QUADRIA CAPITAL

in association with

HEALTH QUAD

pwc

FINANCING THE CLIMATE - HEALTH FRONTIER

EMERGING OPPORTUNITIES

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Introduction

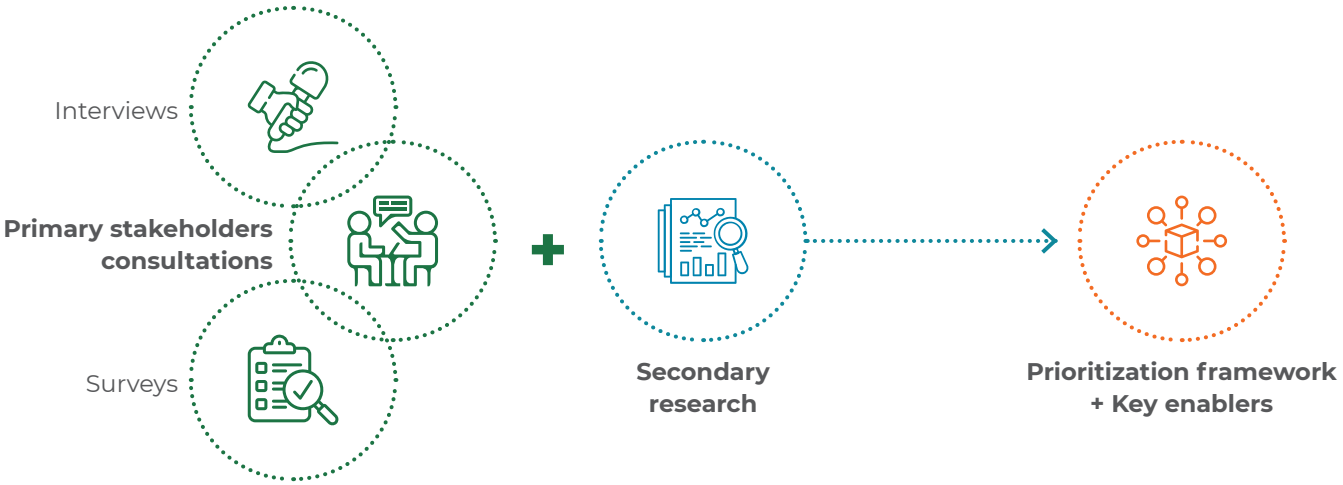
About the report

Quadria Capital has collaborated with HealthQuad and PwC to develop the 'Financing the Climate Health Frontier: Emerging Opportunities' report.

This report offers valuable insights and highlights key opportunities at the intersection of climate change and health. It explores the impact of climate change on human health in India, the current landscape of climate action, and the critical need for adaptation-focused strategies.

Additionally, it presents a prioritized list of climate-health interventions and enablers designed to build scalable, impactful solutions in this area.

The outputs of this report are developed through a comprehensive secondary research and extensive stakeholder consultations. As a result, a prioritization framework has been developed that systematically evaluates and ranks potential interventions based on criteria on social risk and funding maturity, supporting informed decision-making and efficient resource allocation. Framework inputs, drawn from thorough secondary research, were validated and enriched through consultations with diverse stakeholders in the climate-health ecosystem. Interviews and surveys were conducted with key representatives, including investment professionals, sustainability experts, fund members, healthcare providers, and government officials. These discussions provided insights into organizational perspectives, current challenges, future opportunities, and key enablers needed to advance climate-health initiatives.



ACTION FOR CLIMATE HEALTH

Quadria Capital's Action for Climate Health Series

The report is part of the Action for Climate Health (AfCH).

AfCH is launched by Quadria Capital as an initiative that aims to foster dialogue at the intersection of climate change and public health, assess the current landscape, and explore strategies for adaptation and resilience. This series will unite diverse stakeholders—private equity/venture capital players, government officials, think tanks, multilateral and philanthropic organizations—to discuss and collaboratively chart a path forward for a stronger India prepared to tackle climate-related health challenges.

Authorship

QUADRIA CAPITAL

Quadria Capital is an independent private equity firm with $3.5 billion in assets under management (AUM), specializing in investments in the healthcare sector across some of the world's fastest-growing economies in South Asia and Southeast Asia. Quadria Capital invests in leading healthcare businesses, partnering with visionary entrepreneurs to achieve exceptional growth, financial returns, and drive meaningful social impact.

HEALTH QUAD

HealthQuad is India's largest healthcare transformation fund backing innovative models to radically improve healthcare access, affordability, and quality of care by leveraging technology. With $235+ million in assets under management (AUM), HealthQuad is a thought leader and sectoral expert in healthcare and operates with the belief that positive investment returns and deep social impact can be mutually inclusive.

pwc

PwC (PricewaterhouseCoopers) is a global leader in audit, assurance, tax, and consulting, with a presence in over 150 countries. PwC supports organizations in tackling complex challenges, enhancing operational efficiency, and achieving sustainable growth through innovative solutions. Its Health Services Consulting team brings deep expertise across various healthcare sectors, including private equity, insurance, diagnostics, medtech, digital technology, and health system design.

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Sincere thanks to **Rahul Agarwal** and **Akshat Arya** from Quadria Capital; **Nidhi Dahiya** from HealthQuad; and **Dr. Ashwani Aggarwal**, **Mohit Verma**, **Sanyukta Pande**, **Dr. Priyanka Indrodia**, and **Dr. Rajat Kumar Mahobia** from PwC for their invaluable contributions to the development of the key insights in this report.

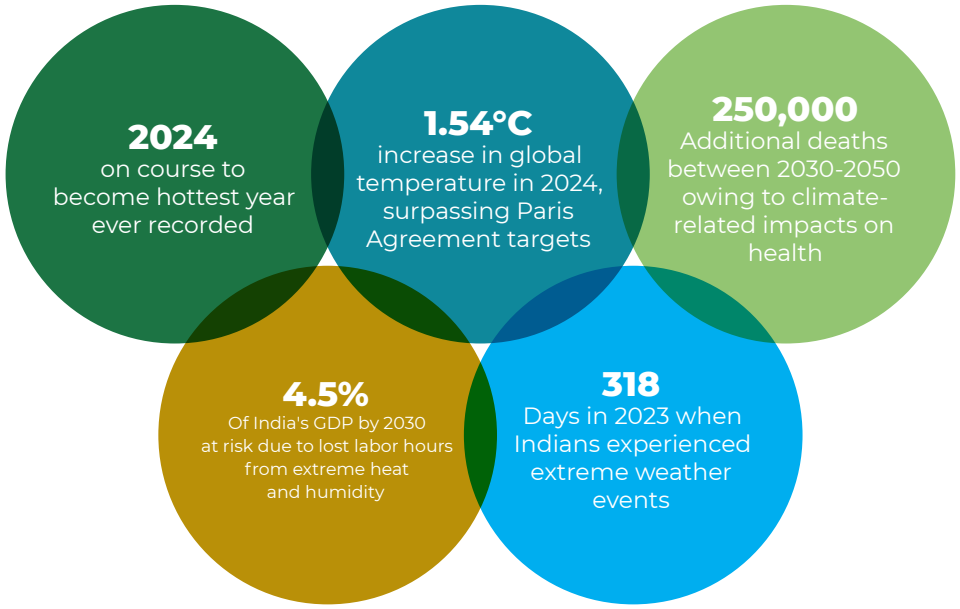
Special acknowledgment to **Karan Kumaresan**, **Dr. Vibhuti Garg**, and **Aaryaman Hoskote** from PwC for their in-depth research and analysis, which have been instrumental in shaping the report's findings.

Executive Summary

Present-day context and climate-related challenges

Globally, 3.6 billion people live in areas highly vulnerable to climate change, and by 2050, an estimated 1.2 billion individuals may be displaced due to its impacts. This alarming statistic underscores the reality that climate change is the most significant health threat facing humanity today. Despite this, less than 2%[1] of global climate adaptation funding is allocated to health-related initiatives, exposing a critical gap in addressing the health consequences of climate change.

In India, over 90%[2] of the population is at extremely high risk of heat stress, which threatens livelihoods and sustainability. Additionally, 5 out of 20 Indians[3] are highly vulnerable to extreme weather events, making the healthcare system, already strained by insufficient government funding and systemic inefficiencies, even more susceptible to the accelerating impacts of climate change. Rising temperatures, extreme weather events, sea-level rise, pollution, and changing rainfall patterns will intensify health risks, leading to more heat-related illnesses, non-communicable diseases, and outbreaks of vector-, air-, and water-borne diseases, along with malnutrition.



To address these pressing challenges, urgent action is required at the intersection of climate and health. This represents a critical opportunity for private stakeholders to not only mitigate the health impacts of climate change but also create meaningful social impact while achieving financial returns.

Climate action so far

In 2022, global climate action stood at $1.4 trillion[4], with more than 90% of activities focusing on mitigation. Presently, debt instruments dominate the action globally, hinting towards lack of equity investments and hence requirement of higher involvement of private sector in the ecosystem. In India, $22.5 billion[5] were raised for climate action in 2022. The current action is dominated by mitigative projects in energy systems and transportation, which account for roughly 70% of all climate initiatives. The climate-health initiatives presently showcase an underinvestment trend as research indicates that a mere 0.5% of total global climate finance is allocated to enhancing health outcomes. According to our analysis, approximately $1 billion—representing 4% of India's total climate action funding in 2022—was allocated to projects at the intersection of climate change and health. Lack of sectoral knowledge/prioritization, limited data, and regulatory uncertainty are the key reasons cited behind the current underinvestment trends.

Call for climate-health action

An estimated $16 billion annually is needed from both public and private sources through 2030 for adaptation and mitigation investments in India's healthcare sector to address climate-related challenges. With current investments at just $1 billion, there is a significant opportunity for private players to step in. While mitigation efforts are crucial for reducing emissions, the impacts of climate change will continue, making adaptation strategies—currently less than 10% of climate action—essential. Our analysis reveals a substantial opportunity for the private sector, with a potential $3 billion annual market for adaptation-focused strategies in the climate-health space.

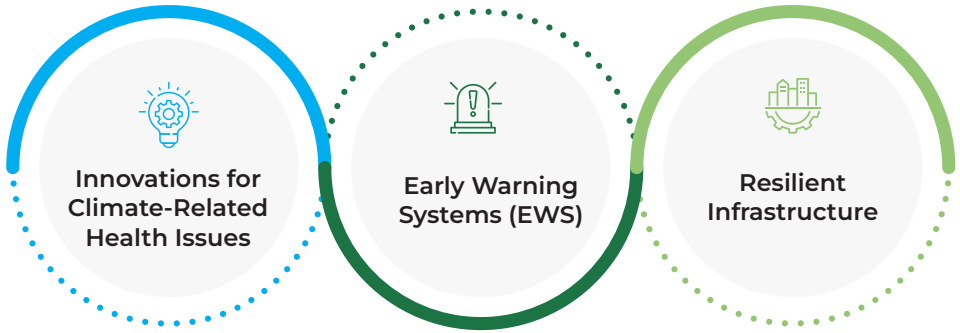
The climate-health prioritization framework

To address the pressing challenges of climate change on human health, India has integrated several policy reforms and action plans within its broader national frameworks. Leading the way are the National Action Plan on Climate Change and Human Health (NAPCCHH) and the National Programme on Climate Change & Human Health (NPCCHH), which play pivotal roles in advancing regulatory action.

As India's climate and health policy response grows, there is an increasing need to ensure that interventions are strategically prioritized. To address this need, the report focusses on developing a prioritisation framework. This framework is a systematic approach that evaluates and ranks interventions based on predefined criteria, facilitating informed decision-making and efficient resource allocation.

As per our stakeholder consultations and secondary research, players in the climate-health initiatives can adopt three major intervention themes as highlighted below.

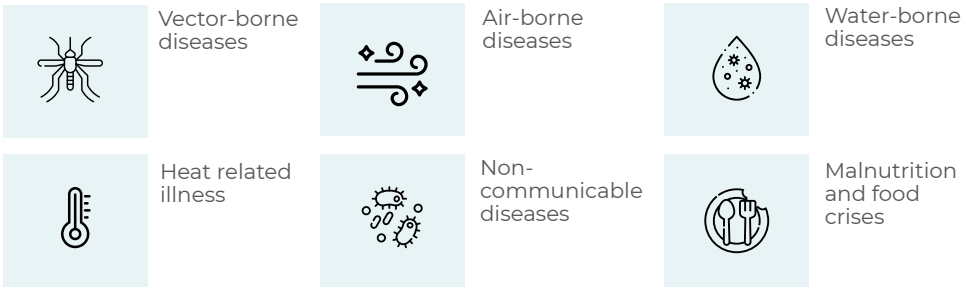
Climate-linked themes for future interventions



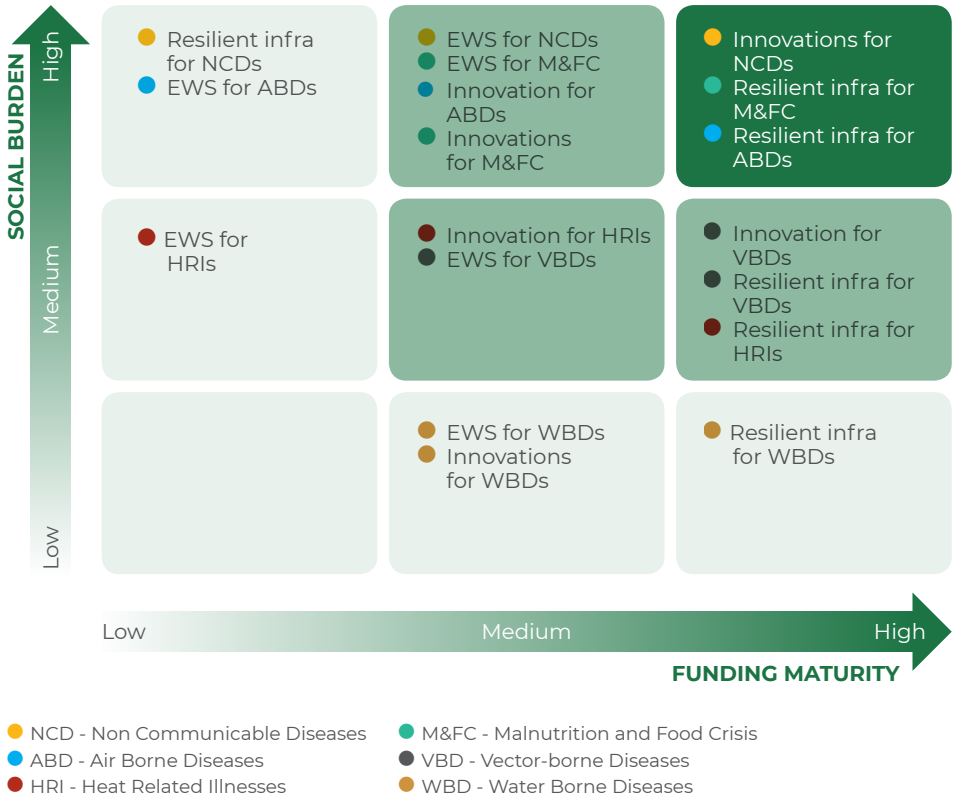
In the Indian context, the following impact themes linked to human health have been identified as requiring urgent attention to tackle the effects of climate change.

Current climate-health interventions primarily emphasize mitigation efforts. This report aims to highlight the critical need for adaptation measures, develop a prioritization framework for adaptation solutions, and identify key enablers to support their implementation.

Climate change-related impact themes linked to human health



The framework is developed to identify which of the three interventions should be prioritized for the six identified human-health related themes based on understanding two key metrics: social risk and funding maturity. The resultant framework is shown below



Pathways for prioritized interventions

As a result of the prioritization framework, three key solutions, in terms of climate-health interventions, have emerged as having a 'high' social risk and funding maturity, thereby hinting towards a greater social and financial return. These solutions are:

- **Resilient infrastructure for Malnutrition and Food Crisis**
  The development of facilities and systems capable of withstanding climate change impacts on food security
- **Innovation for Non-communicable Diseases**
  The use of medical products and technologies aimed at addressing NCDs that are likely to worsen with climate change
- **Resilient infrastructure regarding Air-borne Diseases**
  The design and construction of facilities to counter the rising risk of climate-affected airborne diseases

Enablers to advance pathways

In addition to prioritized interventions, the report has also identified key enablers to drive climate-health action. These offer actionable insights for stakeholders—such as financial agencies, policymakers, and healthcare providers—by focusing on innovative financing, data infrastructure, strategic partnerships, and research advancement, thus building a foundation for scalable, impactful solutions.

ENABLER #1

Innovative financing

Innovative financing approaches, especially blended finance, are essential to scale climate-health initiatives, attract private investment, and drive impactful solutions, addressing the critical funding gap identified by stakeholders in climate action for healthcare. Concessional capital, grant, and guarantees can aid the growth of adaptation efforts.

ENABLER #2

Data availability and evidence generation

Establishing robust data frameworks can improve evidence-based strategies, support early warning systems, and open new opportunities for startups in climate-health analytics, paving the way for scalable, impactful interventions.

ENABLER #3

Strategic partnerships

Strategic partnerships are key to scaling climate-health interventions, combining government reach with private sector agility for proactive, transformative adaptation. Collaborative efforts can enable knowledge sharing, resource pooling, and proof-of-concept projects, driving investment and impactful, scalable solutions.

ENABLER #4

Impact and outcome measurement

A standardized framework for evaluating interventions can improve decision-making, scalability, and resource efficiency, while transparent, outcome-focused practices can attract more funding and align stakeholders with resilience goals. Standardized metrics are key to tracking the full impact of these initiatives.

ENABLER #5

Capacity building on the climate-health intersection

Climate change is expected to introduce and spread diseases, requiring increased climate-health education, research, and development. Integrating climate-conscious training and job creation into healthcare curricula and planning for the evolving disease burden is essential.

Climate change and healthcare: A contextual overview

Tracking climate change: Global scenario

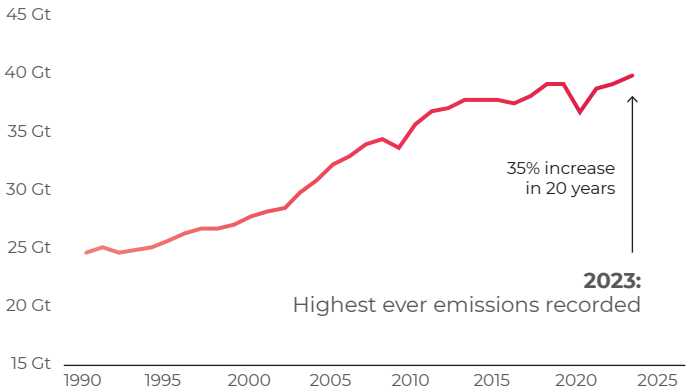
Climate change is a fundamental threat to humanity, impacting the environment and human systems, including social, economic, and healthcare sectors.

The WHO estimates 24%[6] of global deaths are linked to environmental factors. As a threat multiplier, it undermines decades of health progress.

The causes are primarily human activities like burning fossil fuels and deforestation, which release fine particulate matter and greenhouse gases, trapping heat in the atmosphere. This leads to rising temperatures, extreme weather events, and sea-level rise, disrupting ecosystems, health, and economies.

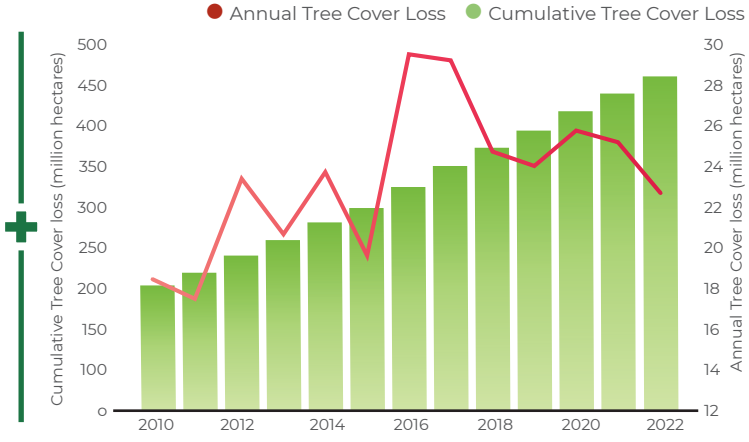
Energy-related emissions reached a new high in 2023

The global rise in CO_2 emissions from fossil fuel combustion highlights the growing contribution to climate change and its accelerating impacts. With emissions growing steadily and reaching a new record high in 2023, this trend highlights a primary driver of global warming that disproportionately affects vulnerable regions like India.

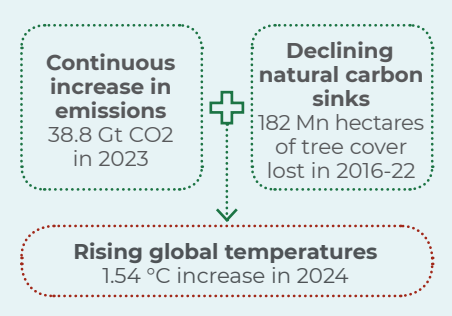


Tree cover loss continues to weaken our climate defense

The significant loss of global tree cover further reduces our natural defenses against climate change. Forests act as crucial carbon sinks, and as they diminish, greenhouse gases remain in the atmosphere, compounding the health effects of pollution and climate-related stressors on populations.

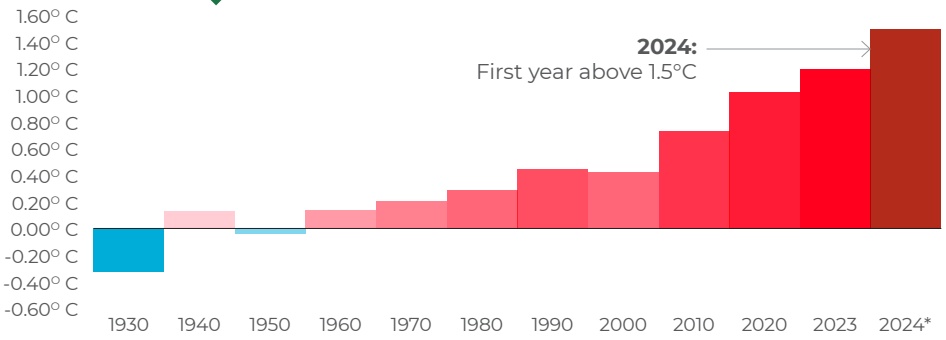


Source: The 2024 report of the Lancet Countdown on health and climate change: facing record-breaking threats from delayed action



2024: On track to become the hottest year on record

The compounding impact of increased emissions and decreased tree cover has led to rising trend in global temperatures. As reported in COP29 in 2024, The January – September 2024 global mean surface air temperature was 1.54 °C[7] above the pre-industrial average, thus making 2024 the hottest year yet.



* Jan-Sept 2024

Source: National Oceanic and Atmospheric Administration & State of the Climate 2024 Update for COP29

Climate change - Widening gaps in India's healthcare system

Climate change is a critical threat to healthcare growth as it introduces new health risks and impacts previously unaffected areas.

Climate change leads to increased deaths and illnesses from heatwaves, extreme weather events, and higher exposure to water-, air-, and vector-borne diseases. These impacts challenge the ability of healthcare systems to cope and require urgent action to address the growing threat.

The impacts of climate change are particularly acute in countries like India that are standing at a crucial juncture of addressing the dual challenge of bridging significant demand-supply gap in traditional healthcare needs while urgently addressing climate-related healthcare risks.

90% of Indian population is at extremely high risk of heat stress

Source: University of Cambridge

18 million Indians reside in areas that are at risk of sea level rise

Source: The World Bank Group

Present healthcare context and future climate vulnerabilities

In India, the healthcare sector has emerged as a major economic driver, both in terms of revenue and employment. As of FY18-23, the sector experienced a growth rate of 11-13% annually, employing approximately 7.5 million[8] individuals. In 2023, the revenue of the Indian healthcare industry was estimated at ≈$130 billion[9]. Looking ahead, the sector is poised for continued growth, with an anticipated compound annual growth rate (CAGR) of 13% from 2024 to 2027.

Despite growth and overall improvements in the healthcare market, India lags behind its peers in several healthcare metrics. For example, healthcare spending as a percentage of GDP in India is only about 2-3%, compared to the OECD average of 9%[10]. Similarly, in terms of per capita spending, India spends $74[11] per capita on healthcare, ranking among the lowest globally.

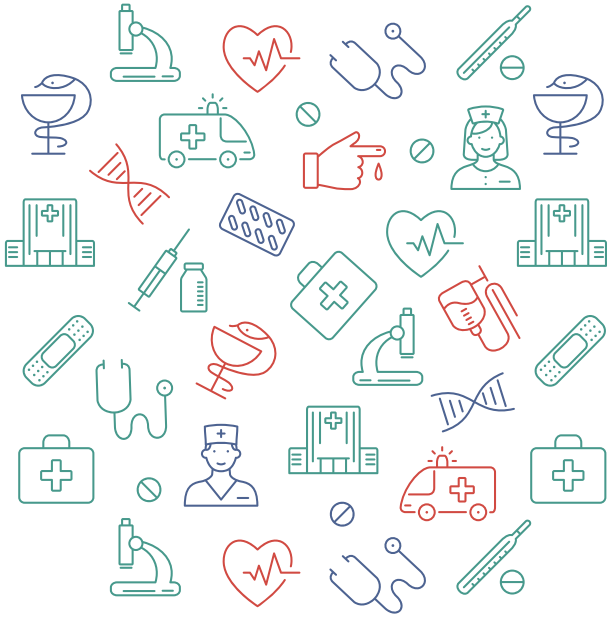
These limitations make India's healthcare sector especially vulnerable to the impacts of climate change. As the climate crisis intensifies, the sector will face mounting challenges, including an increased burden of climate-sensitive diseases, heightened demand for emergency and preventive care, and a need for resilient healthcare infrastructure.

181 billion potential labor hours were lost in 2023 due to heat exposure in India

Source: Lancet Research

Climate change will amplify existing gaps, making it even more difficult for India's healthcare system to keep pace with growing demands and global standards.

Addressing these compounded challenges is essential to protect public health and maintain the country's economic stability.



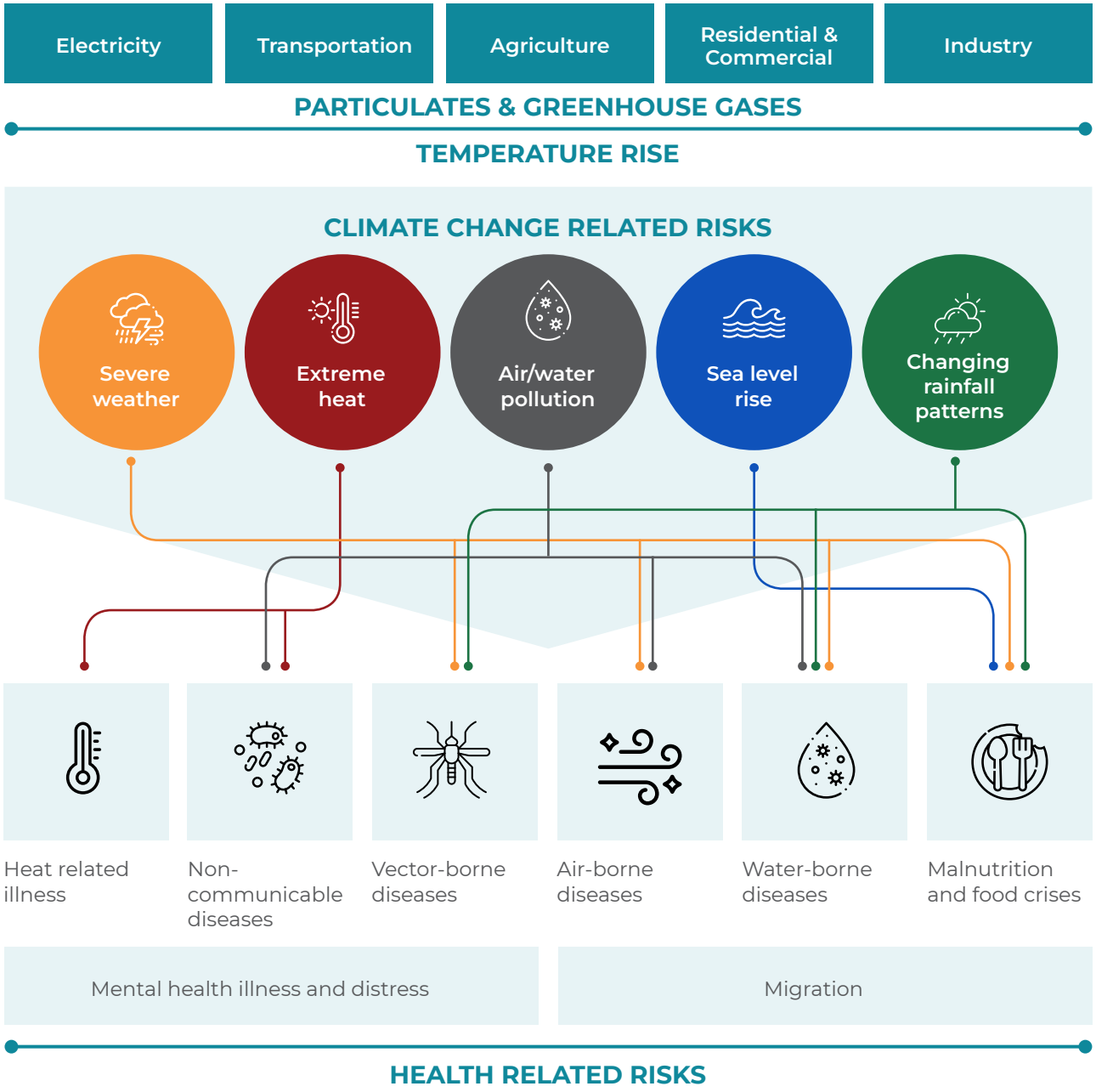
How does climate change impact your health?

As per the World Bank Group, India is highly susceptible to various climate change effects, including extreme heat, severe weather events, changing rainfall patterns, droughts, rising sea levels, and increased pollution.

By 2030, it is estimated that up to 4.5%[12] of India's GDP could be at risk due to lost labor hours from extreme heat and humidity. Beyond economic implications, climate change will disproportionately impact public health. Globally, WHO estimates climate change will result in 250,000[13] additional deaths annually between 2030-2050 from climate-related health incidences.

94%
of our survey respondents envision that climate change will have a 'significant adverse impact' on health in India over the next decade.

79%
of our survey respondents believe that the existing healthcare systems are underprepared to address climate-related health issues.



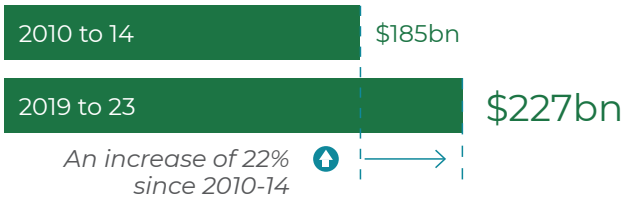
The following are the key climate related risks in India and the associated impacts:

SEVERE WEATHER

Climate change will bring about intense and disruptive weather events such as cyclones, heavy rainfall, storms, and droughts, resulting in flooding, property damage, and loss of life. Rising temperatures and shifting precipitation patterns are expected to increase both the frequency and intensity of these events. In 2023, India experienced extreme weather events on 318[14] out of 365 days.

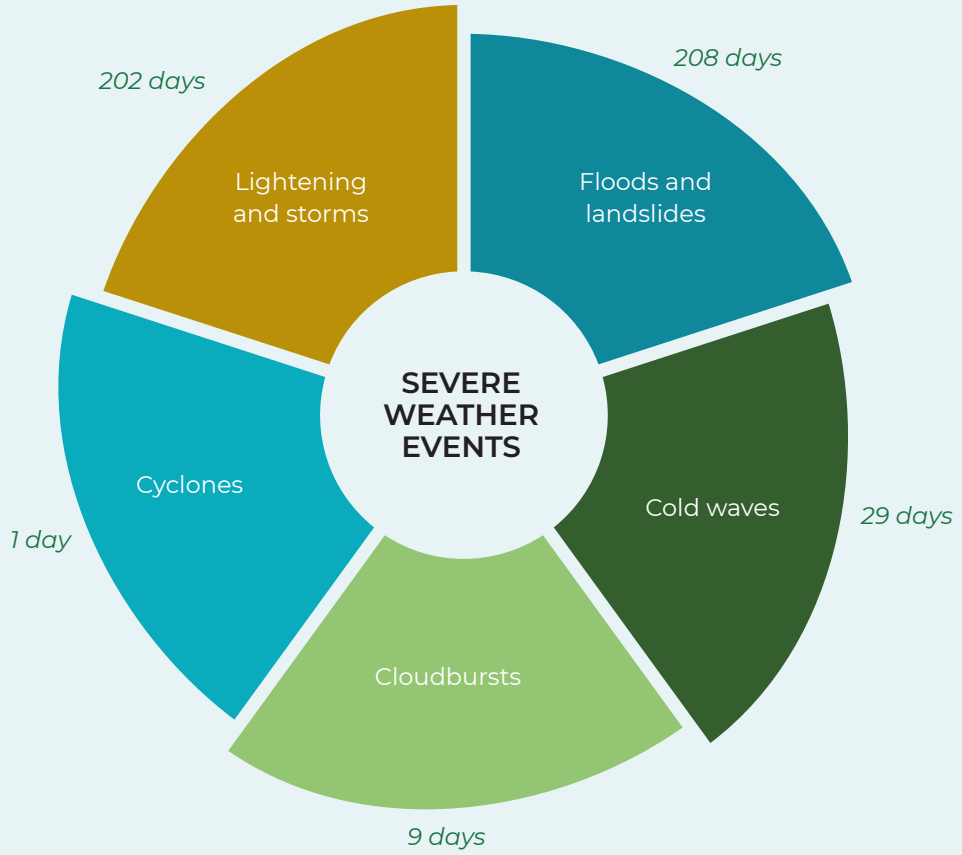
Increased risk of climate-related disasters threatens food production, potentially leading to malnutrition and heightened disease susceptibility in low- and middle-income countries. This issue is particularly acute for those unable to cope with spikes in food prices. Additionally, the burden of several climate-sensitive food-borne, water-borne, and vector-borne diseases is expected to rise under these conditions.

Weather-related extreme events caused $227 billion in global losses annually from 2019 to 2023



Source : The 2024 report of the Lancet Countdown on health and climate change: facing record-breaking threats from delayed action

Number of days of occurrence of severe weather events in India in 2023



In 2023, 26 states in India had a higher number of days of extreme weather occurrences than in the same period in 2022

Source: State of India Environment 2024

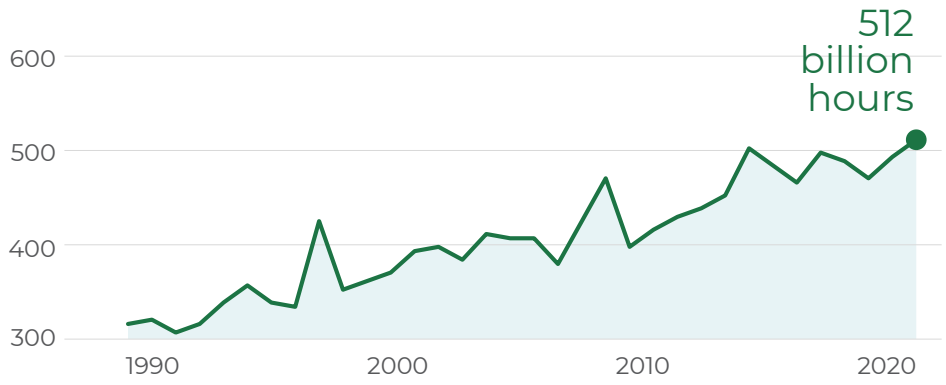
EXTREME HEAT

Climate change is set to increase temperatures in India through gradual warming and more frequent and intense heatwaves, leading to higher incidences of heat-related illnesses. In 2023, there were 121[15] days of recorded heatwaves. From March to May 2024 alone, over 25,000[16] heatstroke cases were reported due to extreme temperatures.

Research indicates that such heatwaves can reduce outdoor working capacity by up to 15%, posing a threat to economic growth. It is estimated that heat-related impacts could push 42 million people in India into poverty. Extreme heat can lead to increased occurrences of non-communicable diseases (NCDs) such as anemia, stroke, cancers, and pulmonary diseases, exacerbated further by disrupted food availability and quality.

A record 512 billion potential labour hours were lost due to heat exposure in 2023. This is equivalent to $835 billion in potential income losses:

Labour hours lost due to heat exposure, global total*



Source: The 2024 report of the Lancet Countdown on health and climate change: facing record-breaking threats from delayed action

AIR/WATER POLLUTION

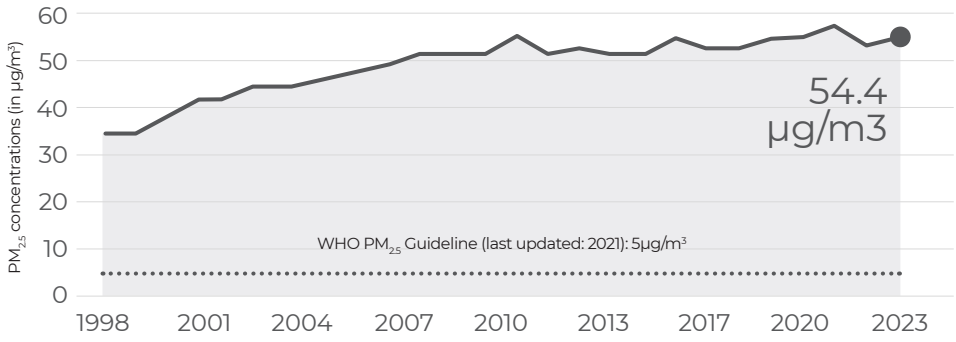
Elevated levels of harmful airborne substances, including greenhouse gases and particulate matter exacerbated by climate change, will contribute to air pollution. Air pollution results in 6.5 million[17] deaths annually, with 70% occurring in the APAC region.

India is home to 39 of the world's most polluted cities, with over 34 million individuals suffering from asthma.

Additionally, water quality and public health will be adversely impacted as changes in precipitation patterns and extreme weather events lead to greater contamination of water sources, resulting in higher concentrations of pollutants and pathogens. A warmer climate could make water-borne diseases, including cholera and diarrheal diseases, more common. Waterborne illnesses cause 1.5 to 2 million[18] deaths worldwide each year.

In India alone, over 6 million cases of typhoid are reported annually, with a 30% increase observed during the monsoon season of 2023.

Annual average $PM_{2.5}$ concentrations in India, 1998-2023



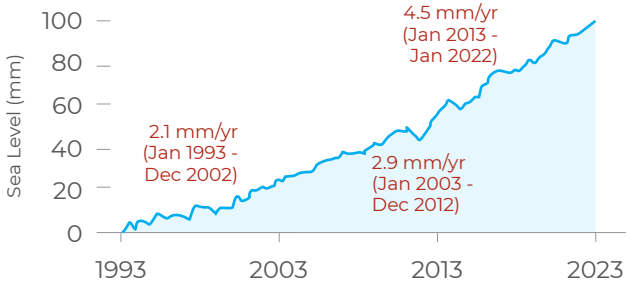
Source: Air Quality Life Index

SEA LEVEL RISE

- Rising sea levels, driven by melting glaciers and thermal expansion due to climate change, pose a significant threat to India's coastal regions. With a coastline spanning over 7,500 kilometers, India is highly vulnerable to coastal erosion, submergence of low-lying areas, and saltwater intrusion into freshwater systems.
- In the Indian context, majority of the sea level rise is due to thermal expansion of ocean water as temperatures increase. As per secondary research, Indian Ocean is the fastest warming ocean in terms of surface warming.

According to World Meteorological Organization (WMO), the rate of sea-level rise was 4.5 millimeter per year between 2013 and 2021, twice the rate between 1993 and 2002.

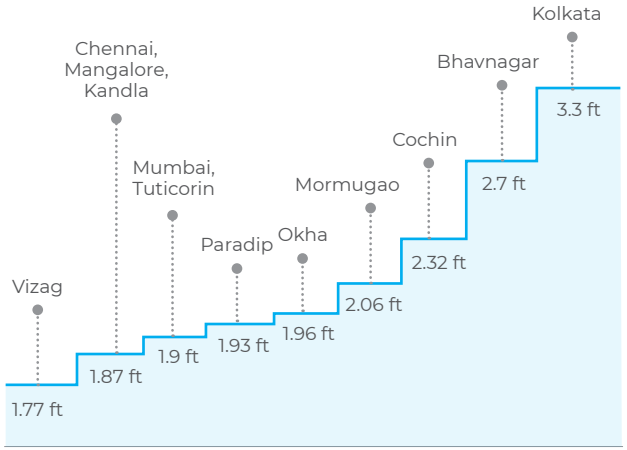
Annual global mean sea level rise



Source: WMO State of the Global Climate Report

- Sea level rise is expected to exacerbate the impact of storm surges during cyclones, increasing damage to infrastructure and disrupting livelihoods. Additionally, saline intrusion into groundwater threatens drinking water supplies and agricultural productivity, further worsening food insecurity and increasing vulnerability to malnutrition.
- Sea level rise in the southwestern Indian Ocean region is occurring at a rate of 2.5 mm/year[19]. 36 million Indians[20] are estimated to be at risk of chronic flooding by 2050 with the number growing to 51 million Indians by 2100.

Expected sea level rise by 2100 for vulnerable India cities



Source: NASA's Sea Level Projection tool

CHANGING RAINFALL PATTERNS

- Global rainfall patterns are shifting due to climate change, primarily driven by rising temperatures and altered atmospheric dynamics. Warmer air holds more moisture, leading to intense rainfall events, while changes in ocean temperatures and wind patterns disrupt the regularity of weather systems. Such changes have made rainfall more erratic, with some regions experiencing floods and others prolonged droughts.
- In India, changing rainfall patterns are expected to lead to water insecurity and decreased agricultural productivity.
- 55% of subdistricts in India witnessed an increase and 11% witnessed a decrease in southwest monsoon rainfall in 2012-2022[21].

A significant increase in the southwest rainfall has been observed in Rajasthan, Gujarat, central Maharashtra, and parts of Tamil Nadu.

Climate risks related to human health and healthcare

Heat-Related Illnesses (HRIs): Rising global temperatures and more frequent heat waves lead to a surge in heat-related illnesses such as heat stroke, heat exhaustion, dehydration, and worsened pre-existing conditions. Prolonged exposure to extreme heat can disproportionately affect vulnerable populations such as the elderly, children, and those with chronic illnesses.

Because of climate change, people faced, on average, a record 50 more[22] days of health-threatening heat in 2023 than expected without temperature change

Non-Communicable Diseases (NCDs): Environmental changes, like heatwaves, air pollution, and water contamination, increase the incidence of NCDs including anemia, pulmonary disorders, and cardiovascular diseases. Research links extreme climate events with higher rates of strokes, migraines, and worsened conditions like dementia and multiple sclerosis.

Vector-Borne Diseases (VBDs): Changes in temperature, humidity, and rainfall patterns due to climate change can expand habitats for vectors like mosquitoes and ticks, which spread diseases such as malaria, dengue fever, Zika virus, and Lyme. These changes can lead to the spread of vector-borne diseases into previously unaffected regions.

Airborne Diseases (ABDs): Climate change deteriorates air quality by increasing pollutant and particulate matter concentrations. Combined with changes in humidity and temperature, this accelerates the spread of airborne diseases like influenza, tuberculosis, and respiratory viruses. Poor air quality also worsens chronic respiratory conditions such as asthma and bronchitis.

In 2020, 110[23] death per 100,000 people in India were from exposure to household air pollution

Waterborne Diseases (WBDs): Increased flooding and disruptions to clean water supplies lead to contaminated drinking water sources, resulting in higher incidences of waterborne diseases like cholera, dysentery, and gastroenteritis. Warmer water temperatures encourage harmful pathogen growth, making water sources even more hazardous for consumption.

Malnutrition and Food Crisis (M&FC): Changes in temperature, rainfall patterns, and increased natural disasters adversely affect crop production, leading to reduced yields, lower quality harvests, and diminished nutritional value. This results in food insecurity and malnutrition, with rising food prices worsening the situation.

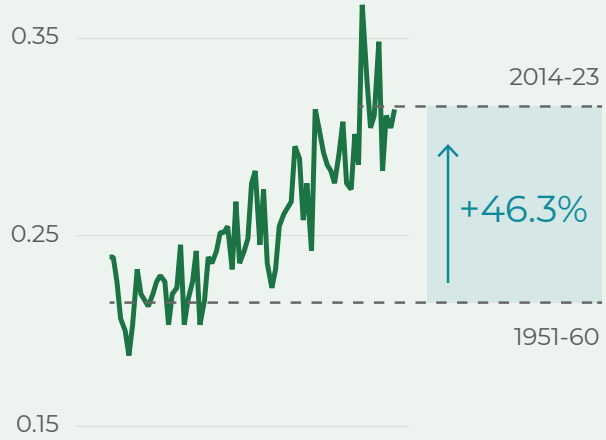
The higher frequency of heatwave days and drought months in 2022, compared with 1981–2010, was associated with 151 million[24] more people experiencing moderate or severe food insecurity across 124 countries

Case in point: VBDs

The climatic suitability for the transmission of dengue has increased over the years

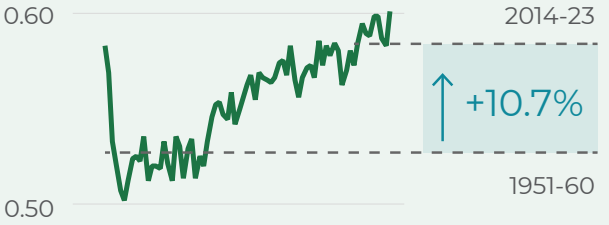
Aedes albopictus mosquitos

Between 1951–60 and 2014–23, suitability for transmission by Aedes albopictus increased by 46·3%



Aedes aegypti mosquitos

Over the same period, suitability for transmission by Aedes aegypti increased by 10·7%



Source: The 2024 report of the Lancet Countdown on health and climate change: facing record-breaking threats from delayed action

Indirect risks linked to climate change

Beyond direct effects on human health, climate change will also strain the healthcare system's capacity, leading to indirect public health impacts.

Healthcare services related risks

Healthcare Workforce Instability

Healthcare Workforce Instability: Climate change increases the frequency and intensity of extreme weather events that disrupt transportation, displace healthcare workers, and damage healthcare facilities. It also heightens the burden on healthcare systems by driving the rise of climate-related diseases, causing higher staff burnout, absenteeism, and workforce retention challenges, particularly in vulnerable regions.

Energy Insecurity in Healthcare Systems

Energy Insecurity in Healthcare Systems: Climate change-induced events strain power grids, causing frequent blackouts or power fluctuations. Healthcare facilities, especially in low-resource settings, struggle to maintain consistent electricity needed for critical operations. Extreme heat can also overload cooling systems, further compromising power reliability.

Vulnerability of Infrastructure and Supply Chains

Vulnerability of Infrastructure and Supply Chains: Climate-related disasters increasingly damage physical healthcare infrastructure, such as hospitals, clinics, and storage facilities. They also disrupt supply chains by damaging transportation networks, delaying essential medical supplies, pharmaceuticals, and equipment deliveries.

Healthcare systems and climate change: A cyclical relationship

While climate change significantly impacts human health, the healthcare sector itself contributes to the severity of climate change. The global healthcare sector's climate footprint equals 4.4%[25] of global net emissions, releasing around 2 gigatons of carbon dioxide into the environment. If healthcare were a country, it would rank as the fifth largest emitter globally.

In India, Scope 1 emissions—directly released from healthcare organizations and their owned vehicles—constitute about 8% of the sector's total carbon footprint. Scope 2 emissions, stemming from energy consumption, including purchased electricity, cooling, steam, and heating, account for roughly 11% of the sector's emissions. Scope 3 emissions, encompassing a wide range of indirect sources related to the supply chain, waste management, and other activities, represent nearly 81% of the Indian healthcare sector's total emissions.

Overall, climate change is poised to profoundly impact human health, affecting individuals and healthcare systems alike. It will disrupt health-related infrastructure and supply chains, presenting potential challenges in delivering care and maintaining medical resources.

Challenges create opportunities

To address climate-related health issues, the stakeholders in the healthcare ecosystem must develop and implement robust strategies for adaptation and mitigation. **This scenario presents investable opportunities offering both financial returns and social impact for private investors to explore the nexus of healthcare and climate change.**

Building resilient healthcare through climate finance

Climate action so far

Generally, the steps to tackle climate change revolve around the two following strategies:

- **Mitigation:** Mitigation focuses on addressing the root causes of climate change by reducing greenhouse gas emissions and enhancing carbon sinks. Such strategies aim to limit the extent and rate of future warming and its associated impacts. **Example:** A healthcare facility installing solar panels and switching to renewable energy sources to reduce its carbon footprint

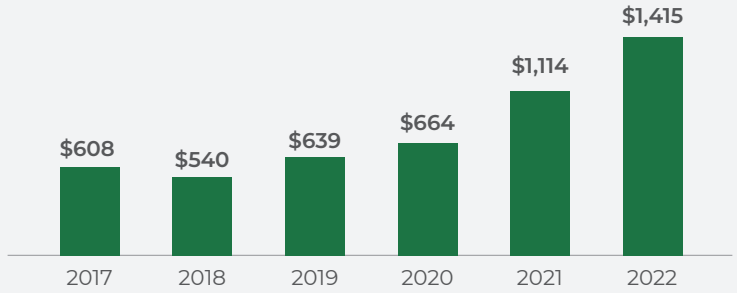
- **Adaptation:** Adaptation involves making changes to systems, practices, and infrastructure to better cope with the effects of climate change that are already happening or expected to occur. **Example:** A hospital in a heat-vulnerable region developing a heat action plan with cooling systems, heat shelters, early warnings, and staff training to manage heat-related illnesses.

Currently, a significant share of climate focus is towards mitigation-based projects.

Global scenario

In 2022, global climate finance flows averaged nearly **$1.4 trillion**[26] annually, with 91% being directed towards mitigation efforts, while adaptation accounted for only 5% of overall climate financing. Presently, public and private investments are nearly evenly split in global climate financing, with debt instruments dominating globally, representing 59% of the total flows.

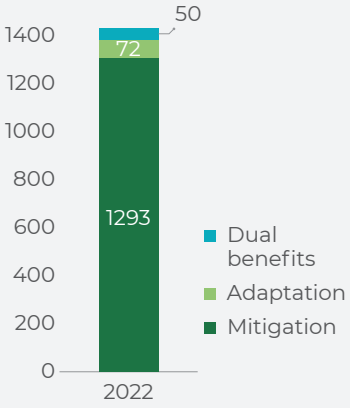
Global climate action ($ billion)



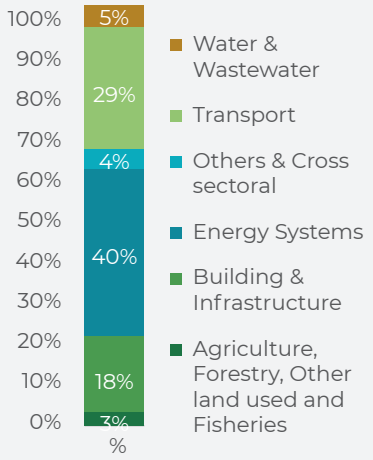
Climate action efforts are currently dominated by mitigative projects in energy systems and transportation, which account for roughly 70% of all climate initiatives. In contrast, activities aimed at addressing health-related impacts of climate change have been relatively minimal over the years.

Global climate action in 2022 ($b)

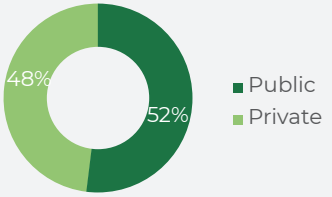
$ 1,415 billion



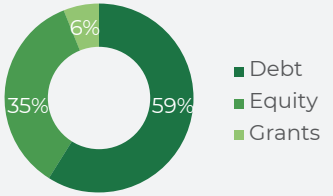
Share of sectors in climate action in 2022 (%)



Split between public and private financing



Proportion of debt, equity and grants



Source: Climate Policy Initiative - Global Landscape of Climate Finance 2023

According to the Wold Health Organisation, 2%[27] of overall adaptation funding and 0.5% of overall climate funding is dedicated to improving health outcomes.

The following are some of the active bilateral and multilateral organizations in the funding landscape of climate change and healthcare.

Funding agency	Focused sub-sectors (climate change x health)	Financing done in 2010-2022
Ministry of Foreign Affairs (Japan)	Health infrastructure, basic healthcare, pandemic response, infectious diseases	$2.2 billion
Japanese International Co-operation Agency	Health policy, medical services, health infrastructure	$1.6 billion
International Development Association	Health policy, medical services, basic nutrition, basic healthcare	$1.6 billion
United States Agency for International Development	Basic nutrition, infectious diseases, vector-borne diseases, pandemic control	$1.5 billion
International Bank for Reconstruction and Development	Health policy, medical services, infectious diseases	$1.0 billion
European Commission	Health infrastructure, basic nutrition	$0.9 billion

Source: OECD DAC database

Our survey results show that the key motivators for funding agencies to support climate action in healthcare are:

- Enhancing healthcare accessibility and affordability
- Achieving the UN Sustainable Development Goals (SDGs) by 2030
- Lowering greenhouse gas (GHG) emissions and reducing vulnerability to climate-related diseases

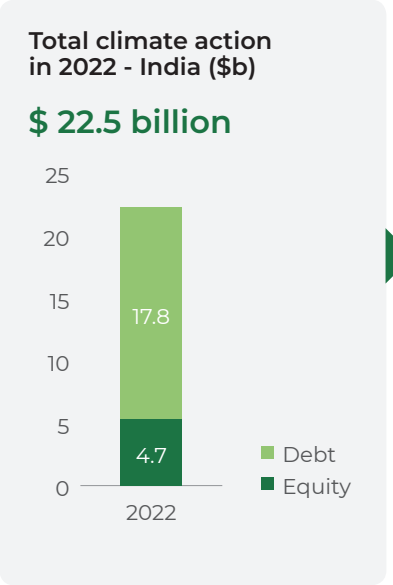
India's path to climate action

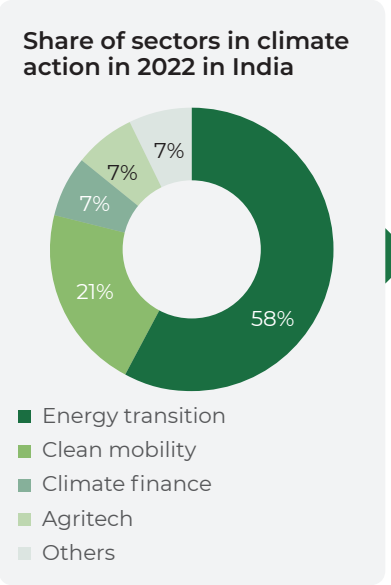
In India, **$22.5 billion**[28] was raised for climate action in 2022, with $4.7 billion coming from equity funding. The share of debt-based instruments is 80% in India, significantly higher than the share globally (59%), thus hinting towards a lack of equity funding and hence, a requirement of higher involvement from the private sector in the ecosystem. In line with the global trend, climate action in India is concentrated on clean mobility and energy transition.

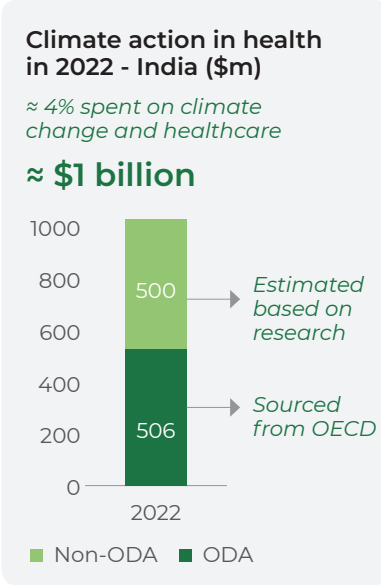
Investing in healthcare for a climate-resilient India

Our analysis shows that approximately **$1 billion**[29]—representing 4% of India's total climate action funding in 2022 —was allocated to projects at the intersection of climate change and health. This underinvestment in climate-health initiatives reflects a global trend, with only 2%[30] of global climate adaptation funding and a mere 0.5% of total global climate finance allocated to enhancing health outcomes.

85%
of survey respondents believe that the current funding level at the intersection of climate and health is inadequate.







Source: Climake- The state of climate finance in India- 2024

Source: Quadria Capital analysis

The OECD's climate-related development finance dataset provides a detailed overview of climate-related health investments, capturing contributions from bilateral, multilateral, and private philanthropic sources. In 2022, India received $1 billion, with **$506 million** from Official Development Assistance (ODA) by developed countries, specifically targeting the health impacts of climate change.

The funding is primarily focused on strengthening healthcare infrastructure, reducing greenhouse gas emissions from healthcare facilities, and supporting research on emerging infectious diseases linked to climate change.

The remaining portion of the $1 billion, approximately **$500 million**, represents non-ODA investments including private sector investments investments focused on enhancing the resilience of healthcare systems. These investments often target healthcare digitalization, including telemedicine, as well as improvements in vaccine production and supply chains. However, these efforts are generally not classified under climate change initiatives. Our analysis shows that about $500 million in deals were made in these areas in 2022, indirectly supporting climate resilience within the healthcare sector.

Survey respondents identified funding from Multilateral Development Banks (MDBs) and Development Finance Institutions (DFIs) as the leading driver of climate action within the healthcare sector.

As mentioned, India received $506 million from Official Development Assistance (ODA) by developed countries, specifically targeting the health impacts of climate change.

The following are the notable ODA investments made in 2022 at the nexus of climate change and healthcare in India.

Funding agency	Funding amount	Sub-sector	Project aim
Japan International Cooperation Agency (JICA)	$347 million	Medical services	To strengthen health system in Assam state of India through improved public medical service delivery with a focus on climate resilient infrastructure.
International Bank for Reconstruction and Development	$51 million	Medical services	To strengthen pandemic preparedness and response systems and institutions in India.
IKEA Foundation	$50 million	Basic health care	To integrate sustainable energy solutions, efficient equipment, and energy design elements into 25,000 health care facilities across India by 2026.
International Bank for Reconstruction and Development	$30 million	Basic health care	To improve quality, equity, and governance of disease surveillance in Gujarat state of India.
International Bank for Reconstruction and Development	$20 million	Medical services	To increase utilization of comprehensive primary health care services, improve quality of care, and strengthen governance of the health sector in India.
Department for Business, Innovation and Skills (United Kingdom)	$1 million	Medical research	To use onehealth approaches to understand and co-develop interventions for zoonotic diseases affecting forest communities in India
Wellcome Trust	$1 million	Medical research	To build data capacity by strengthening the skills and capabilities of data professionals, enabling them to tackle pressing climate, environment, and health challenges.
United States Agency for International Development (USAID)	$850 thousand	Infectious diseases	To identify antimicrobial resistance in priority infectious diseases through an accessible, accurate and adaptable, as well as timely and integrated, diagnostic network system.

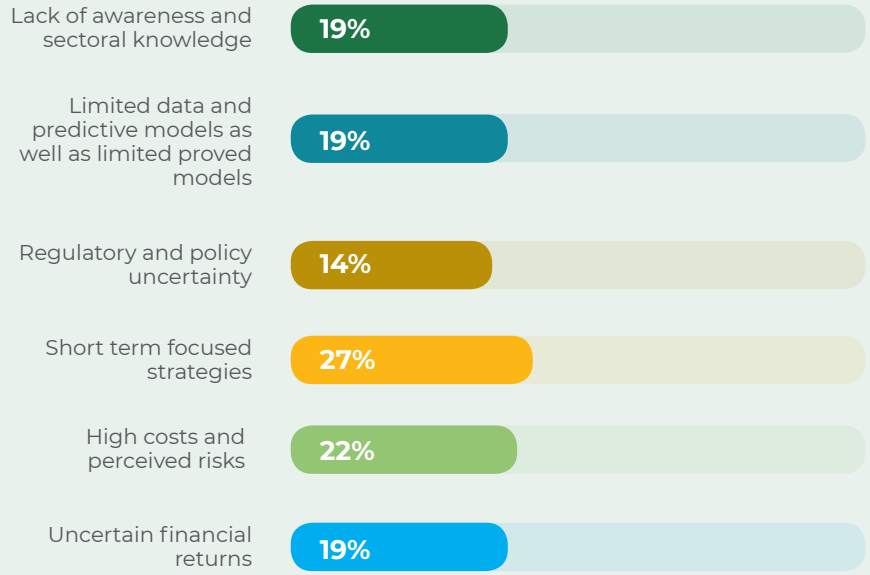
Source: OECD DAC database

Investing in health–call for climate action

To address climate-related impacts as well as improve access, affordability, and quality in healthcare in India, it is estimated that **$16 billion**[31] would be needed annually from both public and private sources till 2030 in adaptation and mitigation related investments in the healthcare sector in India. Private sector participation is expected to contribute 50-60% of this total investment.

With current investments at the intersection of climate and healthcare at $1 billion, and an estimated $16 billion needed to address climate-related health risks, a significant opportunity exists for private players to step in, offering the potential for both financial and social returns.

Funding at the intersection of healthcare and climate change is presently limited because of the following reasons as identified in our survey



When considering the impact of climate change on health, it becomes evident that certain health areas are more affected than others and the level of **current research and actionable guidance is limited.**

There is **insufficient awareness** and conversation on the climate-health intersection along with **gaps in data and evidence.**

The **use of innovative finance instruments** has recently increased to scale up private finance for climate and support the Sustainable Development Goals (SDGs). While blended finance can accelerate and catalyze markets, these models will only be effective if there are **appropriate regulations** in place to accelerate technology adoption in the climate health space.

Such reasons make it challenging for investors and stakeholders to identify and prioritize impactful projects, leading to a gap in the allocation of resources where they are needed most.

This report aims to explore investable opportunities for private funds looking to invest in climate change and healthcare.

Adaptation models: the urgent need of today

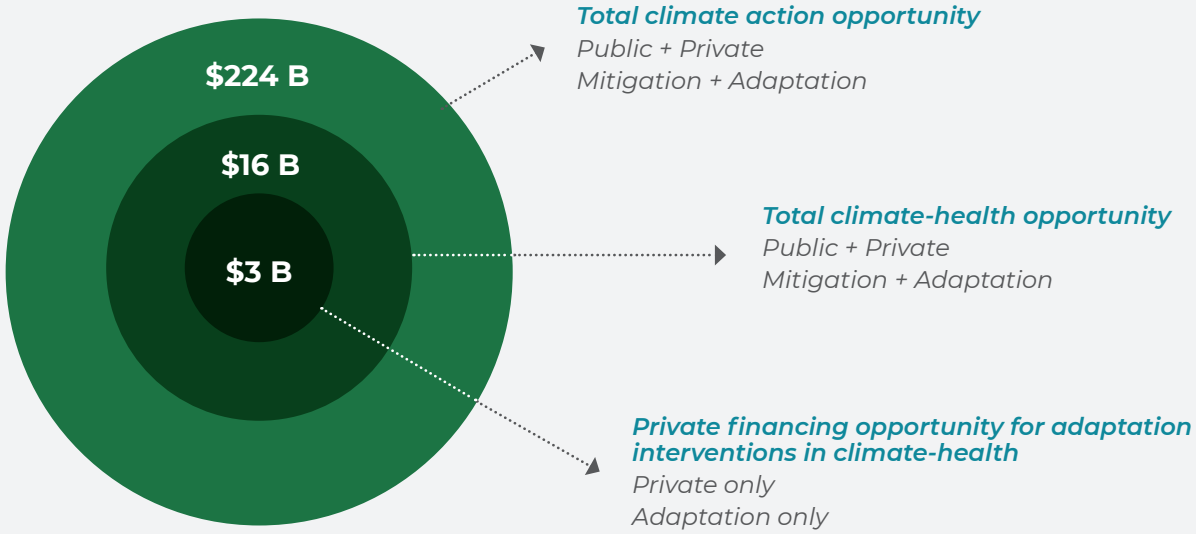
Presently, the bulk of climate financing is directed towards mitigation strategies, with research indicating a funding ratio for climate adaptation versus mitigation of 1:9[32] across various sectors. This disparity is evident in the healthcare ecosystem as well.

in 2024, global temperatures are approximately 1.5 degrees Celsius[33] higher than pre-industrial levels, leading to significant and rapid changes in the atmosphere, oceans, and ecosystems. Consequently, extreme weather events and climate-related disruptions are becoming

more frequent and severe across all regions. **While mitigation efforts are crucial for curbing emissions, the impacts of climate change will persist. Thus, prioritizing adaptation-centered intervention is vital for tackling these challenges effectively.**

Market potential for private sector investment

Annual investments required in climate action in India till 2030



India will need an estimated $16 billion annually for climate action financing in healthcare sector through 2030, sourced from both public and private entities. Within this landscape, the private sector holds a substantial opportunity, with a potential $3 billion annual market for adaptation-focused strategies.

Source: Quadria Capital's analysis of data available in UNEP Adaptation Gap Report 2024 and Climake - The State of Climate Finance in India in 2024

Climate-smart interventions: a pathway to resilience in healthcare

Given the emerging challenges posed by climate change as well as potential future opportunities, it is crucial for the healthcare sector to explore and adopt interventions that integrate climate considerations. Research shows that integrating climate strategies can offer multiple advantages to healthcare organizations as mentioned below:

Top-line growth:
Addressing climate change impacts and implementing strategies to mitigate these effects can enhance an organization's market reputation. This, in turn, attracts patients who prefer environmentally responsible healthcare providers, helping organizations expand into new markets and strengthen their presence in existing ones. Additionally, eco-conscious patients may be willing to pay a premium for green healthcare options.

Cost reductions:
Implementing energy-efficient and climate-friendly systems, such as renewable energy sources or advanced energy management systems, can significantly reduce operational costs. For example, optimizing heating, ventilation, and air conditioning (HVAC) systems in healthcare facilities can lower energy bills.

Productivity uplift:
A climate-focused approach can help companies attract and retain top talent, boost employee motivation through a shared sense of purpose, and improve overall productivity. Research shows that making a positive impact is linked to higher job satisfaction, which in turn enhances employee engagement.

Investment credibility:
Healthcare organizations with strong climate-related credentials are increasingly attractive to investors who prioritize sustainability. This can lead to increased access to capital and favorable financing terms. Further, sustainable practices can enhance the long-term value of assets and facilities.

Less regulatory and legal interventions:
Proactively addressing climate change can help healthcare organizations stay ahead of increasingly stringent environmental regulations and standards. This reduces the risk of non-compliance fines and legal challenges. Furthermore, aligning with climate-related considerations can position organizations favorably for future grants, incentives, and financial support.

Climate-linked interventions in healthcare need to integrate mitigation and adaptation strategies to address climate change effectively. Mitigation efforts aim to reduce the environmental impact of healthcare sector by adopting energy-efficient technologies, utilizing renewable energy, minimizing waste, designing sustainable facilities, and promoting eco-friendly transportation. In contrast, adaptation strategies will equip healthcare systems for climate-related challenges by strengthening infrastructure to handle extreme weather, developing emergency preparedness plans, implementing disease prevention measures for climate-sensitive illnesses, establishing heat action plans, and ensuring access to clean water. Together, these approaches support public health protection while advancing environmental sustainability.

Intervention themes for adaptation strategies

Existing and upcoming players in the healthcare sector can work across three key themes for establishing interventions in climate- health ecosystem. These themes can either result in finetuning the existing services or introducing new products for consumers.

Future interventions for climate change linked human health themes

Innovations for Climate-Related Health Issues:

The intervention encompasses the creation and application of medical products, technologies, and therapies tailored to address health problems exacerbated by climate change. This includes developing vaccines, diagnostic tools, and treatments specifically designed for diseases affected by shifting climate patterns. Such enhancements also include enhancement of healthcare systems and protocols to manage and respond to emergencies caused by climate-related events.

Early Warning Systems (EWS)

The intervention involves the implementation of systems designed to monitor and anticipate climate-related health risks. Utilizing data analytics, sensors, and forecasting tools, these systems provide early warnings for potential health threats, enabling proactive measures to mitigate their impact.

Resilient Infrastructure

The intervention focuses on the design and construction of facilities and systems that can withstand the impacts of climate change. It includes adopting sustainable building practices, using climate-resilient materials, and integrating adaptive technologies to maintain functionality and effectiveness in adverse environmental conditions. In terms of overall infrastructure, the model also pertains to the development of robust and adaptable supply chains for medical supplies and equipment. It further involves preparing and equipping healthcare professionals to handle the health impacts of climate change effectively.

Navigating funding and social impact: A prioritization framework for climate and health

India’s policy framework for climate and health

2008
National Action Plan on Climate Change (NAPCC)

The government’s climate change efforts began with the launch of the **National Action Plan on Climate Change (NAPCC) in 2008,** serving as India’s primary climate strategy. Initially, the NAPCC comprised eight missions focusing on areas such as solar energy, energy efficiency, sustainable agriculture, and water resources.

2010
National Mission on Strategic Knowledge for Climate Change (NMSKCC)

Under the NAPCC, the Department of Science and Technology implemented the **National Mission on Strategic Knowledge for Climate Change (NMSKCC)** in 2010 to promote research, knowledge generation, and capacity building.

2014
National Adaptation Fund for Climate Change (NAFCC)

In 2014, the **National Adaptation Fund for Climate Change (NAFCC)** was established to support adaptation projects, including those in health, in line with the NAPCC. To date, the fund has allocated over $113 million[34], with the majority directed toward projects focused on resilient agriculture and water management.

2015
Health Mission in NAPCC

In 2015, the **Health Mission** was introduced as part of the national missions under the NAPCC. Initially, health was not a primary focus of climate change-related policies and was indirectly addressed within missions such as the National Water Mission and the National Mission for Sustainable Agriculture.

2018
National Expert Group on Climate Change & Health (NEGCCH)

Following the decision to include health as part of NAPCC, the **National Expert Group on Climate Change & Health (NEGCCH)** was established to prepare an action plan, recommend adaptation strategies, and devise a response framework for diseases linked to climate variability and change.

2018
National Action Plan on Climate Change and Human Health (NAPCCHH)

The NEGCCH launched the **National Action Plan on Climate Change and Human Health (NAPCCHH)**, emphasizing the enhancement of monitoring and surveillance systems for climate-sensitive diseases. This plan includes establishing early warning systems and alerts at state and district levels, as well as promoting a green and climate-resilient healthcare sector.

2019
National Programme on Climate Change & Human Health (NPCCHH)

Building on NAPCCHH, the **National Programme on Climate Change & Human Health (NPCCHH)** was launched in 2019 with goals to increase awareness, build capacity, and enhance preparedness.

India’s policy response to the intersecting challenges of climate change and public health has evolved significantly over recent decades, increasingly recognizing health as a critical component of its climate strategy. The government has integrated climate-resilient health strategies within broader national frameworks to address the substantial public health challenges posed by climate change.

At the state level, the Indian government has mandated each state to develop a **State Action Plan on Climate Change and Human Health (SAPCCHH)**, providing region-specific guidance on health adaptation strategies for climate-sensitive diseases. These plans address a spectrum of health issues, including air pollution-related respiratory illnesses, vector-borne diseases like malaria and dengue, and mental health challenges related to climate stress.**Centers of Excellence (CoEs)** have also been established to support state-level adaptation efforts, offering expertise in disease-specific health responses under changing climate conditions.

In terms of mitigation, funds are allocated to the Indian states for green and low-carbon emission initiatives under the National Health Mission. Further, principles of **Green & Climate Resilient Hospitals** have been incorporated under Indian Public Health Standards (IPHS), 2022. The guidelines were developed to support the NPCCHH and to strengthen India's healthcare system.

The case for a climate-health prioritization framework

As India's climate and health policy response grows, there is an increasing need to ensure that interventions are strategically prioritized.

The current policies underscore the government's commitment to building climate-resilient health systems across the nation. However, given the wide range of climate-sensitive health challenges and the constraints on resources, it becomes essential to have a clear prioritization framework to optimize impact and direct resources effectively. To address this need, a prioritization framework has been developed as part of this report. **The framework is a systematic approach that evaluates and ranks interventions based on predefined criteria, facilitating informed decision-making and efficient resource allocation.** This prioritization process not only guides efficient resource allocation but also opens actionable opportunities for private sector investment, aligning public and private efforts towards resilient healthcare interventions in the face of climate change.

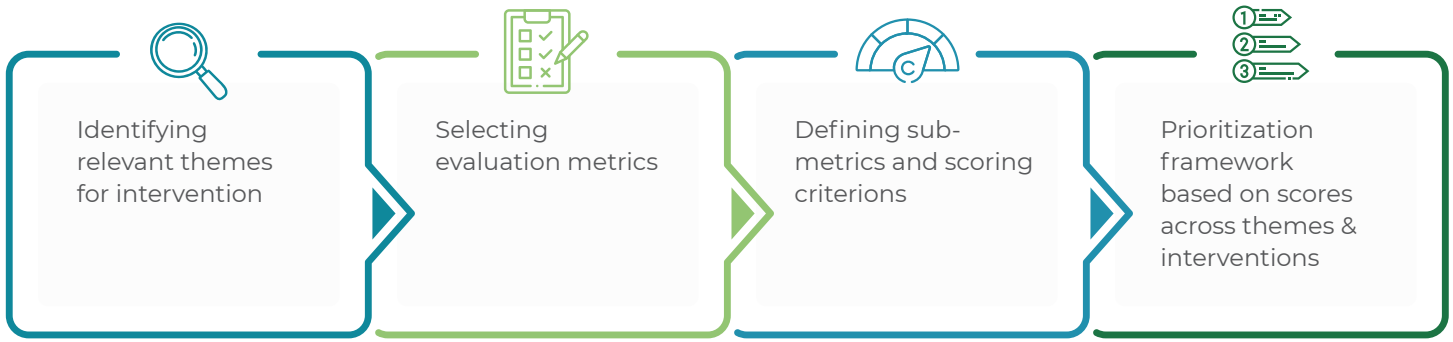
Our survey results reveal that the primary barrier preventing organizations from integrating climate change into their healthcare strategies is a lack of sector-specific knowledge and prioritization, with 27% of respondents highlighting this as the main challenge.

India Climate- Health Policy Framework

Building the prioritization framework: our approach

This report aims to develop a framework that prioritizes solutions based on climate change-related themes linked to human health and identifies corresponding interventions that can drive both potential social and financial return for such themes.

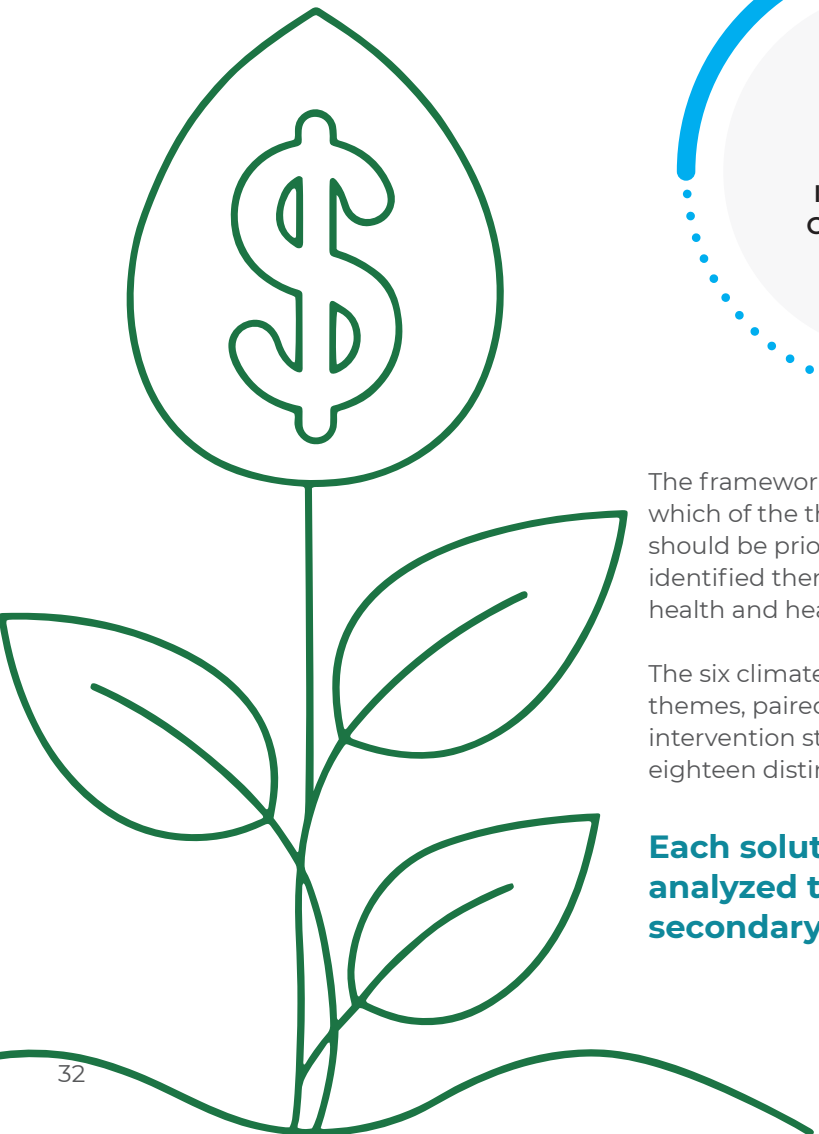
Methodology to arrive at the prioritization framework



In the Indian context, the following impact themes have been identified as requiring urgent attention to tackle the effects of climate change.

Climate change-related impact themes linked to human health

Heat related illness	Non-communicable diseases	Vector-borne diseases	Air-borne diseases	Water-borne diseases	Malnutrition and food crises
Environmental Heat Exposure	Stroke (CVD)	Malaria	COPD	Typhoid	Marasmus
Dehydration, Malignant Skin Melanoma	Hypertension (CVD)	Dengue	Asthma	Hep A	Kwashiorkor
Non-melanoma skin cancer	Heart Failure	Chikungunya	Upper Respiratory Tract Infection and Lower Respiratory Tract Infection	Cholera	Iron Deficiency
	Bipolar Disorders (PTSD)	Zika Virus		Diarrheal Disease	Vitamin A Deficiency
	Depression and Anxiety				Anemia



With reference to the previous section, interventions pertaining to the intersection of climate change and healthcare can be classified into three main categories.

Future interventions for climate change linked human health themes

The framework aims to identify which of the three interventions should be prioritized for the six identified themes related to human health and healthcare.

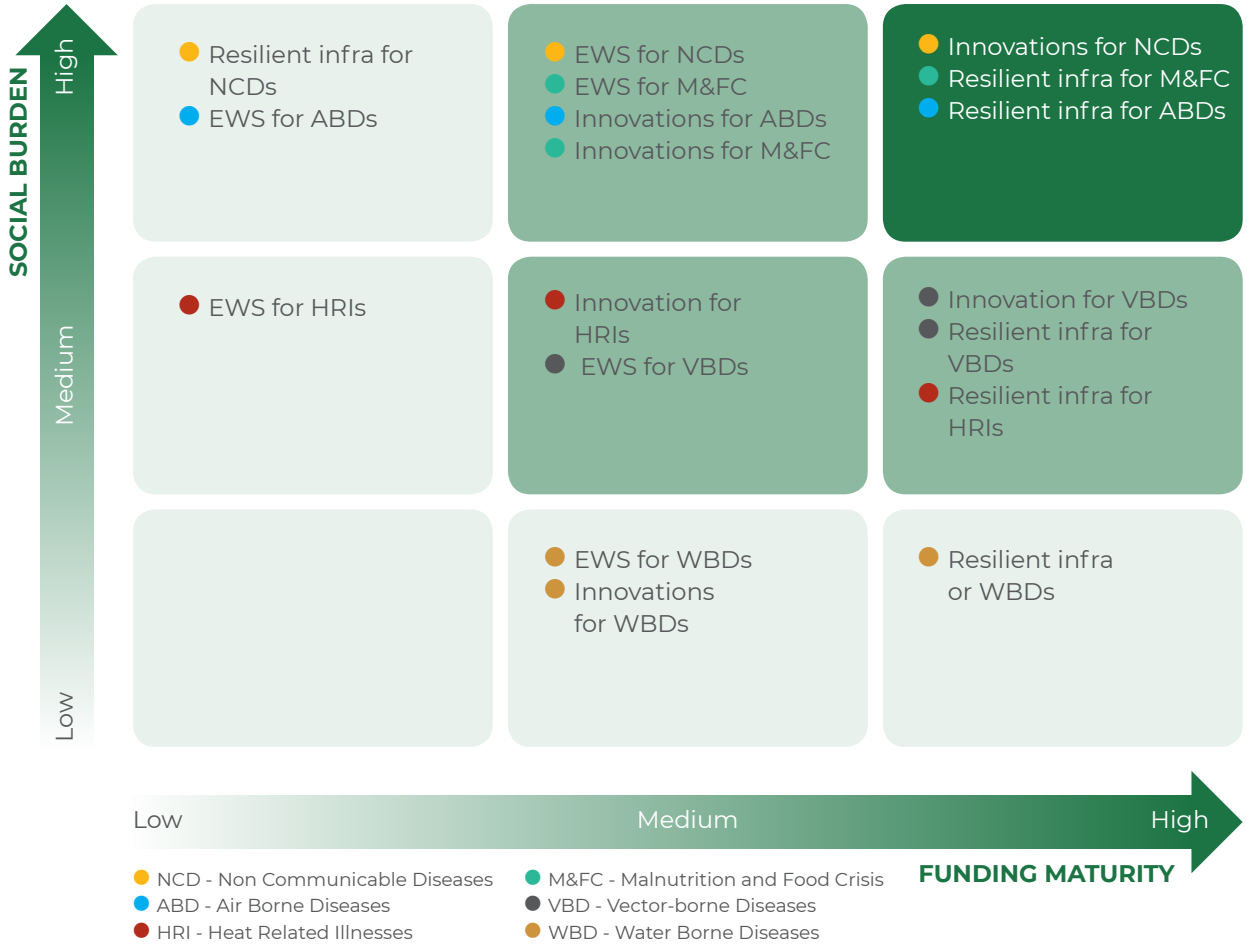
The six climate-related health impact themes, paired with the three intervention strategies, result in eighteen distinct solutions.

Each solution has been analyzed through secondary research to develop a framework that ranks them based on two key factors: social risk and funding maturity.

Investors increasingly seek opportunities that not only provide financial returns but also create positive social or environmental impact. Understanding social risk helps investors assess market demand and align their investments with their impact objectives and strategic vision. Identifying funding maturity helps evaluate risk, understand valuations, and gauge growth potential. In our analysis, social burden is calculated as a weighted score based on the **DALY burden** associated with prevention of a theme (which in turn is directly proportional to the number of people getting impacted) as well as the population's **climate vulnerability** to that theme. Funding maturity, on the other hand, is determined by analyzing **historical funding** across three interventions linked to the six climate change impact themes linked to human health.

Results of the prioritization framework

The framework below presents the findings from our analysis of social burden and funding maturity evaluation metrics.



Priority health related themes

Regarding social risk, non-communicable diseases, airborne diseases, and malnutrition have the most substantial impact due to their high DALY burden and the vulnerability of the Indian population to extreme weather events that exacerbate these health issues.

Priorities in terms of social risk

- Air-borne Diseases
- Malnutrition and Food Crisis
- Non-Communicable Diseases

Top interventions in climate-health

In the realm of interventions, themes centered on innovations and resilient infrastructure have garnered the most funding from both public and private sources. Resilient infrastructure themes are primarily supported by funding from multilateral development banks (MDBs) and development finance institutions (DFIs), particularly in sectors related to food security and water sanitation.

Three key solutions have emerged as the ones that have a ‘high’ social burden score and a ‘high’ funding maturity level, thereby signaling scalability and hence, high potential social and financial returns.

Key priority solutions

Resilient infrastructure for malnutrition and food crisis

Description
The development of facilities and systems capable of withstanding climate change impacts on food security is essential.

Public initiatives, such as food storage facilities (World Bank, Bangladesh) and nutrition enhancement programs (World Bank, Nepal), demonstrate significant efforts to bolster agricultural resilience and strengthen food security.

Additionally, interventions like climate-resilient farms (Eeiki Foods), addressing seasonal variations, and yield-enhancing technology (Fasal) are setting the stage for future agricultural adaptation to climate change

Importance
Indian agriculture—and consequently, the nation's food security—faces significant risks from climate change due to its reliance on monsoon patterns. Key staples such as wheat and rice, essential for nutrition, are especially vulnerable to climate variability, affecting both yields and the stability of the food supply.

The Intergovernmental Panel on Climate Change (IPCC) reports that climate change has already caused a 5%[35] reduction in wheat yields in India, along with a decline in nutritional quality: protein levels have dropped by 12%, zinc by 5%, and iron by 6%.

In India, malnutrition and related illnesses impacted ≈87 million[36] DALYs in 2017-21. In the 2022-23 period, extreme events that contributed to malnutrition/food crisis and posed significant risks to the Indian population occurred on ≈ 49 days[37].

Funding examples
- Bangladesh Modern Food Storage Facilities Project: $ 210m+
- Food and Nutrition Security Enhancement Project, Nepal: $ 28m+
- Fasal: $ 19m+
- Eeki Foods: $ 15m+

Innovation for Non-Communicable Diseases

Description
The solution focuses on development of medical products and technologies aimed at addressing non-communicable diseases (NCDs) likely to worsen with climate change.

Innovations such as AI-based heart disease diagnostics (Cardiolog), algorithm-driven coronary artery health analysis (HeartFlow), and ambulatory ECG monitors (iRhythm) represent significant progress in adapting to heart-related conditions. Additionally, AI-powered mental health chatbots (Wysa) offer valuable support for individuals facing mental health issues.

These advancements pave the way for future solutions to tackle NCDs exacerbated by climate change.

Importance
According to IPCC, the burden of cardiovascular mortality could increase by 47%[38] by 2050s due to climate change. Further, IPCC also claims that mental-health related issues, including anxiety, depression, stress, and post-traumatic stress disorder, will be significantly exacerbated.

Climate change and air pollution elevate the risk of non-communicable diseases (NCDs): nearly 7 million premature deaths each year are attributed to air pollution, with 85% of these deaths resulting from NCDs.[20]

In India, NCDs impacted ≈156 million[39] DALYs in 2017-21. In the 2022-23 period, extreme events that can contribute to NCDs and pose significant risks to the Indian population occurred on ≈ 67 days[40].

Funding examples
- Heartflow: $ 215m+
- iRythm: $ 27m+
- Cardiolog: $ 15m+
- Wysa: $ 20m+

Resilient infrastructure for air-borne diseases

Description
The solution encompasses construction of facilities and systems that can withstand the impacts of climate change on air-borne diseases.

Interventions such as direct air capture and storage (Climeworks) aim to remove and store avoidable carbon di oxide from air preventing any future pollution from the captured air. Similarly, photoelectrochemical oxidation (PECO) technology (Molekule) targets air pollutants at the molecular level, laying the groundwork for further innovations in adapting to airborne disease challenges.

Importance
According to research, the extension of ground-level ozone (O3), changes in precipitation patterns, and more frequent heatwaves can all contribute to air pollution and thus air-borne diseases. Air pollution is responsible for over 32%[21] of mortalities, negatively impacting public health, climate and the economy. exacerbated.

In India, malnutrition and related illnesses impacted ≈231 million[41] DALYs in 2017-21. In the 2022-23 period, extreme events that contributed to malnutrition/food crisis and posed significant risks to the Indian population occurred on ≈ 30 days[42].

Funding examples
- National Clean Air Programme – Govt. of India: $ 1.1b+
- Climeworks: $ 760m+
- Molekule: $ 97m+

According to the WHO, coordinated investments in health and climate action could save millions of lives each year, with nearly 2 million lives saved by scaling up essential climate-health initiatives, especially through reducing air pollution.

NOTABLE HIGHLIGHTS FROM INDIAN CONTEXT

Heat related illnesses and vector borne diseases

Heat-related illnesses (HRIs)

HRIs are ranked as 'Medium' social burden due to the relatively lower DALYs impacted by such illnesses as compared to other priority health themes identified. However, it's important to note that heatwaves—the primary cause of HRIs—are expected to result in the highest global economic losses by 2050.

According to the World Economic Forum (WEF), heatwave-related losses are projected to reach $ 7110 billion[43], nearly four times the cost of heavy rainfall or floods. WEF estimates that heatwaves will account for 57% of the overall economic impact from major weather-related events.

Temperature extremes most directly affect health by compromising the body's ability to regulate its internal temperature. This loss of regulation can lead to a range of heat-related illnesses, including heat cramps, heat exhaustion, heatstroke, and hyperthermia. High temperatures also exacerbate chronic conditions such as cardiovascular, respiratory, and cerebrovascular diseases, as well as diabetes-related issues. These conditions are included within the NCD theme, contributing to the 'High' social risk rating for NCDs.

Heat action plans are being implemented and funded by central governments across various countries. In California, for instance, the state has allocated $ 20 million[44] for the **Extreme Heat and Community Resilience Program,** aimed at supporting projects that enhance resilience to extreme heat. Similarly, the National Oceanic and Atmospheric Administration received $ 4.55 million[45] from the U.S. Department of Commerce to facilitate heat monitoring, data collection, and resilience initiatives.

Vector-borne Diseases (VBDs)

Similar to HRIs, vector-borne diseases (VBDs) have been ranked 'Medium' due to a lower DALY burden. However, it should be noted that VBDs accounted for ~17%[46] of the global burden of communicable diseases and put ~80% of global population at risk of their infection. Globally, the land suitability for malaria transmission has increased by 17%[47] between 1951-60 and 2014-23.

In the Southeast Asia region, India contributed the highest number of estimated malaria cases (79%) and accounted for around 34% of worldwide dengue cases.

Funding for interventions related to VBDs has been driven by innovations such as Oxitec's genetically engineered mosquitoes, part of its malaria program which received $ 18 million+ funding in 2022[48]. The President's Malaria Initiative of the USA has funded more than $ 5 billion[49] in 2020-2024 for global malaria resilience programs. In India, government efforts have established the **National Vector Borne Disease Control Programme (NVBDCP),** which supports early diagnosis and provides technical and operational guidelines to state governments. The program also shares half of the costs for controlling malaria, filariasis, Japanese encephalitis, leishmaniasis, and dengue across the country.

KEY ADAPTIVE OPPORTUNITIES IDENTIFIED

Investing in sustainable adaptive models

This report highlights the growing body of evidence demonstrating the profound impact of climate change on health, spanning areas such as infectious and chronic diseases, rising mortality risks, threats to food security, and deepening health inequities. Regions with higher vulnerability, particularly low- and middle-income countries, are disproportionately affected, facing a greater share of adverse health outcomes due to increasing climate variability. The stakes are significant, with climate-related health challenges underscoring the urgent need for action and presenting a compelling investment opportunity for sustainable returns in a low-carbon economy.

Building on key priority interventions—such as innovations to address climate-related health risks and the development of resilient infrastructure—the report identifies several high-potential investment opportunities targeting critical health challenges. These opportunities are ranked based on their scalability, potential for traction, and long-term impact, offering a roadmap for strategic investments that align with both health and climate goals.

Potential for scalability, traction, and long-term impact. High Medium Low N/A

Segment	Attractive Investment Opportunities	Priority themes			Notable themes	
		NCD	ABD	M&FC	VBD	HRI
Hospitals / Clinical Services and Diagnostic Services	Virtual care delivery					
Hospitals / Clinical Services and Diagnostic Services	Digital therapeutics/AI-based diagnosis					
Hospitals / Clinical Services and Diagnostic Services	Home healthcare services					
Hospitals / Clinical Services and Diagnostic Services	Preventive care services					
Hospitals / Clinical Services and Diagnostic Services	Good health media platforms (channels and apps)					
Hospitals / Clinical Services and Diagnostic Services	Surveillance screening modules					
Food	Nutraceuticals, food and pharmaceutical supplements					
Food	Clean water					
Ancillary Products and Services	Data analytics and AI					
Ancillary Products and Services	Modular climate-resistant building					
Ancillary Products and Services	Rapid testing and certification labs					

Source: Quadria Capital analysis

CROSS CUTTING THEME

Mental health disorders

Climate change significantly impacts mental health, contributing to a range of psychological issues. As environmental conditions deteriorate—through extreme weather events, loss of biodiversity, and increasing uncertainty about the future—people may experience heightened stress, anxiety, and feelings of helplessness. Eco-anxiety emerges as a specific response to these stressors. It reflects the worry and fear about the state of the planet and the implications for future generations.

Notably, each of the six climate-related health themes identified in this study contributes to mental health concerns.

Therefore, approaches that reduce vulnerabilities and address the mental health impacts of climate change are essential. Emerging treatment models for climate-related mental health challenges could also ease the burden on already strained healthcare systems.

Global statistics on mental health

Only 13
the median number of mental health workers for every 100 000 persons

25%
of years lived with disability are caused by mental (14.6%), neurologi-cal (7.6%) and substance use (2.7%) disorders

1 billion
The number of people worldwide living with a mental disorder

$ 1 trillion
The annual cost of common mental disorders

Only 2%
of Governments health budgets are spent on mental health

These figures will be exacerbated by the climate crisis!

Source: The World Bank Group

Case in point:
Wysa - Enhancing accessibility to mental health support for individuals with eco-anxiety

Wysa offers AI-driven mental health support, accessible directly or through healthcare providers and employer programs. Its emotionally intelligent chatbot uses cognitive-behavioral techniques, meditation, and mindfulness exercises to help users build resilience, including resilience for climate-related mental health impacts.

Wysa has raised $30 million+ in funding by investors including HealthQuad, backed by sponsors from Quadria Capital. Wysa exemplifies private investment in climate-mental health interventions. Serving more than 6 million users across 95 countries and engaging in over 750 million conversations, Wysa is enhancing mental health support for individuals facing climate-related stressors.

KEY MITIGATIVE OPPORTUNITIES IDENTIFIED

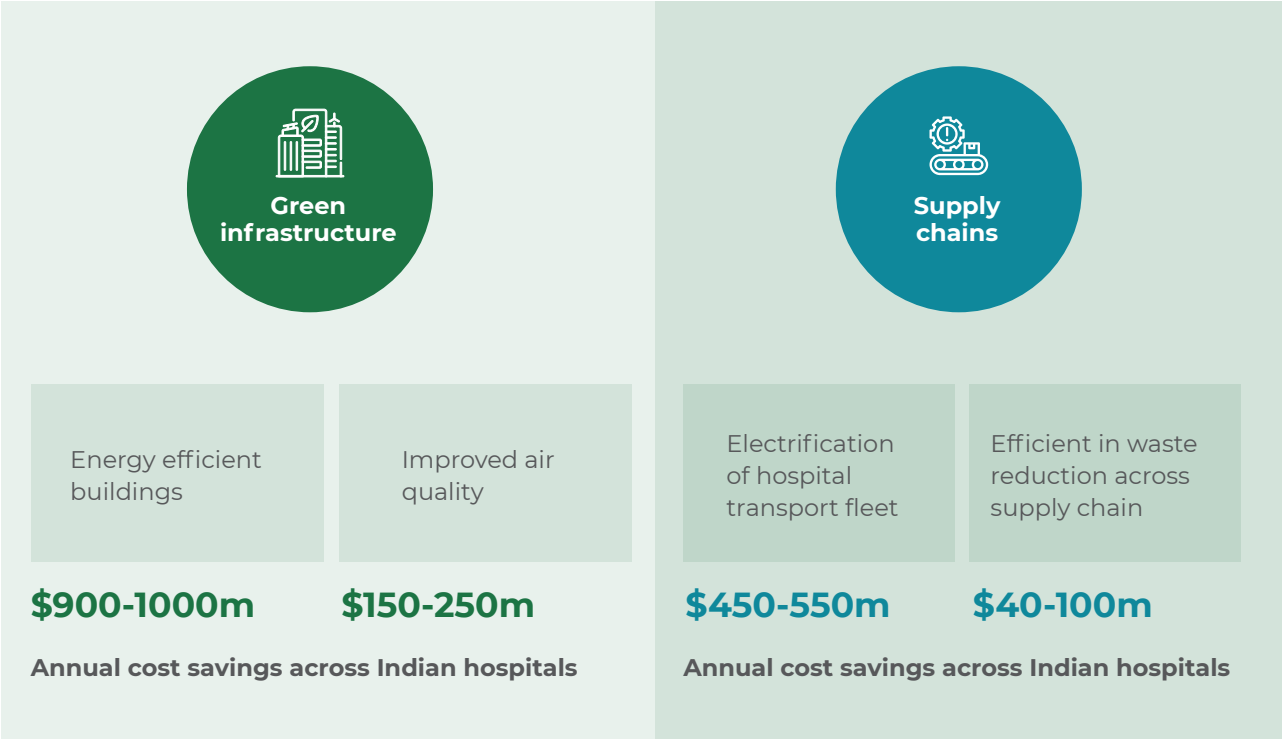
Building future proofed health systems

The framework identifies key solutions that stakeholders can prioritize for further investment, supporting climate adaptation efforts. However, it's important to note that healthcare facilities are significant emitters, accounting for 5% of global emissions. While adaptation remains a pressing need, the focus on mitigation solutions should continue at its current pace.

The health and economic benefits of building climate resilience and implementing mitigation efforts significantly surpass the required investment. Addressing climate change calls for a fundamental rethinking of how we prioritize energy expenditures.

In healthcare ecosystems, targeted investments in two crucial areas of mitigation i.e. green infrastructure and supply chains can lead to reduced emissions and potentially lower costs.

Climate change-related impact themes linked to healthcare mitigative solutions



Source: PwC analysis

Adopting energy-efficient technologies and practices can greatly reduce emissions and significantly cut energy costs, potentially saving Indian hospitals over $900-1000 million annually. This includes investments in renewable energy sources, energy-efficient HVAC systems, and smart building technologies. Similarly, better air quality inside healthcare facilities can aid both employees' as well as patient's health. In supply chains, electric vehicles (EVs) powered by renewable sources provide a sustainable alternative, reducing fuel expenses and maintenance costs, with hospital fleet electrification in India estimated to save over $ 450-550 million annually. Additionally, minimizing supply chain waste can further enhance cost savings and environmental impact for healthcare organizations.

Pathways and enablers for climate-health transformation

Results from the framework: Prioritised interventions

Climate change presents a critical threat to public health in India, demanding urgent and targeted climate action. The biggest challenge behind working at the nexus of climate change and healthcare, as highlighted by the respondents of our survey, has been lack of sector-specific knowledge and prioritization of strategies. Therefore, this study, based on comprehensive secondary research and stakeholder consultations, has identified and prioritized key human health-linked impact themes with the highest social risk. These include Malnutrition and Food Crisis, Air-borne Diseases, and Non-communicable Diseases.

As a result of the prioritization framework, three key intervention solutions have emerged with a 'high' social risk and funding maturity, which we believe can drive significant social and financial returns.

Resilient infrastructure for Malnutrition and Food Crisis

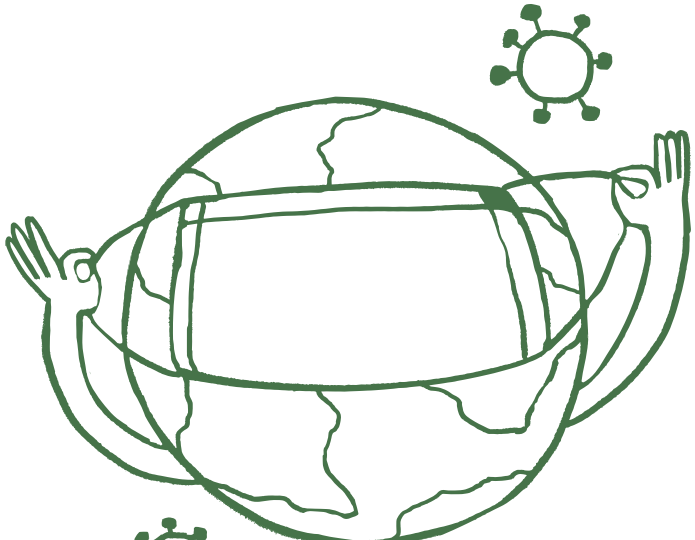
Innovation for Non-communicable Diseases

Resilient infrastructure regarding Air-borne Diseases

With an estimated $3 billion required annually in private capital to support adaptation-oriented interventions, these solutions provide a pathway for stakeholders to drive progress at the nexus of climate change and healthcare.

Cross cutting enablers to advance climate-health solutions

To complement the intervention-focused findings, the study has identified key enablers essential for advancing climate-health action. Derived from our stakeholder consultations, these enablers provide actionable insights for financial institutions, policymakers, healthcare providers, and entrepreneurs committed to addressing the complex challenges posed by climate change on public health. By emphasizing innovative financing mechanisms, data infrastructure and measurement, strategic partnerships, and advancing research and human development, these enablers will aim to close existing gaps and build a supportive foundation for scalable, impactful climate-health solutions.



ENABLER #1

Explore innovative financing to unlock opportunities

Our survey results indicate that securing adequate funding mechanisms is the most critical factor in scaling climate action in healthcare.

To catalyze investment in climate and health projects, stakeholders should prioritize expanding innovative finance approaches, which can unlock additional capital flows and drive impactful, sustainable interventions. Innovative financing is particularly vital for climate-health initiatives, given the high upfront costs, extended payback periods, and inherent uncertainties in these projects. Traditional funding models are often insufficient for these needs, while innovative mechanisms—such as blended finance—help mitigate risk and attract private sector participation.

Blended finance combines catalytic funding from public and philanthropic sources (e.g., grants, concessional capital) to leverage private sector investment toward shared social outcomes. **In India, the blended finance ecosystem has grown from $0.1 billion in 2010 to $1.1 billion[50] in 2022, with 8% of this activity directed towards health initiatives.** Scaling these models could further encourage private investors and broaden funding pools for climate-health interventions.

Innovative approaches and financial instruments for adaptation

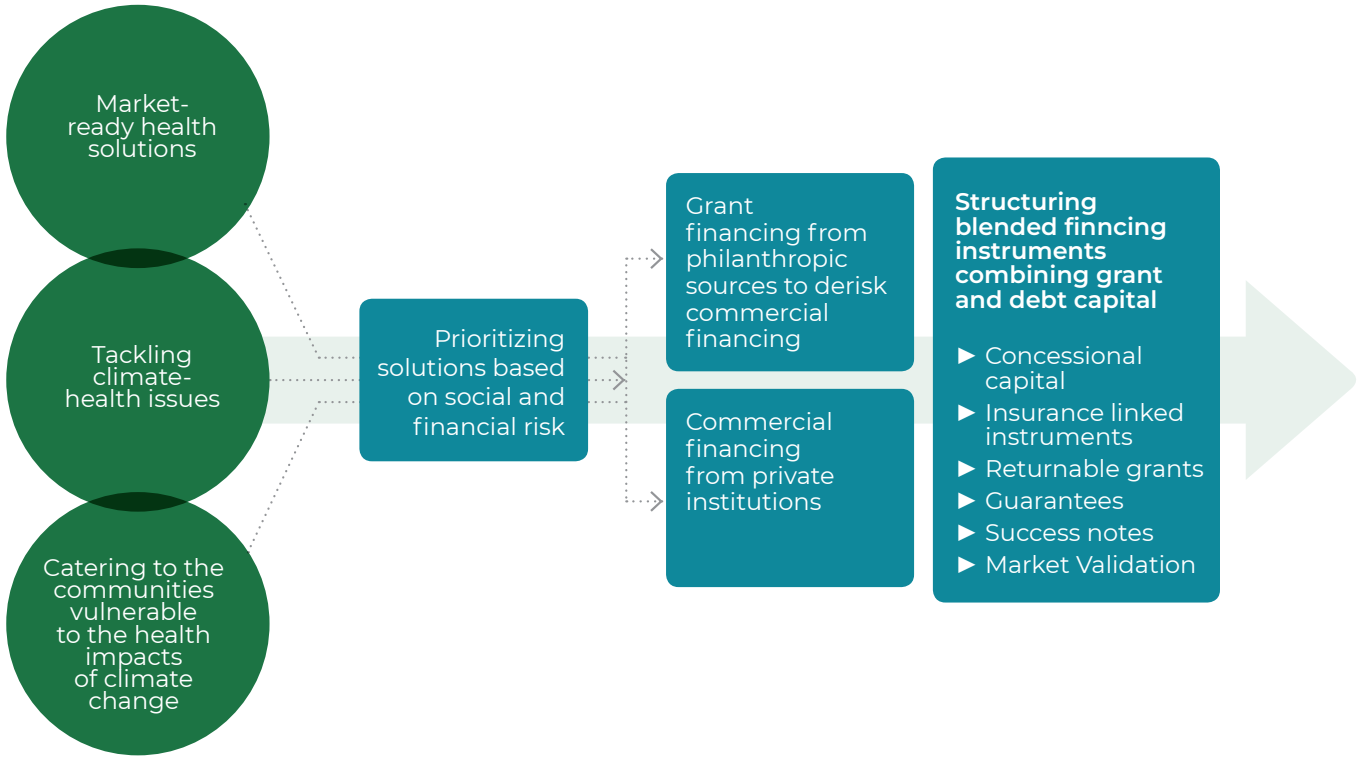
New approaches and financial instruments are emerging that seek to address some of the challenges of adaptation . Some of the key ones are highlighted below for reference:

- **Insurance-linked instruments:** Insurance mechanisms that incentivize resilience and adaptation by either reducing premiums to reflect investments in these areas or increasing payouts to cover such investments.
- **Grants:** Non-repayable or zero-interest funding provided to support specific projects or activities. Future finance payments depend on the delivery of adaptation actions (hence 'performance-based') or in the form of development grants, technical assistance funding and project preparation facility.
- **Financing facilities:** Debt or equity funding for a pool of projects, companies, or individuals at various levels of concessionally including subordinated debt and equity, private equity funds, and other debt facilities
- **Guarantees:** A financial safeguard where a third-party guarantor commits to repaying part or all of a loan to the lender if the borrower defaults
- **Results based finance:** Debt or grant capital for a project or portfolio of projects that is contingent on the achievement of certain outcomes. This can include impact notes, climate bonds, and conservation trusts
- **Resilience/impact:** Initially developed as catastrophe bonds with insurance premiums linked to resilience projects, these instruments now include broader forms such as green bonds. They focus on investments in adaptation and monetize avoided losses through mechanisms like rebate structures.

To maximize impact, it is recommended that stakeholders establish blended finance funds specifically targeted at climate-health projects, encourage partnerships with philanthropic organizations, and advocate for policies that incentivize private sector participation. By adopting these approaches, stakeholders can create a financing ecosystem that better meets the scale of challenges at the climate-health nexus, paving the way for sustainable, long-term solutions.

Integrating health into the 2025 Nationally Determined Contributions (NDCs) is essential.

It is important to ensure that health is prioritized in climate financing, including estimating the resources required to implement health-related policies. This includes specifying the conditions for climate finance to support health actions and plans. Using health impacts and indicators to prioritize investments in key health sector themes will also be crucial.



Around 60 percent of funding for climate-health comes from concessional debt, risk insurance and guarantees[51]

CASE 1:

SAMRIDH - Combining commercial capital with public and philanthropic funds to drive greater investments

Supported by USAID and implemented by IPE Global, Sustainable Access to Market and Resources for Innovative Delivery of Healthcare (SAMRIDH) unlocks affordable capital through blended finance structures to scale high-impact and commercially sustainable solutions targeted to improve healthcare for vulnerable communities. It is structured as a multi-sectoral partnership, with the Government of India, development agencies, private sector, including entrepreneurs, accelerators, and financial institutions, and academia.

SAMRIDH has mobilized a capital pool of $350+ million to offer both grant and debt financing provided to healthcare enterprises, with a target to achieve leverage of 8–10x on its investments. Through this approach over 60+ high impact solutions have been funded reaching over 30 million population.

ENABLER #2

Prioritize data availability and evidence generation

Limited data availability is a major barrier behind working at the nexus of climate change and healthcare, as cited by survey respondents as the second biggest challenge in this area.

Addressing data challenges requires prioritizing evidence generation across the ecosystem. **By establishing robust frameworks for climate-health data collection, stakeholders can develop more targeted, evidence-based strategies, driving greater resilience and impact in their climate response efforts.** Further such frameworks lay groundwork for developing early warning systems, which are currently lagging as compared to other interventions as found from the framework presented in this report.

Improved data availability can open new business opportunities for startups focused on climate-health analytics and create scalable pathways for government-led initiatives.

Establishing robust data platforms would enable stakeholders to gather critical insights, laying the groundwork for developing early warning systems and evidence-based interventions that enhance resilience against climate-related health risks.

CASE 2:

Zzapp Malaria – Setting benchmark for data-driven intervention in climate change and health

Zzapp Malaria has pioneered data-driven interventions at the intersection of climate change and health with its AI-powered mobile app for malaria control. Using satellite imagery and climate data, the app creates optimized larviciding strategies, focusing on areas where climate impacts make vector-borne diseases more prevalent. The app indicates locations for water-body searches, spraying, mosquito trapping, and allocates operational zones to workers. It also uploads real-time data to a monitoring dashboard, enhancing adaptation efforts against climate-induced increases in vector-borne diseases.

In Ghana, a 2018 trial showed the app-enabled team identified 28%[52] more water bodies and achieved over 90% coverage in urban areas, resulting in a 70% reduction in larval habitats. This approach led to a 40% decrease in malaria incidence within the targeted areas in the first year.

Zzapp Malaria has raised $5.1 million from the Innovative Vector Control Consortium (IVCC) and the Bill and Melinda Gates Foundation, showcasing the potential of scalable, data-driven solutions to attract substantial private investment.

ENABLER #3

Develop strategic partnerships to scale climate-health interventions

To meet the scale of the climate change challenge, adaptation financing needs to **shift from the historic reactive focus towards supporting more anticipatory, strategic and even transformational adaptation.** This requires more action in areas that are harder to finance and more complex to develop, which also means government actors have an important role.

Public and private finance must be redirected toward long-term investments in Health for All, stressing the importance of valuing health beyond financial measures, investing in the pillars of a healthy society, and funding health in an equitable and sustainable manner.

Government bodies bring the capability to scale initiatives, while innovators offer agility and advanced data-driven approaches critical for tackling emerging health risks tied to climate change. Through collaboration, governments can amplify promising climate-health solutions, enabling broader implementation and resilience-building in vulnerable communities.

These partnerships also facilitate knowledge transfer between stakeholders, with governments benefiting from cutting-edge insights and technologies, while innovators gain a deeper understanding of regulatory frameworks and public health needs. By combining resources, expertise, and reach, these partnerships can drive impactful and scalable interventions at the climate-health nexus.

Moreover, these strategic partnerships can serve as a foundation for driving innovative R&D investments in the climate-health sector. Stakeholders can create a collaborative environment that promotes advancements in climate-health solutions.

For effective partnerships, prioritizing proof of concept is essential.

Private and public stakeholders should prioritize investing in small-scale demonstrations of effective climate-health solutions before expanding them. Establishing a successful proof of concept strengthens confidence in the partnership's potential, showcasing that collaborative efforts in climate-health can achieve tangible results.

This validation attracts additional investment and reinforces that climate-health initiatives are not only achievable but also valuable for partnership engagement.

CASE 3:

Khushi Baby - Partnership-driven intervention to drive action for the last-mile in India

A powerful example of partnership-driven impact is Khushi Baby's work in Rajasthan, India, where climate change has intensified health challenges, including food insecurity, heat-related illnesses, respiratory issues, and vector-borne diseases. Through its Climate Health Vulnerability Mapping (CHVM) project, Khushi Baby addresses these risks by targeting rural and underserved communities.

At the core of this initiative is Khushi Baby's Community Health Integrated Platform (CHIP), which integrates health records from over 40 million individuals to analyze the connections between climate factors, social determinants, and health outcomes. Leveraging open-source geospatial models, the platform's algorithm identifies areas most vulnerable to climate risks, allowing for targeted, village-level interventions. This data-driven strategy supports 70,000 health workers and 2,500 health officials in efficiently allocating resources and guiding investments.

The success of Khushi Baby's initiative is rooted in partnerships with government health departments and technology leaders like Microsoft Research and Google Health. With over $15 million in funding from India's Ministry of Health and Family Welfare, Khushi Baby exemplifies the pivotal role of government partnerships in driving impact at the climate-health intersection. This project not only demonstrates how such collaborations can ensure scalability and traction for innovative solutions, but also provides a replicable model for climate-responsive healthcare. It highlights the transformative power of strategic partnerships in advancing sustainable, impactful actions that address both climate change and health challenges.

ENABLER #4

Initiate impact measurement and monitoring of outcomes

Understanding the long-term impact generated by investments is essential, as impact measurement has evolved from a "nice-to-have" practice to a critical tool for achieving investment objectives.

49% of our survey respondents believe that impact assessment studies would be most beneficial for their organization to enhance climate – health focused initiatives.

To support effective decision-making, a standardized framework that provides clear, consistent, and robust methodologies for assessing climate-health and adaptation interventions is needed. Such a framework would help stakeholders evaluate the potential and scalability of their interventions, fostering comparability and resource efficiency. Currently, most measurement focuses on output indicators, with limited standardization in outcome measurement.

Adopting transparent impact measurement practices with defined outcomes can also attract more funding for institutions like funds and startups within this ecosystem. On a global scale, stakeholders are encouraged to incorporate climate and health impact metrics into their processes, aligning with resilience and adaptation objectives while increasing their appeal to capital providers.

To enhance impact assessment, standardized outcome metrics—currently underutilized—are essential for capturing the full scope of climate-health initiatives.

A structured, templated approach to outcome measurement would allow stakeholders to consistently track and evaluate intervention effects. Given the long-term nature of health impacts, these metrics are especially valuable.

Interventions can be evaluated based on the following investment criteria:

- **What** climate-driven health risk does the intervention address?
- **Who** benefits from the intervention, particularly in terms of meeting the priority needs of communities most vulnerable to climate-related health impacts?
- **What** clear and measurable outcomes or benefits are achieved?
- **How** cost-effective is the intervention in delivering its impact?
- Are there any **significant risks** related to feasibility or implementation?

CASE 4:

Quadria Capital's approach on impact measurement

In 2023, Quadria Capital launched its Impact Management and Measurement (IMM) framework, applying a three-tiered approach to ESG and impact. Aligned with SDG targets and guided by the Operating Principles of Impact Management, the framework integrates ESG and impact factors into investments. It defines intended impacts using key performance indicators (KPIs) and metrics, ensuring measurable outcomes that adhere to global and industry standards. This approach allows Quadria to track and report on "SDG 3 on Good Health and Well-Being" and "SDG 13 on Climate Action," enhancing investor confidence and attracting additional funding from limited partners.

Additionally, the fund received its first social loan to support healthcare investments in South and Southeast Asia. Structured according to Social Loan Principles, the facility qualifies loans as "social loans" if they improve access to healthcare, support food security, or advance socioeconomic goals. This facility enables Quadria to fund investments efficiently, helping investee companies achieve their objectives while creating meaningful societal impact.

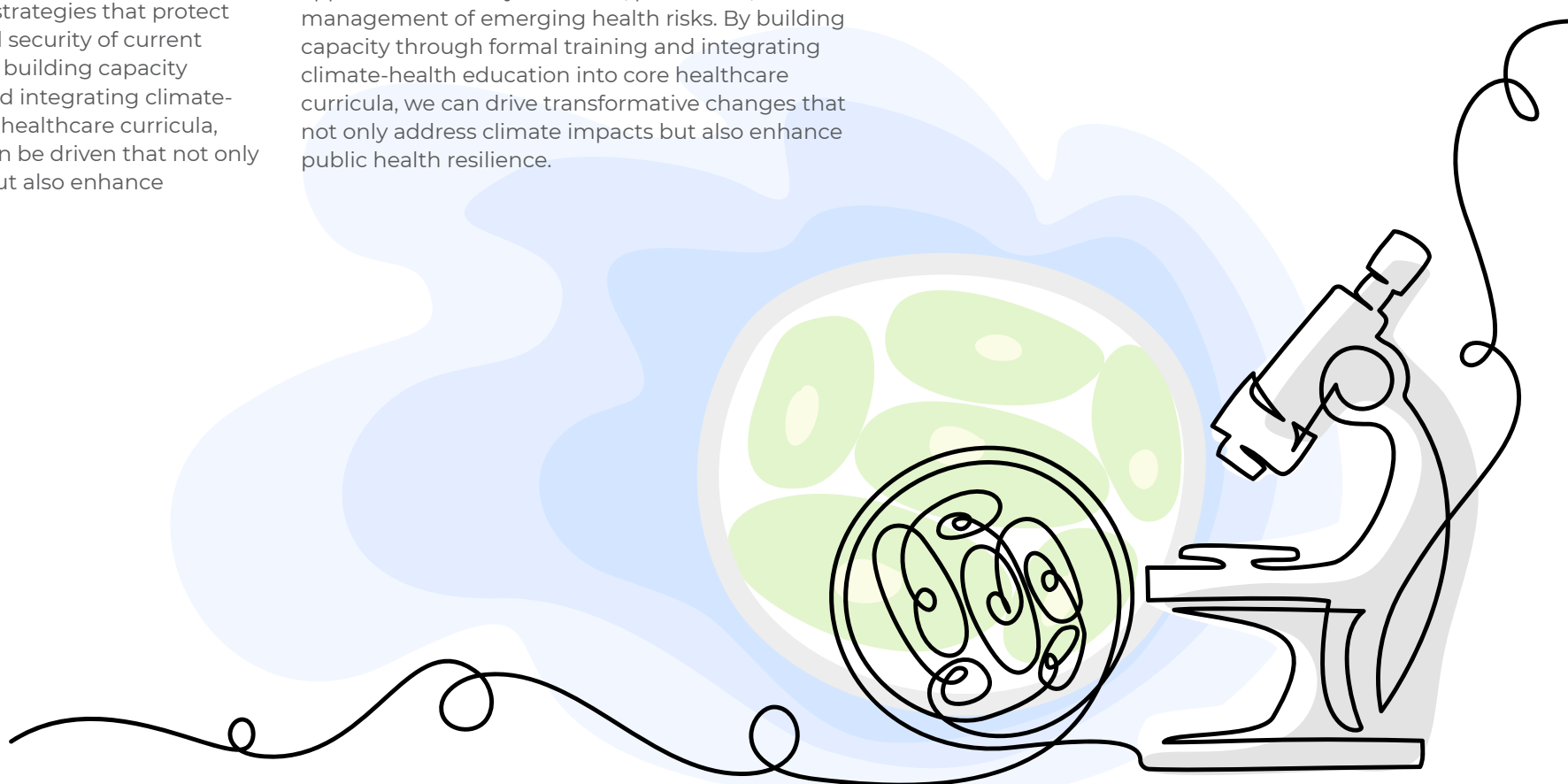
ENABLER #5

Unlock human development and research innovations on the climate-health intersection

Climate change is anticipated to bring new diseases and spread existing ones to regions previously unaffected. Addressing this shifting health landscape requires heightened awareness through climate-health education and a strong emphasis on research and development. There is a need to drive health-focused climate adaptation and learning and development to unlock human potential, through climate-conscious education, training, job creation, and strategies that protect the health, economies, and security of current and future generations. By building capacity through formal training and integrating climate-health education into core healthcare curricula, transformative changes can be driven that not only address climate impacts but also enhance public health resilience.

The lifesciences and pharmaceutical sector in particular needs to plan now for the change in global burden of disease as a result of climate change.

Investing in R&D is essential to foster innovative approaches for early detection, prevention, and management of emerging health risks. By building capacity through formal training and integrating climate-health education into core healthcare curricula, we can drive transformative changes that not only address climate impacts but also enhance public health resilience.



Annexure

Methodology to arrive at the prioritization framework

Methodology

Step 1: Identifying relevant themes for intervention

In the Indian context, the following themes related to human health have been identified as requiring urgent attention to tackle the impacts of climate change.

Heat related illness

- Environmental Heat Exposure
- Dehydration, Malignant Skin Melanoma
- Non-melanoma skin cancer

Non-communicable diseases

- Stroke (CVD)
- Hypertension (CVD)
- Heart Failure
- Bipolar Disorders (PTSD)
- Depression and Anxiety

Vector-borne diseases

- Malaria
- Dengue
- Chikungunya
- Zika Virus

Air-borne diseases

- COPD
- Asthma
- Upper Respiratory Tract Infection and Lower Respiratory Tract Infection

Water-borne diseases

- Typhoid
- Hep A
- Cholera
- Diarrheal Disease

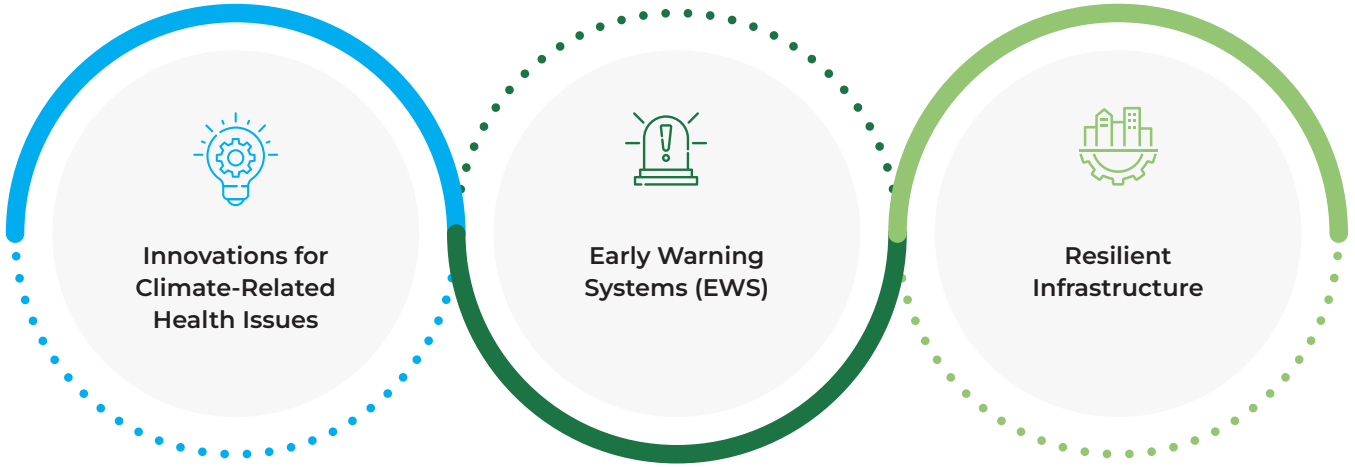
Malnutrition and food crises

- Marasmus
- Kwashiorkor
- Iron Deficiency
- Vitamin A Deficiency
- Anemia

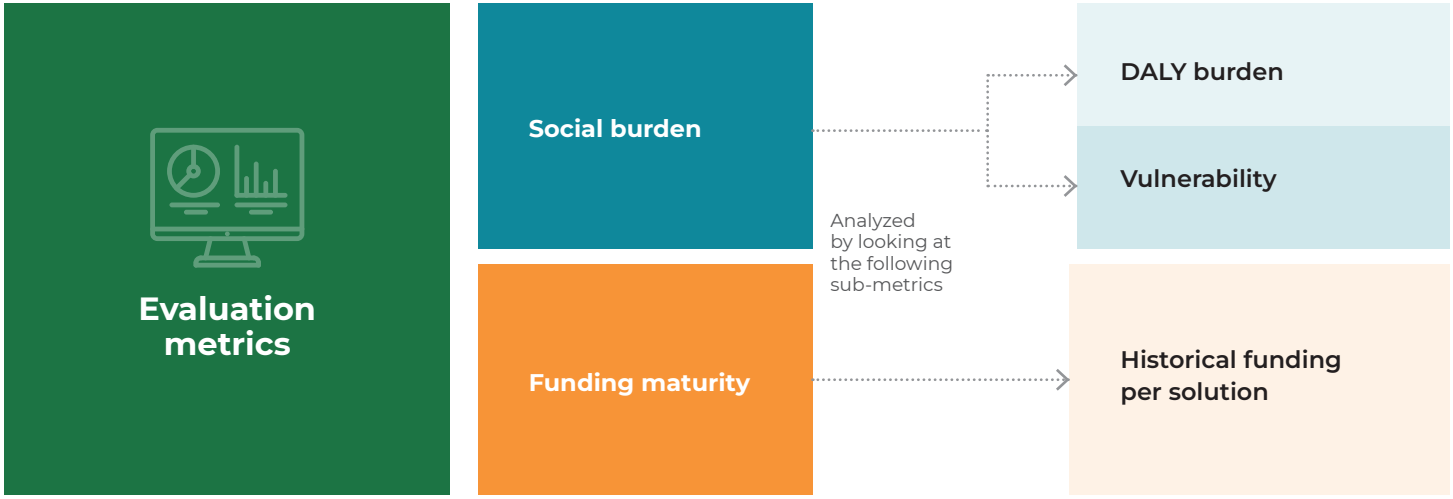
With reference to the previous section, interventions pertaining to the intersection of climate change and healthcare can be classified into three main thematic categories.

The framework will focus on determining which of the three interventions should be prioritized for the six human health and healthcare-related themes mentioned above.

Climate-linked themes for future interventions



Step 2: Selecting evaluation metrics



Through secondary research, it was discovered that investors utilize various metrics to assess investable opportunities. Two key metrics identified are social burden and funding maturity.

In our analysis, social burden is calculated as a weighted score based on the DALY Burden associated with prevention of a theme (which in turn is directly proportional of number of people getting impacted) as well as the population's vulnerability to that theme. Funding maturity, on the other hand, is determined by analyzing historical funding across three interventions linked to the six climate change impact themes.

Step 3: Defining sub-metrics and scoring criterions

Our secondary research resulted in several key inputs that were pivotal in forming the prioritization of solutions in the matrix. Each of these inputs were ranked 'High', 'Medium', 'Low' across themes. The table represents the definitions used behind these rankings.

It should be noted that the social burden score is the weighted average of 'DALY Burden' score and 'Vulnerability' score.

Individual scores for social burden and financial maturity serve as guiding principles for prioritizing themes and corresponding interventions. Each metric is evaluated within a framework that yields a score of 'High,' 'Medium,' or 'Low.' This approach will help investors, policymakers, healthcare providers, regulators, and other stakeholders within the healthcare ecosystem identify opportunities that align with their organizational goals and values.

Sub metric	Evaluation input
Social Burden	
DALY Burden	The sub-metric quantifies the financial resources required to extend healthy life expectancy. This analysis is based on Disability Adjusted Life Years (DALYs) related to identified themes linked to human health. It assesses the monetary investments needed to avert such DALYs in India, providing insight into the severity in terms of number of adjusted life years and total dollar value for each theme.
Vulnerability	The vulnerability sub-metric for each health-related theme has been correlated with the extreme events that contribute to these issues. To determine vulnerability, the number of days when these events occurred in India recently were analyzed, along with the percentage of the population that was highly exposed to such events.
Financial Maturity	
Historical funding per solution	The sub-metric evaluates the funding allocated across various themes for each interventions. The exercise identifies successful interventions and programs that have addressed similar climate and health issues in the past. Given the nascent stage of climate action in India, this research emphasizes global funding trends to provide insights into historical investment patterns. This approach allows us to understand where financial resources have been directed in the context of climate initiatives.

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12 The World Bank Group

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Abbreviations

ABDs	Airborne diseases
AfCH	Action for Climate Health
APAC	Asia-Pacific
CAGR	Compound Annual Growth Rate
CHIP	Community Health Integrated Platform
COPD	Chronic Obstructive Pulmonary Disease
CoEs	Centers of Excellence
COP29	29th Conference of Parties (2024)
CVHM	Climate Health Vulnerability Mapping
DALY	Disability-Adjusted Life Year
DFI	Development Finance Institutions
EWS	Early Warning Systems
EV	Electric Vehicle
GHG	Greenhouse gas
Hep A	Hepatitis A
HRIs	Heat-related illnesses
HVAC	Heating, Ventilation, and Air Conditioning
IMM	Impact Management and Measurement
IPCC	Intergovernmental Panel on Climate Change
IPHS	Indian Public Health Standards
IVCC	Innovative Vector Control Consortium
JICA	Japan International Cooperation Agency
KPI	Key Performance Indicator
M&FC	Malnutrition and Food Crisis
MDB	Multilateral Development Bank
NAFCC	National Adaptation Fund for Climate Change
NAPCC	National Action Plan on Climate Change
NAPCCHH	National Action Plan on Climate Change and Human Health
NCDs	Non-communicable diseases
NEGCCH	National Expert Group on Climate Change & Health
NHM	National Health Mission
NPCCHH	National Programme on Climate Change & Human Health
NVBDCP	National Vector Borne Disease Control Programme
OECD	Organisation for Economic Co-operation and Development
ODA	Official Development Assistance
PECO	Photoelectrochemical Oxidation
PTSD	Post-traumatic Stress Disorder
SAMRIDH	Sustainable Access to Market and Resources for Innovative Delivery of Healthcare
SAPCCHH	State Action Plan on Climate Change and Human Health
SDG	Sustainable Development Goal
USAID	United States Agency for International Development
VBDs	Vectorborne diseases
WBDs	Waterborne diseases
WEF	World Economic Forum
WHO	World Health Organization

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