



# Climate & Health Opportunity Primer

An investment opportunity for social investors

# Authorship

Supported by Bayer Foundation, AVPN has partnered with Dalberg Advisors to develop this 'Climate and Health Opportunity Primer' to highlight the need for social investments to support climate adaptation related to human health. This document identifies opportunities for financial and non-financial support that can be deployed by social investors such as philanthropies, impact investors, and socially responsible corporate investors. The report has been developed based on desk research and draws on input provided by a wide range of stakeholders, including philanthropies, impact investors, solutions providers, and technical experts.



**AVPN is the largest network of social investors in Asia, comprising over 600 funders and resource providers across 33 markets.** Our mission is to increase the flow and effectiveness of financial, human, and intellectual capital in Asia by enabling members to channel resources towards impact. As an ecosystem builder, AVPN enables its members to connect, learn, act, and lead across key pillars and improve the effectiveness of deployed capital, bringing local field needs, regional expertise, and policy insights to the forefront. For more information about AVPN and our work, please visit [our website](#) and read our [latest Annual Review 2022/23](#)

**Bayer Foundation catalyzes advances in science and social innovation for a world with “health for all” and “hunger for none”.** In the area of social innovation, Bayer Foundation supports social enterprises in the area of health, nutrition and environment, with financial and non-financial support to build sustainable business models, empowers women entrepreneurs, fosters collaborations across sectors and explore blended finance models.

**Dalberg Advisors is a strategic advisory firm combining the best of private sector strategy skills and rigorous analytical capabilities with deep knowledge and networks across emerging and frontier markets.** It has a dedicated climate practice to support our clients – from governments to multinationals and financial institutions – in reaching net zero, creating climate solutions, and catalyzing a climate community. For more information about Dalberg and our work, please visit our [website](#).

# Foreword

In a world increasingly confronted by the intricate challenges posed by climate change, our collective focus on safeguarding human health has never been more critical. The nexus between climate and health represents a profound intersection, one where the consequences of inaction are dire and far-reaching. It is within this context that AVPN proudly introduces this Climate and Health Opportunity Primer. AVPN contributed to the development of the [\*guiding principles for financing climate and health solutions\*](#) that were announced at COP28 and as a signatory and contributor to the principles, AVPN sees this primer as a next step to translate the principles into practical guidance for investors.

As we traverse the 21st century, climate change emerges as a paramount health challenge, threatening the very fabric of communities worldwide. The repercussions of climate change are multifaceted, permeating health systems, exacerbating inequalities, and imperilling the fundamental elements of well-being. The Intergovernmental Panel on Climate Change (IPCC) paints a sobering picture, estimating that 3.3 billion face heightened health risks due to climate-related vulnerabilities, with low- and middle-income countries bearing the brunt of this burden.

In response to this urgent imperative, AVPN, in collaboration with the Bayer Foundation, has embarked on a transformative initiative aimed at fostering collaborative pathways for climate-health strategies among Asian funders. This initiative, [\*launched at COP28\*](#), underscores our unwavering commitment to mobilising resources and catalysing action to mitigate the health impacts of climate change across the region.

Within these pages, readers will find a roadmap delineating actionable steps to accelerate transformative climate and health solutions, support the priorities of the most vulnerable communities, and promote an inclusive and equitable approach to financing. From surveillance and management of infectious diseases to enhancing health system resilience, this primer developed in partnership with Dalberg Advisors illuminates a spectrum of solutions poised to mitigate the health ramifications of climate change.

Moreover, this primer serves as a clarion call to social investors, urging them to seize the opportunity to intervene directly and indirectly, catalysing innovation, fostering collaboration, and building the capacity of frontline organisations. Through targeted investments, strategic partnerships, and ecosystem-building initiatives, social investors can play a pivotal role in shaping a resilient future where the health of communities is safeguarded against the ravages of climate change.

As we embark on this collective endeavour, let us heed the call to action articulated within these pages. Together, let us forge a path towards a future where the health and well-being of all individuals, irrespective of geography or circumstance, are upheld and protected.

# Foreword

*The evidence is clear that climate change is already having a serious impact on human lives and health. It threatens the basic elements we all need for good health – clean air, safe drinking water, nutritious food supply and safe shelter – and will undermine decades of progress in global health. We can't afford to delay action any further.”*

**Tedros Adhanom Ghebreyesus**

Director-General of WHO

This foreword is not another explanation of why climate change influences human health – it is crystal clear. This foreword is about our wish as Bayer Foundation to find opportunities for public and private investors to fund solutions tackling the challenges of climate change on health. We deeply believe in the power of collaboration and knowledge sharing to drive meaningful change. Yet, for both public and private funders, navigating the complex intersections between climate and health is challenging - limited resources, competing priorities, and a lack of shared understanding often leave gaps in funding and missed opportunities for impactful joint investment.

Thanks to a collaboration with AVPN, we can further alleviate this challenge. The primer identifies opportunities for financial and non-financial support that can be deployed by diverse categories of funders, including philanthropies, impact investors, and public and corporate investors. We didn't start from scratch - so many smart organisations have already invested in great innovation in the climate and health intersection. By tapping into a wealth of expertise and experience of funder community and ecosystem players, this primer brings insights together, pooling our knowledge, and providing a common language and a shared framework of investment principles.

We hope that practitioners in the social impact ecosystem can make use of the learnings generated when funding initiatives and long-term interventions in the nexus between climate and health.



Foundation

Dr. **Peng Zhong**

Director | Social Innovation  
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# Executive Summary

**The impact of climate change on human health is significant. It requires urgent attention, especially in the Asia-Pacific (APAC), and leaders across the region are taking note.** Extreme weather-related events such as prolonged heat waves, floods, and droughts are causing premature deaths, destroying infrastructure, and damaging economies. Climate events are projected to increase loss of life due to premature mortality and disability, adding up to 2 billion disability-adjusted life years cumulatively by 2050; Asia accounts for nearly 30% of this.<sup>1</sup> Recent years have also seen an exponential increase in the awareness of the impact of climate on human health. Mentions of health in the media coverage of COP28 were 130x higher than during COP27.<sup>2</sup>

**Climate adaptation efforts—including on health—must take centre stage alongside efforts to decarbonize.** Mitigation strategies alone fall short of addressing the immediate climate risks populations face, and the speed of mitigation is unlikely to keep up with the increase in these climate and health risks. And while the health sector itself contributes to climate change, APAC's health sector accounts for just over 2% of global CO2 emissions. Yet APAC region's heightened climate vulnerability, efforts to anticipate and help adapt to climate health

are timely and high priority. Therefore, it is both crucial to accelerate investments in adaptation, and to integrate adaptation strategies into broader initiatives aimed at decarbonizing the health value chain.

**However, there is a significant gap in meeting the climate adaptation financing needs for human health.** It is estimated that developing countries globally will need USD 20 billion annually until 2030 on climate adaptation for human health, yet 93% remains unmet. In APAC, this gap exceeds USD 3 billion, or more than six times the existing level of funding.<sup>3</sup>

**Despite growing awareness of the increasing severity of climate impacts on health social investors and other actors need more visibility on the roles they can play.** They have limited clarity on: **(i) how does climate change impact human health, (ii) what solutions have emerged to address these impacts, and (iii) how can social investments bring solutions to deployment and scale.** This Climate and Health Opportunity Primer aims to provide initial answers to these pressing questions and provide a call to action for social investors to support adaptation to the climate impacts of health in APAC.

## What are the ways in which climate change impacts human health?

### Climate change impacts a wide range of health-related challenges.

As established by the IPCC, the impacts of climate on health are the combined product of hazards (e.g. heat, drought, floods, etc.), a population's vulnerability profile (e.g. age, gender, pre-existing conditions, etc) and exposure (e.g. employment, housing, local geography, etc).<sup>4</sup> This primer broadly categorized these impacts within two groups: first, impacts on human health; and second, impacts on health system delivery capacity (Figure 1).

### Impacts on human health can be categorised along several main pathways:

- a. The spread of infectious diseases, especially as warmer temperatures aggravate the spread of pathogenic diseases
- b. An increase in non-communicable diseases such as from the effects of air and water pollution or heat stroke
- c. Direct physical trauma following climate-induced disasters, as well as secondary trauma (e.g. gender-based violence) and mental health challenges in their aftermath and as stressors on individuals rise
- d. Malnutrition and food insecurity stemming from the impact on agricultural production
- e. Dehydration as a growing problem alongside water security and safety challenges

1. World Economic Forum, "Quantifying the Impact of Climate Change on Human Health", 2024

2. Dalberg analysis

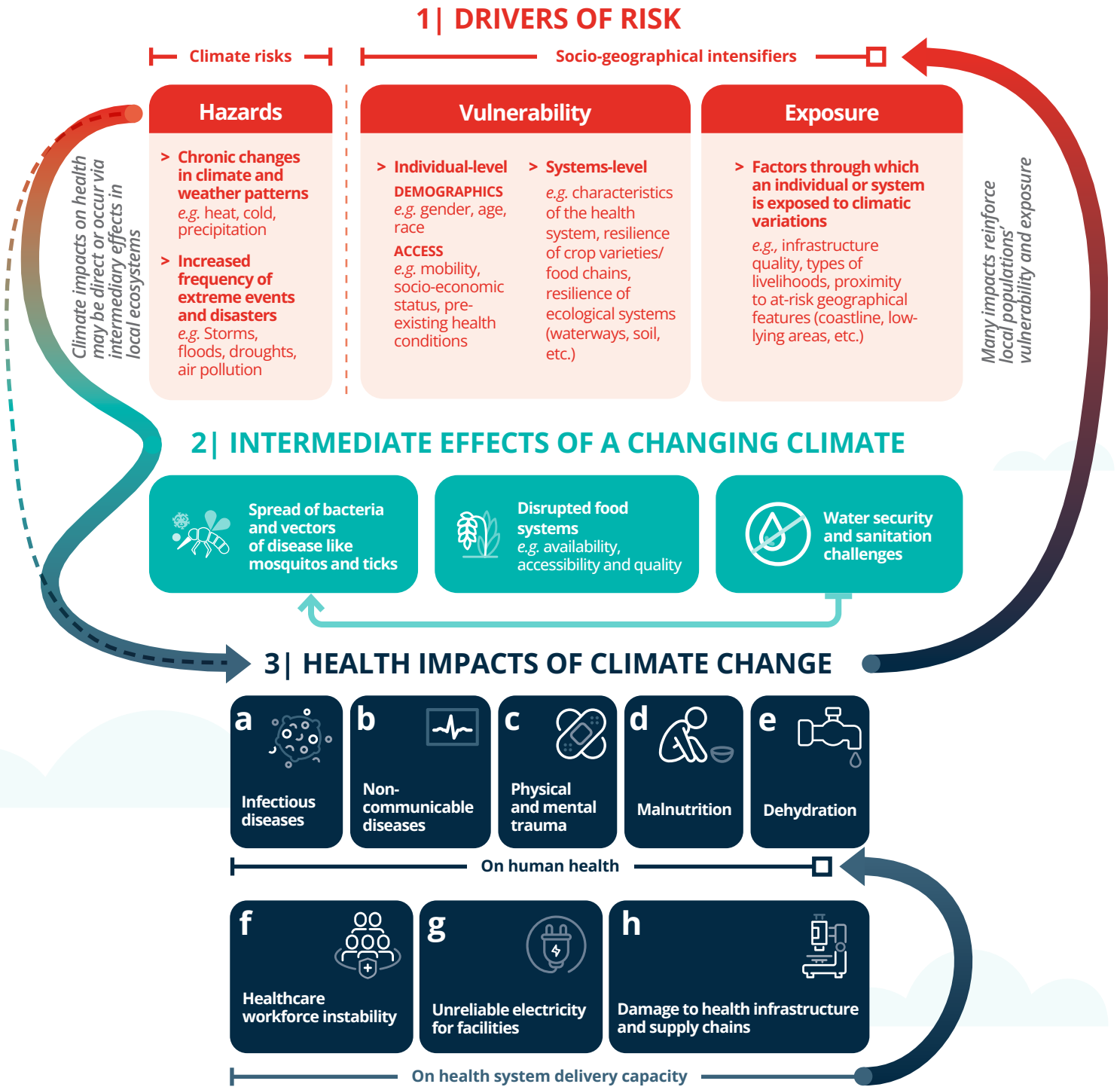
3. Dalberg analysis. Methodology details are shared in Annex A, utilizing data from the UN Environment Programme Adaptation Gap Report 2023 and Adaptation Finance Gap Update 2023, with supporting evidence from the WHO and the Climate Policy Initiative

4. IPCC, *Health, Wellbeing, and the Changing Structure of Communities* (Chapter 7 in Climate Change 2022: Impacts, Adaptation and Vulnerability), 2022

**Climate change can also reduce health system delivery capacity along several pathways:**

- f.** Healthcare workforce instability, given that health workers are disproportionately exposed to climate-related health hazards
- g.** Unreliable electricity access which impacts key services such as lighting, medical device power, and cold chains
- h.** Damage to health infrastructure and supply chains during extreme climate events.

**Figure 1:** Pathways of climate change impact on health<sup>5</sup>



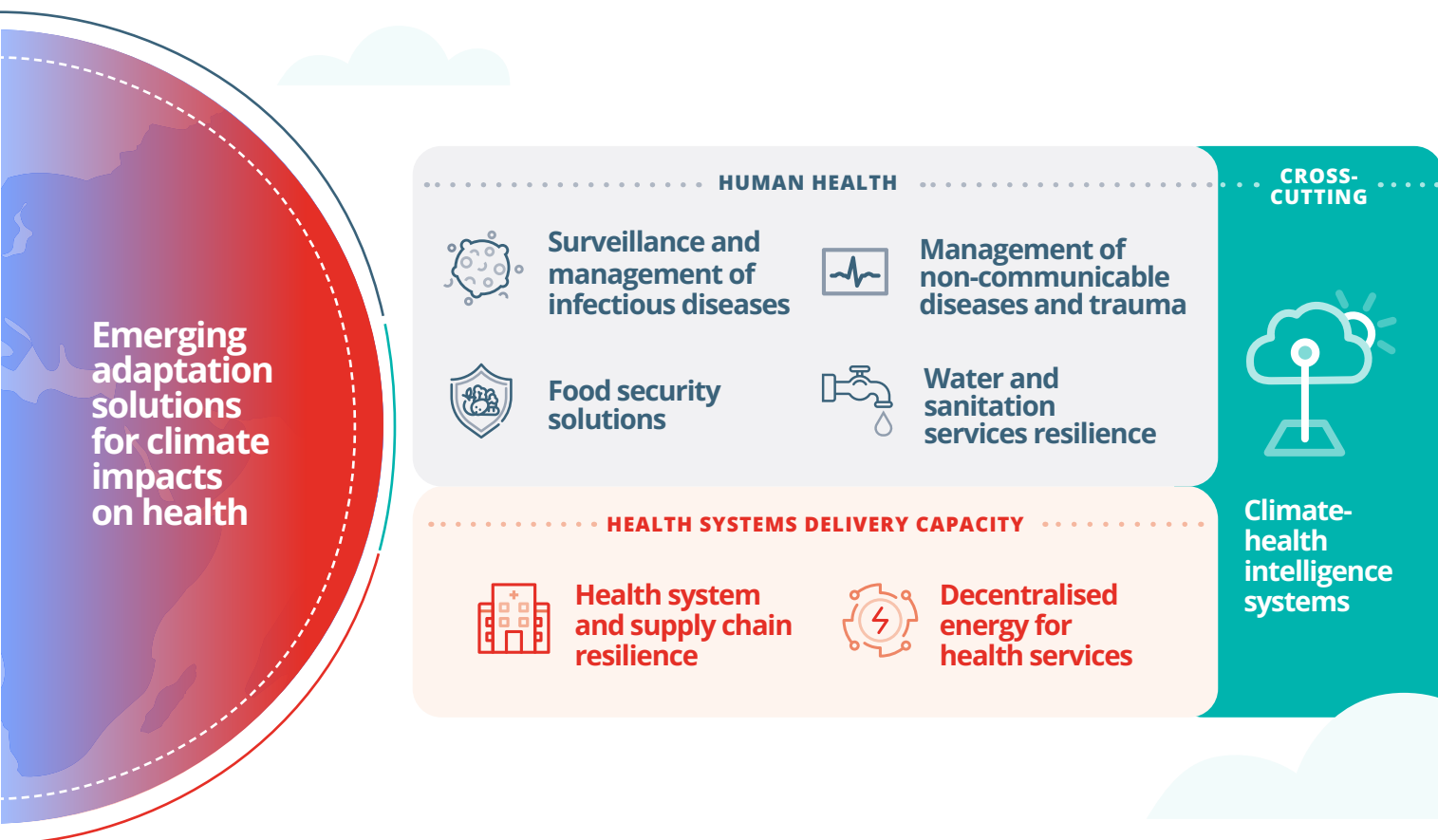
**NOTE:** Only the key health impacts and linkages are included; this analysis is not intended to be comprehensive

5. Dalberg analysis building on frameworks provided in: Cissé, G., R. McLeman, et al, "Health, Wellbeing and the Changing Structure of Communities", 2022 In: Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change; and WEF, Oliver Wyman, *Quantifying the Impact of Climate Change on Human Health*, 2024

## What solutions emerge to aid adaptation to these impacts?

Solutions have emerged across a range of action areas related to human health and health system delivery capacity (see figure 2). Many of these solutions remain nascent, but there are bright spots in several solution areas. Some of these solutions are being supported by social investors including philanthropies, public and multilateral funders, and impact investors. However, most investments are grant based or remain at early seed stages, and deeper, truly intersectional attention to health and climate is needed across the board.

Figure 2: Emerging adaptation solutions for climate impacts on health



Key solution areas to address *human health* include:

- > Surveillance and management of infectious diseases
- > Management of non-communicable diseases and trauma
- > Food security solutions
- > Water and sanitation services resilience

For example, several commercially promising solutions receiving seed and venture funding, respectively, include Singapore-based StratifiCare, which developed the world's first severe dengue prediction test (USD 0.75 million seed funding) and Hong-Kong-based i2Cool, which offers solar reflection paint that reduces indoor temperatures by 10°C (USD 20 million in venture capital). More socially-oriented and community-based solutions, in turn, typically receive philanthropic funding; one example is the Sehgal Foundation's work with communities in India to build rainwater harvesting capabilities and infrastructure.



**Key solution areas to strengthen health system delivery capacity include:**

- > **Health system and supply chain resilience**
- > **Decentralised energy for health services**

While solution providers in these areas must often partner with public health delivery systems by definition, there remains room for investors across the spectrum to engage. For example, solutions such as India's Medicine from the Sky initiative and health-tech firm Blackfrog offer products and services to support cold chains, with initial funding from the state government of Telangana in India, and from impact investors, respectively. Further, many telemedicine providers, such as the mobile application developed and funded by Philippines-based conglomerate the Ayala Corporation, offer services across APAC including in areas which have sparse healthcare connectivity.

**Additionally, an important cross-cutting solution includes:**

- > **Climate-health intelligence systems**

Intelligence systems provide the underlying infrastructure on which many other solution providers can rely. For example, the Geospatial Indicators Dashboard, developed by UrbanShift and Cities4Forests, provides data on indicators across seven themes relevant to climate change including air quality, extreme heat, and flooding.

**A number of barriers, however, hinder the deployment of these solutions at various degrees of intensity, such as** insufficient awareness and conversation on the climate-health intersection, gaps in data and evidence, limited diversity of funding instruments, and dependence on under-resourced public health systems.

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## ***What role do social investors need to play?***

**Social investors are indispensable for catalysing change in under-invested impact areas like climate and health—due to their unique ability to provide funding and market-building support without the expectations of market financial returns.<sup>6</sup>** As in other emerging sectors, social investors can contribute to climate and health with tools across the investment spectrum, from fully concessional grants to financially-focused investments, and from early stage patient seed capital to equity investments in those solutions ready to scale.

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6. A more detailed explanation of social investors is included in the Glossary

For social investors, there are opportunities to invest in laying the groundwork through evidence building, in direct support to solutions, and in creating a collaborative, vibrant ecosystem (Figure 3).

Figure 3: Actions for social investors



Specifically, social investors can:

- > **Make targeted investments in evidence generation**, and address the data availability barriers facing actors across the ecosystem. For example, social investors can invest in basic research or in capturing, processing, and sharing data, such as in the Wellcome Trust's Climate x Health program, which funds research globally to gather evidence of climate impacts on health and relevant solutions.
- > **Invest in organizations developing new models and scaling established solutions.** Social investors can also provide funding to help climate and health solution providers build capacity, tailor their models, and grow their impact. For example, the Asian Development Bank (ADB) venture fund has supported over 45 companies focused on climate impact in APAC and has co-invested with the private sector in more than 30 seed funding rounds.
- > **Foster a collaborative ecosystem of climate and health stakeholders** that aggregates knowledge, promotes intra- and inter-region coordination, and enables better coordination between innovators, investors, and policymakers. For example, The Alliance for Transformative Action on Climate and Health (ATACH), a global initiative of WHO, aims to build climate-resilient and sustainable health systems. It does so by harnessing the collective power of WHO Member States and other stakeholders to integrate the climate change and health nexus into national, regional, and global plans.

Chapter 1

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# The climate imperative for health in APAC

**The impact of climate change on human health is significant, and leaders are taking note.** New data from the World Health Organization (WHO) in 2023 reveals that climate change is expected to cause 250,000 additional deaths per year from malnutrition, malaria, diarrhoea, and heat stress between 2030 and 2050.<sup>7</sup> Leaders at COP28 recently acknowledged the significance of addressing the health impacts of climate change, with 124 countries endorsing the Declaration on Climate and Health.<sup>8</sup>

As the world's most disaster-prone region, Asia-Pacific (APAC) faces particularly urgent health threats from climate change. Climate events are projected to increase the years of life lost due to premature mortality and years lived with disability to the extent of nearly 2 billion disability-adjusted life years (DALYs) cumulatively by 2050—and Asia accounts for nearly 30%, or 588 Million DALYs.<sup>9</sup> The region will also be a major contributor to worldwide climate-related healthcare costs due to the large number of people affected.<sup>10</sup>

**Figure 4:** Examples of the impact of climate change on human health and healthcare costs in Asia



**DATA SOURCES:** WEF, Quantifying the Impact of Climate Change on Human Health, 2024; UNEP, Restoring clean air, accessed in March 2024

7. WHO, *Climate Change*, 2023  
8. Chetan Bhattacharji, *COP28: 124 Countries Commit to Milestone 'Declaration on Climate and Health*, 2023  
9. WHO, *Quantifying the Impact of Climate Change on Human Health*, 2024. Note: See Glossary for DALYs definition.  
10. WHO, *Quantifying the Impact of Climate Change on Human Health*, 2024

**Climate adaptation efforts—including for health—must take centre stage alongside efforts to decarbonize.** The health sector in APAC contributes to just over 2% of global CO<sub>2</sub> emissions.<sup>11</sup> Given the under-penetration of health services in many parts of the region, APAC's health systems should be supported to continue expanding their reach while minimizing emissions. This can include the use of targeted health technologies (e.g. promoting alternatives to desflurane anaesthetics, which have a global warming potential 2,500 times greater than CO<sub>2</sub><sup>12</sup>), as well as broad based climate smart solutions such as the use of energy efficient appliances and renewable energy sources.

**However, mitigation strategies alone fall short of addressing the immediate climate risks populations face,** and the speed of mitigation is unlikely to keep up with the increase in these climate and health risks. The loss of 588 million DALYs in APAC by 2050, described above, is based on the “middle of the road” scenario for climate change defined by the IPCC, which most closely aligns to current trends.<sup>13</sup>

**These midline projections make clear that investment in adaptation is no longer negotiable.** And health outcomes in less optimistic scenarios are likely to be heightened across APAC given the region's particular climate vulnerability. **Therefore, it is both crucial to accelerate investments in adaptation for health, and to integrate adaptation investments into broader initiatives on decarbonizing the health value chain.**

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11. Dalberg estimate, using emissions from East Asia, Pacific and South Asia noted in United Overseas Bank Limited, *Implementing sustainability for the healthcare sector*, 2023; and World Economic Forum, *Here's how healthcare can reduce its carbon footprint*, 2022

12. NHS, *Putting Anaesthetic emissions to bed: commitment on desflurane*, 2023

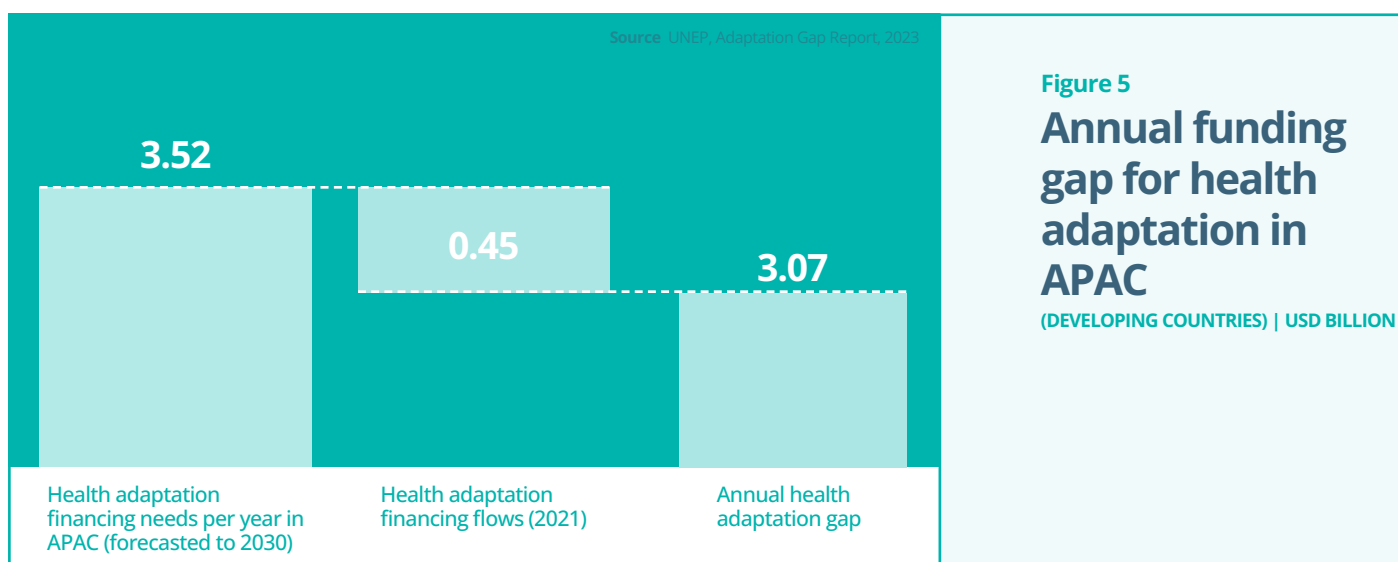
13. Shared Socioeconomic pathway SSP2-6.0, which includes an average temperature increase of 3.23. WHO, *Quantifying the Impact of Climate Change on Human Health*, 2024

## 1.1 The financing gap

Climate adaptation financing needs for human health are estimated at USD 20 billion annually until 2030 for developing countries. This need is exponentially higher when adjacent sectors like agriculture are considered.<sup>14</sup>

The United Nations Environmental Programme (UNEP) estimates the total adaptation finance needs of developing countries at USD 387 billion, of which those attributed to human health represent 5% of total need (USD 20 billion).

Within APAC specifically, the climate adaptation financing gap for human health is estimated at USD 3.52 billion. Here too, the needs of adjacent sectors that impact human health, such as agriculture, are much higher: for example, the adaptation needs of the agriculture and water sectors in APAC represent an additional USD 42 billion and USD 60 billion, respectively.



**Yet current funding falls far short of the need, despite the significant attention received by the climate and health sectors individually.** Globally, UNEP estimates that current public international financing in climate adaptation and health to be USD 1.26 billion. APAC captures 30% of this financing flow, or USD 0.45 billion, leaving a gap of over 3 billion (Figure 5).

**Private sector funding at this intersection is also nascent.** While there have been 15 blended finance transactions (amounting to USD 1 billion) in the health sector in APAC, only two of those transactions (amounting to USD 82 million) intersected with climate adaptation.<sup>15</sup>

14. Overall need and flow figures in this chapter are derived from UNEP, Adaptation Gap Report, 2023 unless otherwise stated. Statistics on human health and for Asia are estimated based on UNEP.

15. Convergence *database*, accessed February 2024

## 1.2 Objectives of this Opportunity Primer

Social investors are indispensable for catalysing change in under-invested impact areas—like climate and health—due to their unique ability to provide funding and market-building support without the expectations of market financial returns.

As in other emerging sectors, social investors can contribute across the investment spectrum, from fully concessional grants to financially-focused investments, and from early stage patient seed capital to equity investments in those ready to scale.

Figure 6: Definition of social investors and investments<sup>16</sup>



### Who are social investors?

Funders who aim to achieve social impact by supporting socially purposeful organisations and funds with a social purpose.



### What are social investments?

AVPN sees social investments as a continuum of capital, allowing investors to strategically combine and allocate grants, debts, and equity for deeper societal impact.

Despite growing awareness of the importance of climate impacts on health, social investors lack visibility on the roles they can play.

#### They have limited clarity on:

- > How does climate change **impact** human health?
- > What **solutions** are emerging to address these impacts?
- > What roles should **social investors** play to catalyse solution development and scale?

This Opportunity Primer aims to provide initial answers to these questions and provide a call to action for social investors to support adaptation to the climate impacts of health in APAC.

16. Please refer to the glossary for definitions

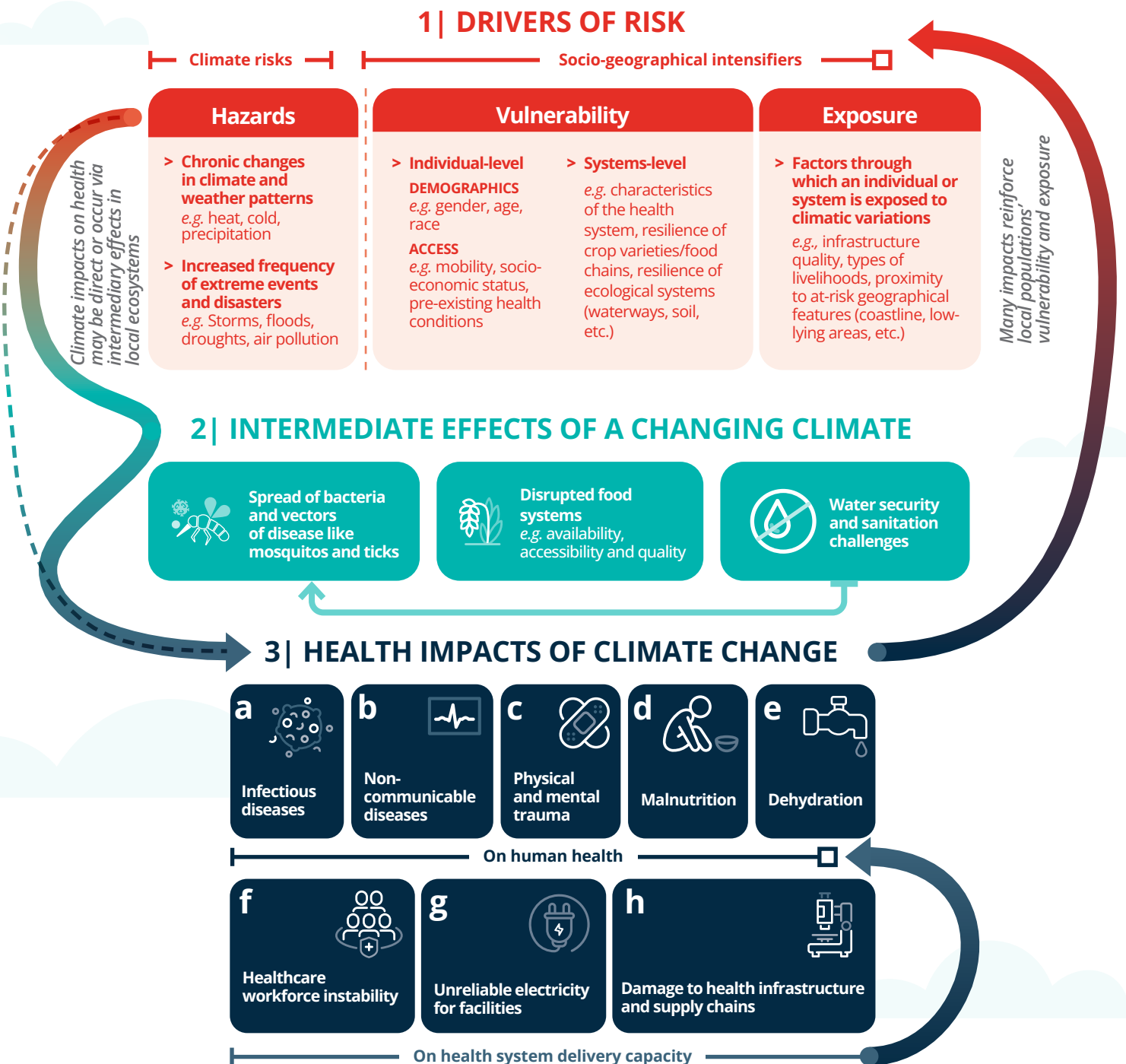
# Understanding the impacts of climate change on health



**Climate change is already playing a major role in health outcomes.** As established by the IPCC, the impacts of climate on health are the combined product of hazards (e.g. heat, drought, floods, etc.), a population's vulnerability profile (e.g. age, gender, pre-existing conditions, etc.)<sup>17</sup> and exposure (e.g. employment, housing, local geography, etc.). In particular, climate hazards also serve as a catalyst for a range of secondary effects related to health, such as the spread of disease vectors, disrupted agriculture and availability of food, water security and subsequent hygiene issues, and direct impairment of healthcare capacity.

Together, these factors result in a wide array of health-related impacts. **In this primer, we have broadly categorized these impacts:** first, **impacts on human health**, such as increased incidence of disease, malnutrition, and dehydration; and second, **impacts on health system delivery capacity**, such as on critical supply chains, the healthcare workforce, and healthcare facilities, and infrastructure more broadly.

Figure 7: Pathways of climate change impact on health<sup>18</sup>



**NOTE:** Only the key health impacts and linkages are included; this analysis is not intended to be comprehensive

17. IPCC, Health, *Wellbeing, and the Changing Structure of Communities* (Chapter 7 in Climate Change 2022: Impacts, Adaptation and Vulnerability), 2022  
 18. Dalberg analysis building on frameworks provided in: Cissé, G., R. McLeman, et al, "Health, Wellbeing and the Changing Structure of Communities", 2022 In: Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change; and WEF, Oliver Wyman, *Quantifying the Impact of Climate Change on Human Health*, 2024

## 2.1 Impacts on human health

The direct impacts of climate change on human health are manifold and, as noted above, depend on the combination of the hazards, vulnerabilities, and exposure an individual faces. The table below summarizes five main pathways through which climate change impacts human health (**Table 1**).

**Table 1:** Impacts of climate change on human health



### Infectious diseases

Over 15 years ago, the IPCC established that changes in weather patterns can cause diseases to spread to new areas that were not previously affected.<sup>19</sup> Climate change can also impact the mutation and fatality of existing infectious diseases, and a 2022 study found that almost **80% of pathogenic diseases are aggravated by climatic hazards**.<sup>20,21,22</sup> For example, a study found that dengue cases in India's Himalayan states increased by 15 to 20 times since 2013, due to rising temperatures creating favourable breeding conditions for mosquitoes.<sup>23</sup>

Secondary effects are also expected to increase, such as exposure to waterborne infectious diseases among infants in low-income households, as parents reduce breastfeeding while coping with heat and competing burdens on their time due to climate change (e.g. income generation to manage growing financial burdens, or household tasks like water collection given infrastructural gaps).<sup>24</sup>

In addition, the **risk of another large-scale pandemic** like COVID-19 within the next 25 years is estimated at nearly 50% and continues to rise, a significant concern for healthcare systems.<sup>25</sup>



### Non-communicable diseases (NCDs)

Conditions like **heat waves and air and water pollution** can result in an increased incidence of NCDs, such as anaemia, stroke, pulmonary disorders, cancer, cardiovascular disease, and even diabetes.<sup>26,27</sup> Air pollution alone is responsible for 6.5 million deaths annually, 70% of which occur in APAC which is expected to worsen in climate change scenario.<sup>28</sup> A study also found extreme climate events were associated with an increase in strokes, migraines, and seizures, as well as worsening dementia and multiple sclerosis symptoms.<sup>29</sup> NCDs can also be aggravated by disrupted food availability and quality, with a rise in obesity and its associated health effects as reliance on long-shelf-life packaged food increases (see also broader trends of malnutrition discussed below). Anecdotal evidence from Dalberg field interviews in Mumbai slum communities suggests that a combination of water pollution and poor access to sanitation results in reduced water consumption, especially by children and women (see Dehydration trends below), which can result in a range of health effects such as reduced kidney function and cognitive performance.

19. Confalonieri U, Menne B, Akhtar R, Ebi KL, Hauengue M, Kovats RS, et al., editors. Cambridge, UK: Cambridge University Press; 2007. Human health. Climate change 2007: Impacts, adaptation and vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.
20. Mora et al, *Over half of known human pathogenic diseases can be aggravated by climate change*, 2022
21. The Lancet, *The resurgence of dengue epidemic and climate change in India*, 2023
22. Dhara et al, *Climate change & infectious diseases in India: Implications for health care providers*, 2013
23. Vigyan Prasar, *Climate change will add to health burden in India*, 2019
24. Part et al, *How do high ambient temperatures affect infant feeding practices? A prospective cohort study of postpartum women in Bobo-Dioulasso, Burkina Faso*, 2022; Kovats et al, *World Breastfeeding Week: Extreme heat and breastfeeding*, 2023; Cerco et al, *The Climate Crisis and Breastfeeding: Opportunities for Resilience*, 2023
25. Smitham, Glassman, *The Next Pandemic Could Come Soon and Be Deadlier*, 2021
26. State of Global Air, *Global Health Impacts of Air Pollution*, accessed March 2024
27. WHO, *Climate change and noncommunicable diseases: connections*, 2023
28. United Nations Environment Programme (UNEP), *Restoring Clean Air*, accessed Feb 2024
29. Bushard, *ALS, Dementia And Strokes Worsened By Climate Change, Researchers Find*, 2022



## Physical and mental trauma

Climate hazards including changes in ongoing weather patterns such as heat waves, as well as **mass disasters like floods, landslides, cyclones, lightning strikes, avalanches and tropical storms** have caused widespread injury and death across APAC.<sup>30</sup>

In addition to direct trauma from climate hazards, this also continues in the aftermath as **secondary trauma**. For example, women and girls confront an elevated risk of **gender-based violence**, such as sexual assault, harassment, intimate-partner violence, child marriage and trafficking. A recent study in South Asian countries observed that each 1°C increase in the annual mean temperature was associated with a mean increase in domestic violence prevalence of 4.4%.<sup>31</sup>

**Mental trauma** is another often overlooked outcome of climate change. Extreme weather events, displacement, loss of livelihoods, and social unrest can directly impact a range of mental health issues, including anxiety, depression, grief, post-traumatic stress disorder, and aggression. For example, a 2022 study found that 21% of Australians who experienced climate-related disasters claimed that it had a moderate to major impact on their mental health.<sup>32</sup> Mental health challenges are also exacerbated by other health risks described in this section, as well as the associated financial burdens on affected families. This is particularly acute for healthcare workers, who face the effects of climate changes both as individuals and as professionals managing the health system capacity challenges described in Section 1.2.



## Malnutrition

As temperatures and rainfall patterns change and disasters occur, crop production can suffer, resulting in **lower output and/or lower-quality harvests** with reduced variety and nutrient content. This can lead to food insecurity and malnutrition, especially among the poor who are unable to weather spikes in food prices. Children are the most affected, risking cognitive delays, wasting, and stunting. Globally, the World Food Programme states that by 2050, the risk of hunger and malnutrition could rise by 20 percent.<sup>33</sup> An estimated 80% of those most at risk of crop failures and hunger due to climate change are in South Asia, Southeast Asia, and Sub-Saharan Africa.<sup>34</sup> Moreover, developing countries in APAC are likely to face the highest reductions in agricultural potential due to climate change.<sup>35</sup>



## Dehydration

Increasing global temperatures will result in greater incidences of heat waves and drought, weakening water security across APAC. Already, a total of 347 million children under 18 were exposed to high or extremely high **water scarcity** in South Asia in 2022, the highest figure globally.<sup>36</sup> **Water safety**, too, is a challenge; in Pakistan, only 36% of the drinking water supply system is considered safe for consumption. These conditions result not only in dehydration but also in widespread outbreaks of waterborne diseases like cholera and malaria.<sup>37</sup>

30. Vision of Humanity, *Natural Disasters & Water Stress Threaten Asia-Pacific*, 2020

31. Down to Earth, *Domestic violence to rise as subcontinent heats up*, 2023

32. Climate Council, *National Study of the Impact of Climate-fuelled Disasters on Mental Health of Australians*, 2022

33. World Food Programme, *Climate Crisis and Malnutrition*, 2021

34. World Bank, *What You Need to Know About Food Security and Climate Change*, 2022

35. ADB, *Agriculture, Food Security, and Climate Change: 12 Things to Know*, 2015

36. UNICEF, *South Asia Has Highest Number of Children Exposed to Severe Water Scarcity*, 2023

37. Ibid

## 2.2 Reduced health system delivery capacity

Climate change also disrupts the delivery capacity of healthcare systems in a range of ways. The table below summarizes three main types of systems impact (**Table 2**). Given the ramifications of these impacts on delaying and reducing the quality of care provided to populations, these systems impacts further exacerbate the human health impacts described in the prior section.

**Table 2:** Impacts of climate change on health system delivery capacity



### Healthcare workforce instability

Health workers face the double burden of risks to their personal health as private individuals (as described in the prior section), alongside the additional risks they encounter as members of the health system workforce. For example, **emergency response workers** like paramedics are disproportionately exposed to direct climate-related hazards during extreme events and disasters, such as wildfire smoke or flooding.<sup>38</sup> Health workers also face additional risks when serving populations affected by infectious disease, mental trauma, and other health challenges described in the prior section.

Further, many health systems struggle to cope with **large spikes in demand**; for example, in 2020, there was a shortfall of 1.9 million nurses in Southeast Asia during the COVID-19 pandemic.<sup>39</sup> As climate change makes extreme events more common, these spikes in demand for healthcare workers will also increase in frequency and magnitude. More investment will be needed to ensure sufficient health worker capacity to prepare, respond, and recover from these events, and to manage burnout and other turnover challenges.



### Unreliable electricity for healthcare facilities

Almost one billion people globally are served by healthcare facilities with **unreliable or no electricity access**.<sup>40</sup> When facilities struggle with energy poverty, key services are impacted—life-saving procedures cannot be performed after sundown,<sup>41</sup> and vaccines and other products lose their effectiveness as described above. As a whole, healthcare providers will also face more frequent and severe **disruptions due to acute climate hazards**, as well as accumulating strains on capacity and finances due to larger disease burdens and other health impacts of the climate crisis.<sup>42</sup>



### Damage to health infrastructure & supply chains

Health infrastructure, like other infrastructure, is often damaged in extreme climate events like tropical storms and floods, including **damage not only to clinical buildings but also to medical supply manufacturing facilities, medical equipment and supplies, and transport linkages**, limiting crucial health services.<sup>43</sup>

Further even minor increases in temperature and humidity poses serious risks to medical **supply chains**, such as blood supply or pharmaceutical product stability. In Bangladesh, up to 25% of vaccines are lost in last-mile rural deliveries, a risk that is likely to increase as temperatures continue to rise.<sup>44</sup>

38. US Environmental Protection Agency, *Climate Change and the Health of Workers*, accessed Feb 2024

39. WHO, *Countries in WHO South-East Asia Region Need 1.9 Million More Nurses, Midwives to Achieve Health for All*, 2020

40. WHO, *Close to One Billion People Globally Are Served by Health-Care Facilities with No Electricity Access or with Unreliable Electricity*, 2023

41. Knoth, *6 Ways Energy Poverty Threatens Health Care for the Poorest*, 2014

42. Marsh McLennan, *Climate change is a growing health crisis*, accessed on Feb 2024

43. WHO, *Measuring the Health Impacts of Disasters*, 2019

44. Eco-business, *The Longest Mile in the COVID-19 Vaccine Cold Chain*, 2020

**Across these varied climate impacts, vulnerable populations in APAC are at a disproportionately higher risk.**

Across APAC, poor and marginalised groups often live in locations and housing conditions that are most exposed to harmful climate impacts – they are susceptible to heatwaves, contracting coast lines, and storm damage, flooding, amongst others. In urban India, homeless populations and slum communities (themselves often migrants from agricultural communities disrupted by climate change) bear the heaviest burden of heat waves and floods; for example, at least 7,000 houses of low-income families were destroyed during 2020 rains in Hyderabad, likely underestimating the total toll.<sup>45</sup> As a whole, women are also particularly vulnerable due to prevailing gender norms. In many countries women are expected to care for children and older adults during disasters and are often involved in sectors such as agriculture that are highly exposed to climate change effects.<sup>46</sup>

**The need to support innovations at the intersection of climate adaptation and health is clear. Yet addressing this requires holistic awareness beyond climate and health alone.**

To minimise and prepare for the worst of climate impacts on health, we will need to holistically integrate climate considerations into a range of adjacent sectors, such as agriculture, infrastructure, energy access, and water, sanitation, and hygiene (WASH) systems. The physiological impacts of heat, for example, may require interventions through urban planning.<sup>47</sup> Similarly, actors leading climate adaptation efforts in these adjacent sectors need to consider potential co-benefits and risks of their work on health as well.

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45. Times of India, *7000 house of the poor in districts destroyed by rains*, 2020

46. UNESCAP, *Social Protection and Climate Change in Asia and the Pacific*, 2023

47. Dalberg interview, 2024

# Emerging solutions for climate adaptation on health

**Protecting people and communities from the health impacts of climate change will require an ambitious and holistic adaptation approach.** Within the two-fold framework of impacts on human health and on health system delivery capacity introduced above, the table below summarises several pathways within which adaptation solutions are emerging (*Figure 8*).

**Figure 8:** Potential adaptation solutions to climate impacts on health

**HUMAN HEALTH**



**Surveillance and management of infectious diseases**

Detecting, preventing, treating, and managing climate-related outbreaks of infectious diseases



**Management of non-communicable diseases and trauma**

Addressing physical and psychological impacts of climate such as heat stress, pollution, and displacement



**Water and sanitation services resilience**

Ensuring safe and reliable water supply and sanitation facilities in the face of climate-induced water scarcity and contamination



**Food security solutions**

Ensuring access to nutritious and high-quality food amid climate-related disruptions such as droughts, floods, crop failures, soil alkalinity and degradation, and displacement

**HEALTH SYSTEMS DELIVERY CAPACITY**



**Health system and supply chain resilience**

Strengthening healthcare facilities, supply chains, and systems to withstand climate-related shocks and disruptions, and to maintain access for hard-to-reach populations



**Decentralised energy for health services**

Increasing adoption of off-grid renewable solutions in healthcare to promote resilience to climate events for service delivery and cold storage (e.g. for vaccines, medicines, blood products)

**CROSS-CUTTING**



**Climate-health intelligence systems**

Monitoring and early warning systems to anticipate and mitigate health risks related to extreme weather events, heat waves, and pollution

The following sub-sections dive into each of the above solutions areas to provide an overview, emerging examples in APAC, current funding levels, and the key challenges. An overview of the roles that social investors can play is provided in Chapter 4.

**Potential adaptation solutions for climate impacts on health**

## 3.1 Infectious disease management and surveillance

Shifting temperature and weather conditions due to climate change increases the spread of bacterial, viral, vector-borne and zoonotic diseases, e.g. via outbreaks of mosquitos.<sup>48</sup> To manage this, solutions are needed for improved detection, surveillance, prevention, and management (*Table 3*).

**Table 3:** Example solutions on surveillance and management of infectious diseases

### Data and predictions on disease burden and vector transmission

**CholOut-EWS** is an open-source software developed by the International Centre for Diarrhoeal Disease Research in Bangladesh to model and forecast the risk of cholera outbreaks, and then communicate these through a user-friendly early warning system for researchers and policymakers.

In 2023, the Wellcome Trust supported this project as part of its USD 29 million funding for new cutting-edge digital tools.<sup>49</sup>

### Novel testing and surveillance methods

Singapore-based **StratifiCare** developed StratifiDen—the world’s first severe dengue prediction test, which helps identify dengue patients that are at risk of developing severe disease complications and require hospitalisation.

StratifiCare has raised USD 0.75 million from funders such as Asian Development Bank (ADB) Ventures.<sup>50</sup>

### Prevention and treatment for affected populations

**Bugworks Research India** is a Bengaluru-based start-up aiming to fight antibiotic-resistant superbugs, which kill nearly 60,000 newborns every year.

Bugworks has received early research funding from the Indian government and is also the first company in Asia to receive investment from CARB-X, the U.S. government’s main funding vehicle for the fight against superbugs.<sup>51</sup>

**Grant-based public and philanthropic funding for infectious disease surveillance and management has been deployed primarily towards gathering evidence on the changes in vector transmission driven by climate change.** Notable philanthropic social investors supporting this solution include the Wellcome Trust, the Rockefeller Foundation, and the Bill and Melinda Gates Foundation. For example, Wellcome Trust funds research and partnerships to better understand how infectious diseases thrive, including research on its linkages to climate change.

48. NCID, *Climate Change and Infectious Diseases*, accessed on Feb 2024; Wellcome Trust, *Will climate change lead to more drug-resistant infections?*, 2022

49. Health Tech Newspaper, *Wellcome announces £22.7 million in funding for projects developing digital tools for climate-sensitive infectious diseases*, 2023

50. StratifiCare, *Singapore MedTech Startup StratifiCare Raises S\$1 Million in Oversubscribed Seed Financing*, 2021

51. AMR Insights, *The Startups Waging War Against Superbugs*, accessed on Feb 2024.



**Yet there remains a need for more grant-based funding for this linkage, as well as on data collection infrastructure to support it** (e.g., air quality and weather monitoring systems) in remote areas. Developing treatments and interventions for APAC will also require tailored insights, specifically on understanding the health impacts on vulnerable populations such as pregnant women and children and marginalised communities.

**There are also emerging examples of financial return-seeking investments in the detection and treatment of infectious diseases and vectors.** For example, ADB Ventures alongside other venture capital firms has invested in StratifiDen (see above), which provides a test that detects and predicts the severity of dengue cases.

**However, social investors allude to lack of proofs of concept and limited evidence of the scalability of emerging innovations on infectious diseases as barriers to investment.** The nascent and unproven nature of many products—as well as dependency on public health systems for uptake—deters return-seeking investors.

## 3.2 Non-communicable diseases and trauma management

Solutions will be needed to manage the health effects of the physical impacts of climate change, such as extreme weather events, pollution, heat stress, displacement, and psychological distress (Table 4).

Table 4: Example solutions on management of non-communicable diseases and trauma

### Heat stress mitigation in urban communities

Hong Kong start-up i2Cool offers a paint technology with high solar reflection capabilities that helps buildings reduce surface temperature by 40°C, and indoor temperatures by 10°C, allowing for a 42% energy savings.

The i2Cool paint has been used in buildings across Hong Kong, and the company is looking to expand into the Middle East. As of 2023, the start-up has received USD 20 million in funding from venture capital groups and the City University of Hong Kong.<sup>52,53</sup>

In another example, the Singapore government's 2009 Landscaping for Urban Spaces and High-Rises (LUSH) scheme introduced over 300 ha of greenery in new developments to offer shade, improving comfort for residents and leading to significant reductions of 10–31% in energy cooling load.<sup>54</sup>

52. Jazul, [Hong Kong startup cools the world one stroke of paint at a time](#), 2023

53. Pitchbook, [i2cool](#), accessed on Feb 2024

54. Phua, [Cool solutions for a hotter climate: Tackling urban heat island effect with innovation](#), 2023

**Table 4:** Example solutions on management of non-communicable diseases and trauma

### Support to manage air pollution exposure

Nafas is an Indonesian start-up that helps people reduce their exposure to hazardous air.<sup>55</sup> In partnership with Airly, an air-quality sensing firm in Europe, Nafas manages a network of over 180 air quality sensors across Indonesia that offer real-time air quality information through its smartphone application.<sup>56</sup>

Nafas also offers Clean Air Zone, a B2B subscription service for indoor organisations to monitor and manage air quality and virus spread, as well as other air purifying products.<sup>57</sup>

As of October 2023, the start-up has raised over USD 1 million in pre-seed funding from angel investors.<sup>58</sup>

**For the most part, solutions for NCDs and trauma management are still nascent, and funding is limited.** To date, funding for research on physical and mental trauma caused by adverse climate events has largely come from philanthropic funders, such as Wellcome Trust, and from other public social investors. However, some solutions on adapting to deteriorating air quality have been deployed in APAC and have attracted financial return-seeking funding. For example, many solution-providers offer products for air quality monitoring, such as Nafas in Indonesia (see above).

**Innovation and growth beyond R&D and seed investment stages on climate and NCDs and trauma are constrained by poor evidence on commercial viability,** thus philanthropic funding may be needed to build new markets or serve difficult-to-address user segments. Many solutions are also dependent on public procurement, such as investments by urban planning departments to reduce air pollution and heat island-related health concerns through examples like Singapore's LUSH scheme described above. Efforts to raise awareness and build capacity will be important for local governments to better understand and procure such solutions.

55. Nafas, *About us*, accessed on Feb 2024

56. Nafas, *New sensors have arrived: Semarang, Surabaya, and Malang!*, 2022

57. Nafas, *Clean Air Zone*, accessed on Feb 2024

58. Mulyanto, *Indonesian startup Nafas takes on urban air pollution*, 2023

### 3.3 Food security solutions

Solutions are needed to ensure the resilience of food supply chains and maintain access to nutritious food for climate-affected communities (**Table 5**).

**Table 5:** Example solutions on food security

#### Diversification of food sources to adapt to changing climate patterns

**Next Gen Foods** developed TiNDLE, a plant-based alternative to chicken. TiNDLE has been supplied to around 150 restaurants in Asia, including Singapore, Hong Kong, Macau, and Malaysia.<sup>59</sup>

As of 2022, Next Gen Foods has raised USD 100 million from both private and government-owned investment firms.<sup>60</sup>

#### Climate-smart agriculture

**Beleaf Farms** is an Indonesian start-up established in 2019 as a hydroponic farm. It offers high-quality produce while using up to 90% less water than traditional farms and maintaining a lower carbon footprint.<sup>61</sup>

In 2022, the company launched Farming as a Service (FaaS) to offer support to select partner farms, controlling and improving the yield by up to 15%. In May 2023 alone, it distributed 700 tons of produce.<sup>62</sup> With a current network of 145 farmers, the business aims to empower at least 2,000 farmers by the end of 2024. Beleaf has received USD 6.85 million in Series A venture capital funding as of August 2023.<sup>63</sup>

**Food security solutions have received some attention from climate adaptation funders to date, and are among the most mature health-related solutions in APAC, but a gap remains.** Food and agriculture accounted for nearly 20% of total adaptation funding in 2023.<sup>64</sup> Significant public, philanthropic, and private funding is already dedicated to developing and scaling climate-resilient agricultural technologies and practices in the region. Agriculture technology (Ag Tech) start-ups in APAC received USD 2.6 billion in the first half of 2023; nearly two-thirds (USD 1.7 billion) of this focused on innovation and product development.<sup>65</sup> While some solution providers have received equity investments, debt funding to SMEs remains limited and could be served by impact-minded investors.

**However, more data collection and analysis are needed to illuminate how the impacts of climate change on food security vary by region and population.** Clearer identification and intensities of these impacts will help direct resources to the most vulnerable populations and spur the development of tailored solutions.

59. Chong, *Temasek-backed plant-based 'chicken' maker raises US\$100m Series A funds for US expansion*, 2022

60. Ibid

61. Finneren, *Beleaf Farms: A Sustainable and Growing Business*, 2022

62. Alpha JWC, *Beleaf secures USD 6.85 million in Series A funding from Alpha JWC Ventures and Openspace to expand Farming-as-a-Service program*, 2023

63. Tay, *AgriTech startup Beleaf Farms rakes in US\$6.9 million in Series A round*, 2023

64. UNEP, *Adaptation Gap Report*, 2023

65. AgFunder (2023), *Asia-Pacific AgriFoodTech Investment Report 2023*

## 3.4 Water and sanitation resilience

Communities affected by climate disruptions and at risk of climate-induced water-borne disease outbreaks need access to safe and reliable drinking water and sanitation facilities (**Table 6**).

**Table 6:** Example solutions on building resilience of water and sanitation

### Rainwater harvesting systems

**The Sehgal Foundation** offers a water management program that builds and restores infrastructure to help rural communities in India to harvest and store rainwater for direct use and/or replenish groundwater.

As of September 2023, the program has held over 3,700 capacity-building sessions and has built 664 wells.<sup>66</sup>

The foundation has partnered with multilateral agencies like the UNDP.<sup>67</sup>

### Products to maintain hygiene in water-stressed regions

**Clensta** is a start-up from Delhi that has developed a range of waterless hygiene products. These products allow for body cleansing and disinfection without water, making them particularly suitable for bedridden individuals or ICU patients in low-resource settings.

Clensta's products have been used in Indian hospitals and armed forces, including the Navy, Army, and Central Reserve Police Force.<sup>68</sup> The firm has raised USD 9 million in a mix of debt and equity led by TradeCred and is co-led by a member of the United Arab Emirate's royal family.<sup>69</sup>

### Water purification

**Wateroam**, a Singapore-based social enterprise, has developed a water filter that provides safe drinking water without electricity. It is lightweight and can be transported into hard-to-reach locations.

As of 2024, Wateroam's products are deployed in 44 countries including Bangladesh, Cambodia, Indonesia, and Vanuatu, and has impacted more than 200,000 people via collaboration with NGOs such as BGR International and Relief Singapore

Water security and sanitation solutions are also a key focus sector for current adaptation funding. In 2023, water security and quality solutions received USD 70 billion, or 18% of total adaptation financing.<sup>70</sup> This funding was largely focused on the development of water management practices, water storage and irrigation infrastructure, and other water security solutions in low- and middle-income countries (LMICs).

66. Sehgal Foundation, *Water Management*, accessed Feb 2024

67. Sehgal Foundation, *Partners*, accessed Feb 2024

68. Samridh Health, *Clensta*, accessed on Feb 2024

69. Rudra, *D2C Beauty & Personal Care Brand Clensta Raises \$9 Mn Funding*, 2023

70. UNEP, *Adaptation Gap Report*, 2023

While traditional water security management is largely dominated by public funding, return-seeking investments have been deployed in the development and piloting of new water management solutions.<sup>71</sup> For example, ThinkPhi (see above), a privately held start-up, distributes water management products across India. However, there continues to be a need to drive innovations targeting at-risk demographics and to achieve proof of commercial viability.

### 3.5 Health system and supply chain resilience

Healthcare facilities, supply chains, and services must be capable of withstanding and recovering from climate-related shocks and stresses, and of addressing the needs of climate-affected populations (Table 7).

Table 7: Example solutions on health system and supply chain resilience

#### Hospital retrofits for climate resilience

In 2023, Save the Children collaborated with the Green Climate Fund, the Government of Lao PDR, and WHO to launch a USD 28.2 million project.

**The Strengthening Climate Resilience** of the Lao People’s Democratic Republic (PDR) Health System Project aims to provide enhanced early warning systems for climate disasters and improved health service access. It is expected to benefit 100 health facilities, 250 communities, and over 1.8 million people in climate-vulnerable rural areas.<sup>72</sup>

#### Telemedicine to improve access in climate-vulnerable areas

Philippines-based **Ayala Corporation** launched a health ‘super app’ in 2023, combining three Filipino healthcare tech platforms with a total user base of over two million people.

This app offers teleconsultations, medicine delivery services, laboratory tests and home care, providing remote support to Filipinos at every stage of care. The corporation’s aim is to convert one in five Filipinos to app users by 2030.<sup>73</sup>

#### Health workforce awareness on climate risks and interventions

**Health Care Without Harm’s Climate Program** works with healthcare stakeholders in Southeast Asia to meet global health goals.

Its work is to support the adaptation and/or development of tools for healthcare climate mitigation and resilience. For instance, it aims to develop capacities within clinicians to educate patients regarding conditions owing to climate change and also suggest strategies for patients to reduce their carbon footprint which have health co-benefits.

Healthcare Without Harm-Asia is funded by private foundations such as Oak Foundation, Robert Wood Johnson Foundation, and Skoll Foundation.<sup>74</sup>

71. OECD, *Financing a water secure future*, 2023; WEF, *Is water tech the next frontier for investment?* 2023; WEF, UN Water Conference: How ‘aquapreneurs’ are innovating to solve the water crisis, 2023  
 72. Relief Web, *Major Climate Resilience Project Launches in Lao PDR*, 2023  
 73. Ang, *Philippine’s biggest conglomerate Ayala to launch health superapp*, 2023  
 74. *Healthcare Without Harm website*, as accessed in March 2024

**Table 7:** Example solutions on health system and supply chain resilience

### **Innovations for last-mile medical delivery**

***Medicine from the Sky*** is a World Economic Forum (WEF) initiative in partnership with the State Government of Telangana and Apollo Hospitals in India.<sup>75</sup> The pilot aims to enable and scale drone-based medical deliveries of blood, medicines, and vaccines in the region.<sup>76</sup>

During the pilot launch, drones covered a total aerial distance of over 600 km delivering a range of medical products, including COVID-19 vaccines, regular vaccines, medicine, and blood.<sup>77</sup>

### **Health infrastructure resilience is a global adaptation priority.**

Nearly 70% of LMIC adaptation plans in 2023 include a focus on health infrastructure resilience.<sup>78</sup> Current funding for this solution also predominantly stems from public sources.

**In addition, the COVID-19 pandemic highlighted the need for more resilient supply chains and system capacity.** Severe supply shocks during the pandemic spurred significant investment in supply chain resilience across industries, including health. Nearly 30% of the more than USD 13 billion invested globally in early-stage logistic businesses in 2023 went to the healthcare sector.<sup>79</sup> These investments, though not strictly motivated by climate change, provide a much-needed boost to resilience in the sector against shocks of all kinds, including from climate hazards. Moreover, the pandemic also revealed limitations in current health systems' ability to cope with large spikes in demand. Such spikes are likely to become more frequent and severe as climate change impacts increase, and investment will be needed to increase health system resilience to meet these demand spikes.

**Increasing the resilience of health supply chains in APAC will require better understanding of their climate-related vulnerabilities.** More data and evidence are needed to illustrate the health supply chain's exposures to climate events and the potential scale of impact across APAC. Grant makers can work with public health systems to better understand these vulnerabilities and deploy innovations, such as the drone-based medicine delivery initiative led by the WEF in partnership with the Telangana state government in India.

**On infrastructure resilience more broadly, one 'low hanging fruit' for social investors includes retrofitting infrastructure to improve readiness for adverse climate events.**<sup>80</sup> For example, return-seeking investors already investing in healthcare infrastructure should incorporate funding for 'climate proofing' buildings as part of their funding to build a new hospital. Strengthening healthcare systems infrastructure also needs the support of grant-makers to integrate climate risks into healthcare planning and the identification of appropriate solutions.

75. WEF, How drones could change the future of healthcare delivery, 2020

76. Ibid

77. WEF, *Medicine from the Sky, India*, 2022

78. UNEP, *Adaptation Gap Report*, 2023

79. Crunchbase Database, accessed March 2024

80. Interview with a health-focused private equity funder in APAC

## 3.6 Decentralised energy for health services

Clean energy solutions (such as solar, wind, and micro-hydro) need to be deployed at the local level to improve energy access for healthcare systems. This will enhance healthcare delivery and resilience in the face of direct climate impacts and growing demand for healthcare due to climate hazards.

In addition, cold-storage solutions are needed to ensure that essential medical supplies, vaccines, and perishable goods (such as food and medicines) remain viable and accessible in remote or disaster-prone areas, regardless of energy access (**Table 8**).

**Table 8:** Example solutions on access to reliable energy and cold storage

### Off-grid or mini-grid renewable energy solutions for hospital services

Kerala, a state in southern India, has grappled with a 12-month power crisis due to low rainfall affecting hydroelectricity generation. This has led to usage restrictions and managed power outages, jeopardising the healthcare system's functioning. **Aster DM Healthcare**, a for-profit private healthcare provider, plans to set up a 55-acre solar project to power seven hospitals in Kerala. The solar project will provide clean and reliable energy to Aster DM Healthcare's hospitals in the state. The company is expecting to save nearly USD 4 million in electricity costs and reduce CO2 emissions by 460 tons per year.<sup>81</sup>

As another example, Canadian-Nigerian firm EM-ONE commissioned 13 off-grid containerized solar microgrids to power off-grid rural hospitals in Kaduna State, Nigeria. With support from UK Aid and the EU, these microgrids will provide power for health centres' critical functions, including lighting, X-ray machines, and water pumping, allowing the hospitals to operate 24/7 and improve millions of lives.

The systems will generate more than an estimated 1,300 MWh of energy annually, offset over 520,000 litres of diesel, and reduce CO2 emissions by nearly 1,400 tons per year.<sup>82</sup>

### Decentralized cooling technologies to store vaccines and medications

**Blackfrog**, an Indian company, has developed Emvólio, - a portable, battery-powered active cooling device that will provide a delivery platform for delivery of vaccines and other biological products. The device can keep products such as blood and serums between 2°C and 8°C for up to 12 hours in the field.<sup>83</sup>

Blackfrog is supported by both commercial and impact investors, including Venture Centre (NCL, Pune), BIRAC, Social Alpha, CCAMP (NITI Aayog), and Forge (Coimbatore).<sup>84</sup>

81. Economic Times, [Aster DM Healthcare to set up 55-acre solar project to power seven hospitals in Kerala](#), 2023

82. Schneider Electric, [Powering rural clinics in Nigeria with solar microgrids](#), 2020

83. Blackfrog, [Products](#), accessed March 2023

84. Blackfrog, [About](#), accessed March 2023

**A mix of private, public, and philanthropic capital is funding efforts to develop and deploy off-grid renewable solutions in healthcare.**

Unreliability of the grid persists in many parts of APAC. Off- and mini-grid providers are entering the market to solve this challenge, including in healthcare. For example, Aster DM Healthcare (see above) has raised over USD 160 million across four funding rounds as of 2024 to build a solar energy project to power hospitals.<sup>85</sup>

### 3.7 Climate-health intelligence systems

Climate and health intelligence systems collect, analyse, and disseminate data to enable proactive responses to climate-related health risks. These systems gather real-time climate and health data from diverse sources, tracking parameters such as temperature, air quality, and disease outbreaks. Insights distilled from these data contribute to targeted health interventions, enhance preparedness for climate-related health risks, and enable informed decisions during climate-related health emergencies (Table 9). They provide the crucial underlying infrastructure on which many other solution providers described in the sections above must rely.

Table 9: Example solutions on climate-health intelligence

#### Heat wave alerts and communication campaigns

In 2023, the Hong Kong Government launched a three-tier **'Heat Stress at Work Warning'** system to protect outdoor workers.<sup>86</sup> The system includes Amber Heat, indicating high heat, Red Heat Stress, indicating very high heat stress, and Black Heat Stress, indicating extremely high heat stress.<sup>87</sup>

These warnings are issued through the GovHK Notifications or MyObservatory mobile applications.<sup>88</sup>

#### Air quality and flooding data dashboards

**The Geospatial Indicators Dashboard**, developed by UrbanShift and Cities4Forests, provides data on indicators across seven themes relevant to climate change including air quality, extreme heat, and flooding.<sup>89</sup>

This tool covers 35 cities globally including APAC cities such as Chennai, Jakarta, and Palembang.

UrbanShift is led by the UN Environment Programme with support from The Global Environment Facility (GEF). Cities4Forests was founded by the World Resources Institute, Pilot Projects, and REVOLVE with support from various social investors.

85. Tracxn, *Aster DM Healthcare*, accessed on Feb 2024

86. Tilo, *Hong Kong's new 'warning system' will protect workers from heat*, 2023

87. Ibid

88. Ibid

89. Shiftcities.org, *Geospatial Indicators Dashboard*, website as accessed in March 2024



**Table 9:** Example solutions on climate-health intelligence

### **AI powered flood forecasting system**

**Google's Flood Hub** is an AI-powered flood forecast system based on publicly available data sources. It predicts the areas that will be affected and expected water levels, alerting disaster planning decision-makers in high-risk areas up to 7 days in advance.<sup>90</sup>

Flood Hub was launched in 2018 with geographies in India and Bangladesh. It now covers river basins in over 80 countries worldwide, providing critical flood forecasting for over 1,800 sites and covering a population of 460 million people.

**More philanthropic participation is needed across the climate and health intelligence value chain.** Importantly, this should include research to facilitate more targeted data collection and the development of predictive models tailored to the climate-health context. These models could be used to develop intelligence products like AI-based early diagnostics for climate-health risks, as well as real-time public health monitoring and early warning systems. Philanthropic funding is also required to support innovation alongside public health systems. Climate-health intelligence systems are nascent, have yet to establish commercial viability, and are largely tailored to public health use. While commercial investors may have little interest under these conditions, philanthropies should play a major role in supporting the research, testing, and piloting of emerging solutions.

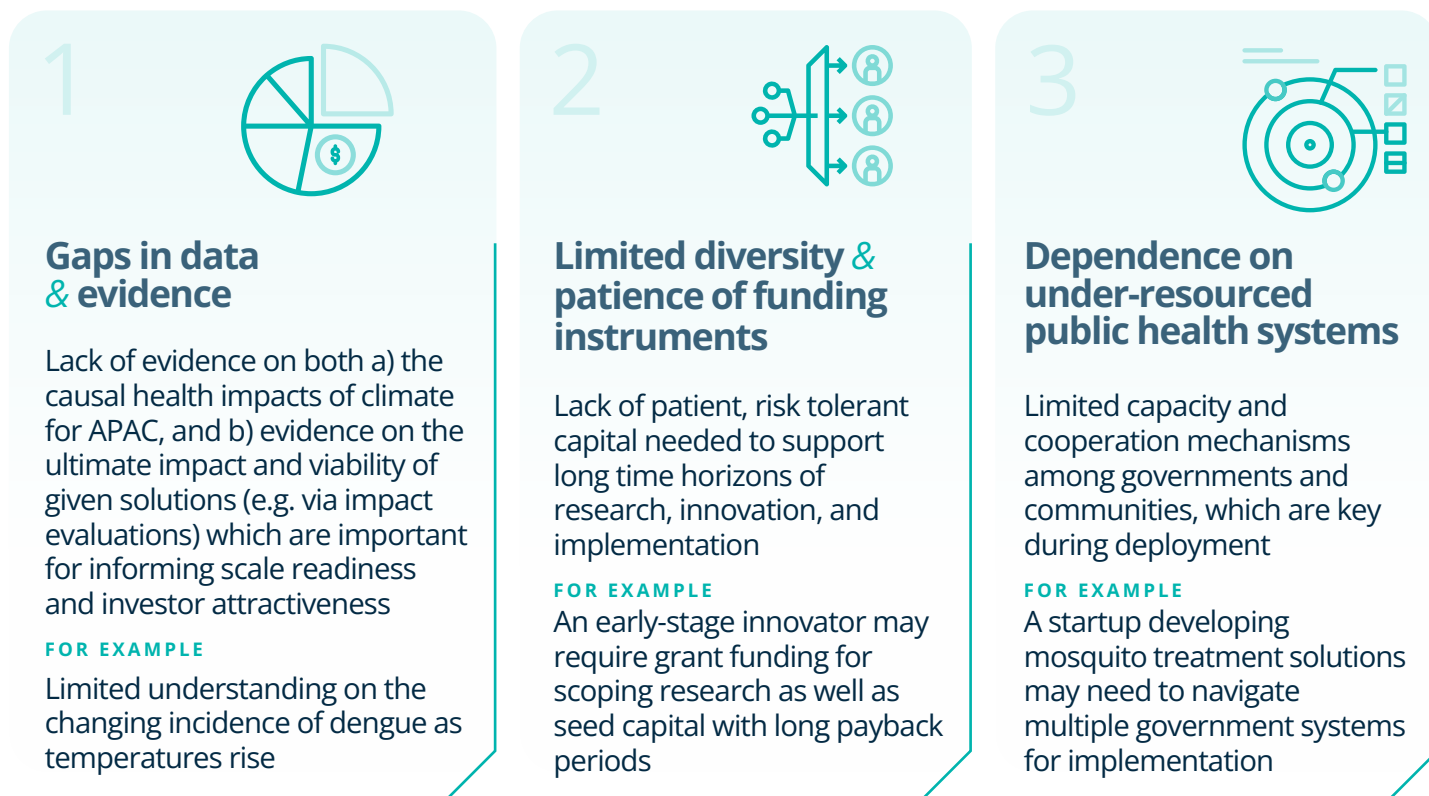
90. Blog.google, Sustainability, *Helping more people stay safe with flood forecasting*, 2023

## Barriers to scaling solutions for climate and health

Overall, this primer emphasizes that limited access to finance, and siloed thinking on climate and health limit progress, suggesting a need for more holistic investment and cooperation to keep climate-related health risks in focus.

In addition to these foundational gaps, several additional common barriers constrain investor attractiveness and scale for the solutions described above (**Figure 9**).

Figure 9: Barriers to investor scaling solutions for climate and health



**These barriers are most visible in the most nascent solution areas**, such as surveillance and management of infectious diseases, management of NCDs and trauma, and climate-health intelligence. In these solutions, there is need for greater investment in data and evidence building, particularly on APAC specific contexts and on vulnerable populations. Yet this is constrained by a lack of foundational resources in the health system, from workforce capacity to data infrastructure like air quality monitoring stations or surveys on disease incidence in remote communities. In turn, this lack of information limits the ability of solution providers to establish the viability of their models to scale, limiting their attractiveness to investors and the range of relevant funding instruments.

**However, even the more mature solutions areas and proven business models remain constrained by dependence on under-resourced public health systems** i.e. in food security, water and sanitation, health system and supply chain resilience, and decentralised energy. For example, a social enterprise working towards improved management of water in South-East Asia cited inadequate deployment and maintenance of local water pumps by the government as a key barrier. Often, the public healthcare delivery systems are also key procurers of the solutions but decision making times are long, and capabilities to engage with small enterprises are limited.

## Chapter 4

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# A call to action for social investors

**Social investors, whether return-seeking or solely impact-focused, have an opportunity to address the barriers that hamper progress on climate and health** and prevent further expansion of risks in the future. Recognizing the intersectionality between the climate and health sectors, investors will also need to develop a common language on objectives and metrics to enable comparison of investments (and measurement of their impact) in climate adaptation in health across the region. It is important that they support the inclusion of those objectives in investment strategies, and consider the adaptation impact case in investment decision-making processes.

To support emerging solutions and address barriers like those described in the prior section, investors can ensure solutions for Asia are built in Asia through three main channels (**Figure 10**).

**Figure 10:** Actions for climate-health social investors



## 4.1 Invest in evidence building and data generation

**Grant funders can support tailored research on climate and health challenges in the APAC region** to help innovators, policymakers, and other health sector stakeholders make better decisions and develop regionally-relevant solutions. First, foundational research to understand the impacts of climate on health and gaps in current response is key to understanding the ecosystem and what is required to address the most urgent risks and opportunities. Further, a range of monitoring and evaluation approaches and methods can be used to measure the impact of existing solutions and to track their progress and potential to create sustainable change at scale. Credible evaluation data provides a critical foundation for establishing the viability of business models, and can send a strong positive signal to social and commercial investors alike.

Such research typically requires long time horizons, and as a public good is best suited for public or philanthropic funding. Similarly, this research also relies on underlying data infrastructure (i.e. air quality monitoring stations, labs focused on regional infectious disease variants, etc.). By supporting these underlying foundations for good evidence, philanthropic funders can lay the groundwork for commercially-viable solutions that utilise these assets to emerge, such as consumer- and business-facing climate-health intelligence systems (see, for example, solutions like Nafas or Hong Kong's Heat Stress at Work Dashboard profiled in the prior chapter).

#### SPOTLIGHT



### Wellcome Trust Climate x Health grants

- > The Wellcome Trust climate and health programme seeks to generate a greater understanding of the health impacts of climate change and integrate these insights into decision-making, adaption planning, and policy
- > The programme is funding research across the world to gather evidence of the health impacts of climate and identify potential solutions and policies to protect and improve human health in the face of changing climate
- > Research funded by the programme seeks, for example, to understand how El Niño impacts health or how pregnant women can be protected from rising temperatures

## 4.2 Invest in solution development and model scaling

Social investors in APAC can invest in promising models by using a combination of traditional philanthropic grant making, blended finance, and impact investments. The choice of instruments should depend not only on investors' risk and return preferences but also on differing investee needs along the journey from development, seeding, prototyping, to scale.

### 1 | Promote innovation

**As described in the preceding chapter, much of the private sector adaptation market remains nascent—especially in health—and social investors have a role in promoting innovation by seeding and supporting early-stage solutions.**

In the case of climate-health solutions, there are opportunities to drive innovation in early-stage solutions such as in surveillance and management of infectious diseases, management of NCDs and trauma, and climate-health intelligence. For example, despite the significant attention and resources devoted to infectious disease research in APAC universities, researchers are often unsure of how to take the next step in bringing the solutions to scale.

Promoting early innovation can be supported via small ticket size grants for early-stage start-ups to engage in rapid prototyping. At the pilot and early deployment stage, other types of innovation-support funding such as accelerators, blended finance, and other early-stage impact investment models can be utilised to push solutions toward growth. However the setup of many of these mechanisms can be costly, and it is important that social investors establish and fund institutional structures building on past lessons learned and proven and replicable mechanisms.

## SPOTLIGHT



### Asian Development Bank Ventures

- > The Asian Development Bank's (ADB) Venture Fund supports over 45 companies focused on climate impact in APAC
- > Investments span several sectors in climate adaptation and mitigation, including health, transport, agriculture, water, and infrastructure
- > The fund has co-invested with commercial investors in more than 30 seed funding rounds, supporting climate and health innovations in disease, food, and climate monitoring such as UniFAHS in Thailand and StratifiCare in the Philippines

## 2| Scale & integrate solutions

**When evidence of impact and the viability of a model is established, social investors can help shepherd the solution on the pathway to scale.**

Investing in public health system integration is best suited to traditional public and multilateral funding, including many of the solution areas described in Chapter 3. However, there remain opportunities for return-seeking investors through blended finance transactions e.g., for products with established demand including enterprise-facing products such as construction materials and supplies for private healthcare providers such as off-grid cold storage solutions, or consumer facing products such as those that enable individuals and households to access healthy food, and protect themselves from pollution and sanitation risks. This is especially seen in the digital health area where digital innovations are able to bridge the last mile delivery gap in many health systems. myMedicines, Nigeria's innovative online medicines platform, is an example that has scaled in Nigeria, connecting 20% of all Nigerian pharmacies, with a proven business model for investors.<sup>91</sup>

Given more established proofs of concept, the most significant opportunities for return-seeking capital are currently on solutions related to food security, water and sanitation, health system and supply chain resilience, and decentralised energy for health services.

## SPOTLIGHT



### Rockefeller Foundation's commitment towards climate and health

- > During COP28, the Rockefeller Foundation committed USD 100 million to address the health impacts of climate change<sup>92</sup>
- > This commitment will be deployed towards the foundation's work including on:
  - Policy and partnerships to merge the priorities of governments, private sector, and non-profits towards collective action
  - Providing financial assistance to frontline communities to adapt to climate change
  - Facilitating community-driven innovation by elevating the voices and needs of the most vulnerable

91. Bayer Foundation, *"Delivering medicines at the doorstep of urban and rural Nigerians"*, accessed in March 2024

92. The Rockefeller Foundation, *The Rockefeller Foundation Commits USD 100 Million To Test and Scale Climate and Health Solutions Globally*, December 2023

## 4.3 Invest in ecosystem building, policy shaping & collaboration

**Social investors in APAC have a key role to play in coalition-building** with other investors, product and service providers, public institutions, community-based networks, and other stakeholders to champion and promote awareness of climate and health challenges in the region. They can also advocate for a holistic approach that acknowledges adjacencies in related sectors like agriculture, infrastructure, energy access, and water, sanitation, and hygiene (WASH), as discussed in Chapter 2.

### SPOTLIGHT



### WHO Alliance for Transformative Action on Climate and Health

- > The Alliance for Transformative Action on Climate and Health (ATACH), a global initiative of WHO, aims to build climate-resilient and sustainable health systems
- > It harnesses the collective power of WHO Member States and other stakeholders to integrate holistic thinking on climate change and health into national, regional, and global plans
- > ATACH focuses on financing, monitoring, quality assurance, knowledge sharing, and coordination to drive this critical agenda forward

**An APAC-focused climate and health initiative can build on the growing momentum on climate adaptation and resilience to achieve the following:**

- > **Build capacity and knowledge transfer:** A climate and health focused coalition in APAC could leverage the resources of social investors to collate existing research and evidence and develop new knowledge products. Knowledge products such as research focusing on APAC-specific climate and health burdens, data dashboards that report on climate-health monitoring systems, or impact assessments of current solutions can help stakeholders across the sector better understand the health impacts of climate and document the landscape of opportunities for social investors.
- > **Promote intra- and inter-regional and sectoral collaboration and partnership:** Coalitions can build trust and break down siloes to drive innovation and scale. Champions for partnership can encourage cross-sector collaboration and the 'translation' of values and approaches between the health and climate sectors, e.g. to facilitate the involvement of health experts in the development of climate monitoring systems. Moreover, the cross-boundary nature of climate change means solutions much also have regional cooperation, e.g. to facilitation negotiation frameworks on air pollution where impacts are felt across multiple countries.

- > **Engage government bodies:** Social investors should not overlook the importance of creating an enabling policy environment and addressing regulatory barriers for adaptation and resilient investment. Grant funding is also needed to build the capacity of public functionaries at the federal, state, and urban-local levels to integrate adaptation and resilience measures in policy-making and to build scale-ready solutions into the delivery of public finance and services. For example, institutions like municipal councils have a significant ground-level impact on public health quality and reach in APAC. Yet they are often resource constrained and have limited capacity to focus on planning beyond immediate needs. Social investors can provide dedicated resources to such institutions to embed awareness on the intersection of climate and health, and to facilitate connections with relevant research, solution (including vendor and buyer networks), and sources of finance.
- > **Provide investor-investee matchmaking:** A climate and health coalition can build a landscape of investible opportunities and facilitate introductions and transactions between investors, businesses, and organisations working at the intersection of climate impacts on health. Social investors report difficulty identifying investible opportunities despite the growing momentum of research and product development in the APAC region and globally. A hub for such opportunities could help ensure promising opportunities get the attention and resources they need to scale, while promoting healthy competition and learning.

#### SPOTLIGHT



### Health Innovation Exchange

- > The Health Innovation Exchange (HIEx) facilitates partnerships between healthcare policymakers, investors, and innovators, including at the intersection of climate and health
- > HIEx aggregates and spotlights promising and impactful innovations across the healthcare sector to reduce friction and enable investment and adoption into healthcare systems
- > Recently, the platform launched the Climate & Health Innovation and Equity Fund (CHIEF) in partnership with the International Solar Alliance, which seeks to develop a USD 500 million pool of innovative blended catalytic finance instruments for climate and health



In conclusion, this Primer calls upon the APAC social investor community to champion interventions at the intersection of climate adaptation and health. Despite clear links between climate change and health, there remains insufficient funding and attention on emerging and established solutions to tackle these issues. To address this, we need a science-driven, cross-sectoral approach tailored to the APAC context, uniting governments, businesses, NGOs, communities, and academia.

AVPN, in partnership with Bayer Foundation, is committed to leading the way in tackling climate and health challenges holistically. AVPN is championing collaborative action among social investors to drive positive change through initiatives such as the Climate Pathfinders Programme, which aims to equip climate leaders with the knowledge to apply a climate intersectionality lens in their theories of change.

By bringing actors together, AVPN has also set up the “Climate x Health: Lighthouse for Asia” to generate practical solutions and mobilise capital towards climate and health causes across Asia. The Lighthouse endeavors to ignite innovation at the convergence of climate hazards and social and economic determinants of health.

**This involves:**

- a.** aggregating and spotlighting knowledge and evidence for capacity building
- b.** incubating and validating innovations and surfacing actionable insights for effective adaptation responses
- c.** creating a neutral space to engage with policy shapers and practitioners for advancing the field agenda
- d.** developing powerful evidence backed narratives to mobilize catalytic capital.

As the impacts of climate change advance, tackling social and environmental issues in siloes is no longer an option. The relationship between climate and health is no exception, and forward-thinking social investors should lead the way in championing a holistic, cross-sector approach to advancing solutions. This Opportunity Primer calls upon the APAC social investor community to champion interventions that catalyse sustainable innovation and progress at the intersection of climate adaptation and health.

# Annex

## A. Climate x Health funding landscape methodology

Data for the adaptation funding needs and flows for developing countries referenced in this report have been sourced from the UN Environment Programme Adaptation Gap Report 2023 and Adaptation Finance Gap Update 2023, with supporting evidence from the WHO and Climate Policy Initiative.

### Notable definitions from the UNEP report:

- > Adaptation Financing Needs: This was derived from countries' domestic adaptation plans, as communicated in their NDCs and NAPs, only including developing countries.<sup>93</sup>
- > Adaptation Financing Flow: The analysis is restricted to public international funding sources to developing countries, with data originating from the OECD DAC database.<sup>94</sup> This includes financial contributions from bilateral finance providers and multilateral agencies, but does not include public domestic funding and private funding due to insufficient data.<sup>95</sup>

Estimates have been made for geographic (APAC) and thematic area (human health) specific needs and flows based on the median value of the global statistics. This approach acknowledges the usage for directional purposes only.

## B. Glossary

### Adaptation (to climate change)

In human systems, the process of adjustment to actual or expected climate and its effects, to moderate harm or exploit beneficial opportunities. In natural systems, the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate and its effects (IPCC 2022).

### Climate change

The United Nations Framework Convention on Climate Change (UNFCCC), in its Article 1, defines climate change as: 'a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods'. The UNFCCC thus makes a distinction between climate change attributable to human activities altering the atmospheric composition and climate variability attributable to natural causes (IPCC 2022).

93. UNEP, *Adaptation Finance Gap Update 2023*, 2023 (pg 67)

94. UNEP, *Adaptation Finance Gap Update 2023*, 2023 (pg 69)

95. UNEP, *Adaptation Finance Gap Update 2023*, 2023 (pg 43)

**Continuum of capital (in social investments)**

Financial, human and intellectual capital that are invested with the expectation of measurable results and cover the entire spectrum of social investing, from impact-only to a combination of impact and environmental-social-governance (ESG)-themed investing and financial returns to risk-minimisation through ESG screens and integration

**Disaster**

A 'serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability, and capacity, leading to one or more of the following: human, material, economic and environmental losses and impacts' (UNGA, 2016).

**Disability-affected life years (DALYs)**

Mortality does not give a complete picture of the burden of disease borne by individuals in different populations. The overall burden of disease is assessed using the disability-adjusted life year (DALY), a time-based measure that combines years of life lost due to premature mortality (YLLs) and years of life lost due to time lived in states of less than full health, or years of healthy life lost due to disability (YLDs). One DALY represents the loss of the equivalent of one year of full health. Using DALYs, the burden of diseases that cause premature death but little disability (such as drowning or measles) can be compared to that of diseases that do not cause death but do cause disability such as cataract causing blindness. (WHO, website as accessed in 2024)

**Hazard**

The potential occurrence of a natural or human-induced physical event or trend that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems, and environmental resources.

**Mitigation (of climate change)**

A human intervention to reduce emissions or enhance the sinks of greenhouse gases (IPCC 2022).

**Resilience**

The capacity of interconnected social, economic, and ecological systems to cope with a hazardous event, trend, or disturbance, responding or reorganising in ways that maintain their essential function, identity, and structure. Resilience is a positive attribute when it maintains capacity for adaptation, learning and/or transformation (Arctic Council, 2016).

**Risk**

Risks in the context of climate change refer to the potential adverse outcomes for human and ecological systems. These risks stem from both the impacts of climate change and human responses to it, affecting various aspects such as lives, livelihoods, health, economic assets, infrastructure, ecosystems, and species. They arise from the interplay of climate-related hazards with the exposure and vulnerability of affected systems, which themselves may vary in magnitude, likelihood, and uncertainty due to socio-economic factors and human decisions.

**Impacts (of climate change)**

The consequences of realised risks on natural and human systems, where risks result from the interactions of climate related hazards (including extreme weather/climate events), exposure, and vulnerability. Impacts generally refer to effects on lives, livelihoods, health and wellbeing, ecosystems and species, economic, social, and cultural assets, services (including ecosystem services) and infrastructure. Impacts may be referred to as consequences or outcomes and can be adverse or beneficial (IPCC 2022).

**Social investor**

Foundations, grantmakers, impact funds, family offices, banks, wealth management firms, private equity (PE) and venture capital (VC) funds which seek impact outcomes. This category includes impact investors.

**Vulnerability**

The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements, including sensitivity or susceptibility to harm and lack of capacity to cope and adapt. See also Exposure, Hazard, and Risk (IPCC 2022).

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