Quantifying the Impact of Climate Change on Human Health

INSIGHT REPORT
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Building climate-resilient health systems

Healthcare executives and policymakers need to focus on prevention, recovery and innovation.
3.1 Resistance and recovery, the two key pillars for sustainable health systems

A framework for developing solutions

Healthcare leaders worldwide need to encourage models of care and flexible infrastructures to build resilience for the anticipated increases in climate-related morbidity and mortality. They must also support regional policy-makers to address adapted strategic plans emphasizing healthcare system capacity and agility. Due to the substantial risk that climate change poses to local, regional and global health, it is important to explore solutions that address the needs of the healthcare infrastructure and resources at all three levels.

The climate-resilient health systems framework (see Figure 26) foresees that healthcare systems will need to develop or improve on two important areas: 1) resistance, the ability to prevent, reduce or delay climate change’s impact on humans, and 2) recovery, providing fast stabilization of the affected populations and healthcare infrastructure and effective treatment of long-term consequences.

**FIGURE 26** Climate-resilient health systems framework

<table>
<thead>
<tr>
<th>Health system resistance capability</th>
<th>Health system recovery capability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative population health¹</td>
<td></td>
</tr>
<tr>
<td>Avoidance (mitigation)</td>
<td>Stabilization (first response)</td>
</tr>
<tr>
<td>Containment (adaptation)</td>
<td>Return to health (treatment)</td>
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**Rationale**

- **Evade or delay** a health impact or climate event entirely, for example:
  - Eliminate root cause of the climate event
  - Eliminate health impact once climate event occurs

- **Reduce** health impact and minimize time before start of the recovery phase, for example:
  - Anticipate and monitor health impact
  - Prepare healthcare services for the health impact

- **Stabilize and minimize** impact for affected population, for example:
  - Emergency treatment to reduce risk of long-term health consequences and mortality

- **Return to steady-state** population health, for example:
  - Monitor for continuous treatment of diseases

**Note:** ¹ Versus steady-state without climate event.

**Source:** Oliver Wyman analysis

Making health systems resistant to climate change

To construct a climate-resilient healthcare sector and delivery system, communities must focus on effectiveness and accessibility as top strategic objectives. These can include adaptation planning, infrastructure resilience, disease surveillance and response, capacity building, innovative research and development, continuous evidence gathering and policy integration.

As described in chapter 2, health outcomes based on climate events were researched, and adaptation/preparedness measures were identified to address these outcomes. These can include forecasting activities such as novel therapeutic and diagnostic development or ensuring enhanced access and production capacities in anticipation of increased demand for the treatment of climate-related conditions. A key way to implement preventative measures is also to increase capacity building, knowledge transfer and community involvement, especially for vulnerable and hard-to-reach populations.
Enhancing the capability of health systems to recover from climate impacts

The second element of resilience is the ability to recover fast from climate events. Health systems need the ability to stabilise shocks and crisis situations and recover from both acute and longer-term climate events and related health impacts. Prioritizing recovery to a pre-disaster state ensures that health systems can address ongoing community needs as well as manage the health consequences of climate events. This can include the development of innovative treatments for infectious diseases, drug delivery innovations and preparedness planning of emergency services in anticipation of climate events.

Together, these two pillars form the foundation of climate-resilient health systems. By combining proactive resistance measures with robust recovery strategies, health systems can more effectively mitigate the impact of climate change on public health, safeguard the well-being of communities and promote a sustainable healthcare infrastructure.

Additionally, by implementing solutions that increase resilience, healthcare systems can enhance their ability to respond to disasters and ensure continuity of care in the face of climate challenges.

Developing innovative solutions

Developing solutions for climate-resilient health systems will require coordination among all stakeholders and the identification of risk factors. These include sharing data and knowledge on conditions and impacts as well as active collaboration across private sectors, both geographically and by focus area.

The importance of early warning systems

Technology and media can play a big role during disasters, helping stakeholders set up early warning systems for affected communities. For instance, the deployment of the Hot Weather-Health Watch/Warning System in the United States from 1995 to 1998 provided early warning in the instance of heat waves and helped save hundreds of lives for a fractional dollar cost. More recent digital public health campaigns around vaccinations offer another example of how organizations can reach large numbers of people as they did during COVID-19. Companies, such as Google, are pitching in to provide crisis alerts and forecasts for floods, wildfires and hurricanes.

For many diseases, including malaria and dengue, there is always an urgent need for reliable and rapid diagnostic tests. As warmer temperatures and increased humidity encourage the growth and spread of mosquito populations, community data collection, accurate geographic information system forecasting and mosquito monitoring, can help indicate a future outbreak. These early warning systems trigger timely public health responses that can include larvae control, released male Wolbachia-infected mosquitoes, distribution of bed nets, diagnostic availability, preventative and treatment therapeutics.

Role of healthcare and life sciences organizations

As major stakeholders and primary solutions providers, companies in the health and life sciences industry need to recognize the importance of ongoing innovative research and development to meet the growing demand for solutions to diseases and conditions aggravated by climate change, such as infectious and vector-borne diseases as well as respiratory and cardiovascular ailments. Collaboration with healthcare providers and regulatory bodies is also essential to ensure the timely availability and uptake of these solutions.

In turn, pharmaceutical and medical device and technology companies will require sound economic incentives and stable funding over the long term to help them commit the necessary resources to research and development for medicines and vaccines for underdeveloped or even undeveloped markets. They may also need support to ensure sufficient production capacity to avoid shortages – a problem that developed during past epidemics.
At the same time, focus on new preventative smart solutions and increased speed to market are needed, including work on improved diagnostics, monitoring devices and drug delivery systems to ensure coverage for climate-related conditions such as heat-related diseases and infections, respiratory and cardiovascular ailments and infectious diseases. These advancements will enable early detection and intervention, leading to better health outcomes. Increasing access to technology and reducing its cost will be critical to addressing health impact in developing countries.

3.2 Why policies and incentives need to change to enable climate-resilient health systems

**The role of governments and the public sector to drive innovation and support the transition**

Public sector participation is vital when it comes to raising awareness about health risks associated with climate change. For instance, support from agencies such as the Centers for Disease Control and Prevention (CDC) in the US was instrumental in developing robust public awareness campaigns during the COVID-19 pandemic.42

Similar approaches are ongoing and encouraged to address climate-related health impact visibility and awareness from both the public and private sectors. Examples include the WHO Alliance for Transformative Action on Climate and Health (ATACH), the WHO National Adaptation Plans (NAP),43 Fridays for Future, the Clima-health platform by the WHO and WMO, as well as important work carried out by the Rockefeller Foundation, Wellcome Trust, ClimateWorks Foundation, the Forum for the Future and the Global Institute for Disease Elimination.44
Government support is a key factor, as demonstrated during the pandemic. The public sector was vital in keeping hospitals and clinics operating through subsidies and underwriting the cost of protective gear and medicines. The US government spent more than $30 billion to support research, development and production of the COVID-19 vaccine.

Another area where public support is required is in necessary infrastructure upgrades to ensure their resilience in the face of climate- and weather-related challenges. This will be especially vital in high-risk geographies.

The public sector’s involvement tends to ensure a comprehensive approach to health preparedness in which innovation, paired with private-sector involvement, becomes a driving force behind timely responses to evolving health challenges. Rapid and effective collaboration will be key to meeting the challenges of climate-related health conditions.

Even so, private-sector financing is crucial given the variety of capital sources from which it can draw, including sources not usually available to governments or non-governmental organizations (NGOs). For example, in 2020, Bank of America issued a $1 billion environmental, social and governance (ESG) bond to lend to not-for-profit hospitals, nursing homes and manufacturers of healthcare equipment.

Additionally, the private sector is armed with operational know-how regarding the production and delivery of therapeutics. This expertise enables private entities to provide a range of proactive responses to evolving health challenges. The remarkable aspect is often the scalability of these solutions, transcending industry boundaries and geographic borders. Making use of their access to substantial financial capital and commercial and manufacturing savvy, the private sector can emerge as a catalyst in creating and scaling innovative solutions to address the health impact of climate change.

Yet companies will also face challenges, at least initially, that may limit an innovation’s commercial viability. To overcome these hurdles, government incentives can be instrumental in encouraging private-sector involvement in undertaking difficult but necessary projects. This is where the strategic allocation of funds becomes a defining force for resilience, and coordination between public and private sectors is pivotal to ensure that funds are invested where most needed and not only where the return is the best.

Incentives act as a bridge, encouraging this collaboration and amplifying efforts to address the health implications of climate change on a broader scale. A workable comparison would be with their use to cultivate new therapeutics to treat rare diseases. These conditions affect roughly 4% of the global population and require a multiyear development and approval process. Many of these diseases do not have a treatment today and would not be addressed at all without technological advancements, an increase in the number of cases, or external incentives.

Chagas is a vector-borne disease that mainly afflicts low-income communities in the Americas. It affects up to seven million people today and causes 14,000 deaths annually. There would probably not be a treatment for it were it not for the US Orphan Drug Designation programme, which was used several years ago to underwrite the development of benznidazole. The US Food and Drug Administration (FDA) granted it priority review and orphan product designation. Due to the disease being vector-borne, the number of Chagas cases is expected to rise due to the changing climate.
Incentives to drive private sector participation

Four crucial incentives will drive action by the private sector: direct economic incentives, financial enablement, regulation and awareness.

Direct economic incentives play a crucial role in motivating the private sector to enhance preparedness for climate change. These incentives encompass such tools as tax credits, subsidies, research grants and implementation grants. Governments, NGOs and financial institutions can use these direct economic incentives to channel funds towards initiatives aimed at mitigating the impact of climate change on health. The Bill & Melinda Gates Foundation and similar NGOs often assume the role of allocating funds, aggregating resources from diverse sources and strategically directing them to private sector projects deemed impactful and prudent.

Finance enablement levers serve as another mechanism to drive private sector behaviour. This category includes tools like loan subsidies and government guarantees. The aim of this strategy is to enable private capital owners to invest in projects geared towards reducing the climate impact on health. By offering these levers, governments partially offset investor risks associated with uncertainty about future development scenarios and potential technology limitations, making it more attractive for private entities to invest in health-focused climate initiatives.

The use of regulation is another potential motivator for the private sector and can involve stricter rules that, for instance, mandate the use of a new product or a loosening to encourage participation. For instance, these levers could include fast approval processes for necessary treatments, patent protection and clinical trial support to spur innovation.

There is also an opportunity for more disclosure requirements on climate-related health impacts, which often lead to public pressure for government and private sector action. That was the case during the COVID-19 pandemic when rising, publicly-announced death rates prompted demands for a vaccine and incentivized people to get vaccinated once it was available. Hospitals, for example, could be required to report mortality from certain climate-related diseases for tracking purposes.

Obligatory health-impact reduction targets could further provide requirements to prepare for the health impact of climate change. This could also be part of a broader topic of addressing social determinants of health, which is already required within the Medicare programme in the US. Regulation levers like targets can propel the private sector towards proactive measures in preparing for climate-change-induced health impact.

Finally, awareness itself serves as a powerful incentive. This involves the preparation of public reports that prioritize areas with the highest impact, shedding light on critical health challenges of climate change. Broad dissemination of information and best practices not only raise awareness about pressing health issues, but they cultivate a collaborative environment where diverse entities can unite to tackle the evolving challenges.
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<tr>
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<th>Incentive types</th>
<th>Institution</th>
<th>Description</th>
<th>Examples</th>
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</thead>
<tbody>
<tr>
<td><strong>Direct economic incentives</strong></td>
<td>Tariffs, taxes and subsidies</td>
<td>Governments</td>
<td>Reducing taxes or introducing subsidies for products that have a proven effect on addressing climate health impact</td>
<td>US Orphan Drug Act (1983) provides companies with up to 50% tax credits to cover research costs for orphan diseases.51</td>
</tr>
<tr>
<td></td>
<td>Research or implementation grants</td>
<td>Governments/NGOs/supranational</td>
<td>Research grant for innovative solutions search to climate change impact on health</td>
<td>The US National Institute of Environmental Health Sciences (NIEHS) provides exploratory grants of up to $2.3 million to examine the health impacts of climate change and to develop solutions.52</td>
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<tr>
<td><strong>Direct funds</strong></td>
<td></td>
<td>Governments/NGOs/supranational</td>
<td>International fund for disease outbreak control in priority areas</td>
<td>The Global Fund allocates up to $5 billion annually to fight malaria, human immunodeficiency virus (HIV), and tuberculosis (TB) through a partnership funding model.53</td>
</tr>
<tr>
<td><strong>Finance enablement</strong></td>
<td>Loan subsidies</td>
<td>Governments/ supranational</td>
<td>Government-subsidized free-interest loans for selected climate change health impact solutions</td>
<td>European Green Deal Investment Plan includes €25-30 billion public sector loan facility.54</td>
</tr>
<tr>
<td></td>
<td>Government guarantees</td>
<td>Governments</td>
<td>Government guarantees for innovative solution start-ups who are seeking to attract funding</td>
<td>The government of Sweden offers more than $2 billion worth of guarantees for large green industrial investment projects.55</td>
</tr>
<tr>
<td><strong>Awareness building</strong></td>
<td>Public reports</td>
<td>NGOs/supranational</td>
<td>Report by an NGO with climate health impact prioritization, targets definition and recommended actions</td>
<td>The WHO’s 2014 report, Quantitative risk assessment of the effects of climate change on selected causes of death, 2030s and 2050s.56</td>
</tr>
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<td></td>
<td>Conferences</td>
<td>NGOs/supranational</td>
<td>Annual summit on climate health impact to discuss latest innovations and progress</td>
<td>American Meteorological Society Annual Conference on Environment and Health.57</td>
</tr>
<tr>
<td><strong>Regulation</strong></td>
<td>Reporting/disclosure requirements</td>
<td>Governments/NGOs/supranational/payers</td>
<td>Requirement for hospitals to disclose statistics on morbidity and mortality rates for selected climate-related diseases</td>
<td>EU Corporate Sustainability Reporting Directive: carbon footprint reporting requirements.58</td>
</tr>
<tr>
<td></td>
<td>Obligatory impact reduction targets</td>
<td>Governments/supranational</td>
<td>Requirement for hospitals to establish targets on reduction of mortality for selected climate-related diseases</td>
<td>UK legally binding net-zero target under the Climate Change Act 2008.59</td>
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<td></td>
<td>Simplified approval process</td>
<td>Governments</td>
<td>Priority review and support with clinical trial support to improve success chances and reduce time to market</td>
<td>United States Food and Drug Administration (FDA) Tropical Disease Priority Review Voucher System reduces review process from 10 to six months for prioritized treatments.50</td>
</tr>
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</table>
Best practices for a life sciences and public sector collaboration on climate

There have been some important precedents set on how to tackle major public health crises that can now provide powerful tools for tackling the health impact of climate change. In the US, the Orphan Drug Act of 1983 is a pivotal example of healthcare legislation that specifically addresses the pharmaceutical industry’s problem of reaching a profitable commercial scale when a market’s size is limited and anticipated sales will not cover development costs.\(^1\) It introduced compelling incentives, including a seven-year market exclusivity for drugs treating orphan diseases, irrespective of patent status.

To further stimulate research and development, the law offers tax credits of up to 50% for associated expenses. The United States Food and Drug Administration (FDA) plays a crucial role by providing grants for clinical testing of orphan disease treatments and assisting in framing investigation protocols. Additionally, FDA user fees were waived to facilitate the development of treatments for such diseases.

In 2007, the FDA introduced priority review vouchers (PRVs) as a strategic tool to encourage pharmaceutical companies to invest in treatments for neglected diseases.\(^2\) This voucher, granted to a producer, expedites the FDA’s review process for one of their drugs – reducing it from the standard 10 months to just six months. The Tropical Disease Priority Review Voucher System, a part of this initiative, spotlights diseases like malaria, cholera and dengue, aiming to address health issues predominantly affecting regions exposed to climate change.\(^3\)

This approach accelerates the development and approval of treatments for prioritised diseases. It also strategically directs pharmaceutical efforts towards areas that may have otherwise been overlooked, showcasing the potential of policy-driven incentives in shaping the pharmaceutical landscape for improved global health outcomes.

This could prove to be an important tool for climate-related health issues.

The European Union’s Horizon Europe 2027 is a critical funding programme for research and innovation in health, technology and other sectors. It boasts an impressive €95.5 billion budget.\(^4\) The health cluster within the Horizon Europe programme is dedicated to enhancing and safeguarding people’s health and well-being through innovative research solutions.\(^5\)

In particular, the programme focuses on environmental and social health determinants and understanding and counteracting the impact of environmental stressors on human health. By allocating resources to delve into the intricate relationship between environmental factors and health outcomes, Horizon Europe’s health initiatives aim not just to address the symptoms but to proactively develop innovative solutions. The funding mechanism in Horizon Europe is based on the principle of co-financing.

Public-private partnerships and successful models of cross-sector collaborations

Countries, particularly middle-income ones, face common challenges such as limited primary care capacity, outdated infrastructure and high out-of-pocket payments – all of which could hinder climate-related disease treatment. New pathways must be considered to overcome these hurdles and implement innovative solutions. Public-private partnerships offer a promising avenue. These long-term contracts enable the provision of health facilities, equipment and healthcare services. Under these arrangements, the private partner participates in designing, implementing and funding the project. The private partner handles healthcare services delivery and the provision of managerial and operational expertise, while the public partner focuses on defining and monitoring compliance with contractual objectives. While they can impose...
future budgetary burdens, careful consideration in designing, planning and monitoring these contracts can bridge the funding gap and yield positive outcomes for health budgets.

COVAX is an example of an effective public-private response to a health crisis. It is a global initiative designed to ensure equitable access to COVID-19 vaccines worldwide.66 It was co-led by Gavi, the Vaccine Alliance to improve access to new and underused vaccines for children living in poor nations, the WHO and the Coalition for Epidemic Preparedness Innovations. COVAX brought together governments, global health organizations, manufacturers, scientists, the private sector, civil society and philanthropy to provide innovative and equitable access to COVID-19 diagnostics, treatments and vaccines. All participating countries were to have equal access to these vaccines once they were developed.

The Coalition for Epidemic Preparedness Innovations (CEPI) is an innovative global partnership between public, private, philanthropic and civil society organizations. It was launched at the Forum’s Annual Meeting in Davos 2017 based on the recognition that a proactive and coordinated effort would be required to develop and deploy new vaccines to prevent future epidemics. Its mission is to expedite the advancement of vaccines and other biological countermeasures in response to epidemic and pandemic threats, ensuring widespread public accessibility.

Another example is the World Economic Forum’s, Giving to Amplify Earth Action (GAEA) – an initiative that forges new public, private and philanthropic partnerships (PPPPs) to help unlock financing needed to reach net zero. It helps to prioritize interventions and design PPPP funding models. Piloting and improving PPPP models will eventually help develop an effective operating model that can handle larger projects.

Similar models will be crucial in addressing climate-related health impacts. Public-private partnerships should be integrated into governmental health financing, purchasing and organizational strategies. This approach empowers businesses to engage in health-focused climate action.

Exploring the known unknowns: future considerations and potential avenues for research

Recently, several non-profit organizations, such as Wellcome, the Rockefeller Foundation and the WHO, have invested in research that is shedding light on various aspects of climate change’s impact on human health – some of which this report incorporated.67,68,69 Each framework offers a unique way to structure the health impact of climate change and assess the impact at different levels of effect (e.g. climate event vs certain disease level), although all data suggest that the impact of climate change will be deadly, especially for certain populations.

This report has attempted to build the first comprehensive framework to chart and quantify the overall effects on humans and the economy as a tool for policy-makers and the healthcare industry, recognizing the need for consistent data, cohesion and collaboration.

Marked by complex interdependencies and cascading effects, unravelling these intricacies requires further dedicated research. Harmonizing frameworks can form a unified foundation that will allow for a more robust understanding of the complex dynamics between climate change and its effects on human health in future analyses.

Several aspects of the impact of climate change on human health still remain unquantified. For example, it’s unclear how the increased spread of certain climate-related diseases will impact the frequency and severity of other diseases. The effect of climate change on underlying comorbidities is also an area requiring more research, such as the strain of exposure to sustained heat waves and its relation to hypertension or mobility and access to treatment of dialysis or cancer patients during heat stress. There is also a lack of clarity on the compounded effects of consecutive or simultaneous climate events on morbidity and mortality rates. Quantifying these uncertainties is essential for effective planning and response strategies.

Data gaps also exist for remote communities. For instance, the life expectancy of asthma patients in some Latin American and African countries remains scarcely documented. Quantifying the health impacts in these regions often relies on estimates derived from more extensively studied geographies and populations. This lack of specific research hampers the ability to tailor interventions and preparedness strategies for these communities, leaving them vulnerable to the health repercussions of a changing climate.

Bridging this research divide is essential for creating targeted and effective measures that account for the unique health challenges faced by these often neglected regions. One way to generate community support and engagement can be through outreach to the younger population and future leaders through organizations such as the Global Shapers Community.70 With malaria associated with climate change on the rise, this preventative option will save many lives worldwide. Making more efficient and affordable versions of existing treatments will contribute significantly to the global economy’s ability to mitigate as much as possible climate change’s impact on health.
Conclusion

Climate change is a health emergency. This report’s projections of morbidity and mortality from climate-intensified natural disasters, cumulatively close to 15 million deaths, more than two billion healthy life years lost, and $12.5 trillion in economic losses by 2050 bring into focus the dimensions of the crisis. The risk from global warming threatens to destabilize both the healthcare ecosystems and the planet.

The clarion call to action must be for governments and industry to try to avoid this future by actively cutting GHG emissions today. In parallel, policy-makers and the health and life sciences sector must begin to envision and prepare for a future of severe and frequent natural disasters and the dire impacts on communities and regions that accompany them.

For the healthcare industry, this must be a moment of reflection. What should its role be in this future, and how can it make its infrastructure, workforce and operations more resilient to the inevitable pressures from the climate crisis? The importance and fragility of healthcare workers must not be underestimated. Working tirelessly in the face of overwhelming numbers of patients and inadequate staffing and supplies, this workforce will need to be physically and mentally prepared with the adequate tools, infrastructure and resources both immediately and in the long term. The health emergency around climate change will prove relentless, with the added potential of physical destruction, power interruption and supply chain collapses.

The health and life sciences industry needs to continue setting priorities and strategies today for this future, establishing avenues for collaboration within industry, government and all other impacted stakeholders. Having the quantification of the scope of disaster is a critical step towards risk assessment and preparation. The next step is to understand how well current systems would cope with this level of stress and pressure. Healthcare systems must embed climate-change resilience mechanisms to resist impact and recover fast if resistance is insufficient. Conducting regular stress tests in the healthcare sector, similar to those implemented in banking after the 2008 financial crisis, could be helpful to check the status quo. Solutions will need to be tailored to regional needs and populations served, recognizing that some of the hardest hit areas will be those with the fewest resources.

Governments and policy-makers are recognizing the imminent threats to global health from climate change. COP28 featured the first-ever “Health Day” and saw more than 120 nations sign a Declaration on Climate and Health, pledging to be proactive about the looming threat. More than $1 billion was committed to health-related projects to mitigate the impact of climate change.

Yet much more is needed given the pervasiveness and severity of the climate problem. Mitigating it will require a high degree of global cooperation to develop solutions that fortify the global health infrastructure, not to mention a willingness to commit resources early. So far, governments and industry have been slow to step up.