this volume will, it is hoped, serve as a continuing resource to stimulate further discussion and guide policy action. A commentary on the project is also published in *The Lancet Planetary Health.*

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