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Adaptation Research Alliance Chair's Summary: Global Health Results-Oriented Adaptation Research for Climate Resilient Health Systems

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Introduction

Climate change impacts health systems, including through extreme weather and chronic stresses that may cripple health facilities, disrupt critical services and key infrastructure networks, and overwhelm workforce capacity (Ebi et al 2018). The disastrous impact the COVID-19 pandemic had on health systems is likely to be dwarfed by the potential catastrophic impacts of climate change. Whether as a result of the ongoing global pandemic or the climate crisis, the impacts on health and health systems are not and will not be felt equally between or within countries (Ebi et al 2018). Though 'we are in the same storm, we are not in the same boat' (Barr, 2021). Decades of achievements in global population health are at risk of being eroded (Berry et al 2018).

The resilience within a given health system, including its capacity to detect, plan for and adapt to climate-related shocks and stresses, determines the health impacts of climate change (WHO 2015; WHO 2021; Chamberland-Rowe 2019; Blanchet 2017). Lower-resourced health systems - often those that are rural and remote, but also increasingly urban and overstretched - with less capacity to absorb and transformationally adapt are likely to be more susceptible to the increasing stresses and shocks linked to our changing climate (Ebi et al 2018). The people served by these health systems face disproportionate, and negative health outcomes. Climate change will both amplify existing hazard exposures and create new threats (Hess et al 2012), increasing risks if health inequities continue to widen. The importance of strengthening health systems has received widespread consensus over the past decade (see Figure 1 for a timeline of key documents and processes) (WHO 2008-2021; Kruk et al 2015; 2017; Berry et al, 2018; Barasa et al., 2017, 2018; Blanchet et al., 2017; Chamberland-Rowe et al., 2019; Fridell et al., 2020; Hanefeld et al., 2018; Kruk et al., 2015; Nuzzo et al., 2019; Turenne et al., 2019). Yet a focus on efforts to strengthen the *climate resilience* of health systems is relatively nascent and is not yet widely held as the key cross-cutting, long-term public health priority that this report strongly advocates.

To achieve the vision that all health systems improve resilience to climate change by 2030 much needs to be done globally. About 50 percent of countries surveyed (51 out of 101) reported having a national health and climate change strategy or plan yet a qualitative analysis of the plans indicated that the content and scope of these strategies and plans varied widely (WHO 2019). Access and flow of funding for both research and operationalisation of resilience are lacking: less than 0.5% of multilateral climate finance is allocated to health projects (Ebi et al 2019). The 2018 Adaptation Gap Report concludes "there is a significant global adaptation gap in health, as efforts are well below the level required to minimize negative health outcomes" (UNEP 2018).

This report summarises the key findings from a global consultation process held across August-September 2021 on behalf of the Adaptation Research Alliance with health systems experts. The focus was on adaptation research that 1) responds to critical vulnerabilities in health systems in the next decade of climate change, and 2) would have immediate application and be highly policy relevant. The Delphi Technique was used to gather expert-based judgment. Twenty-six experts participated in the process and provided input through interviews, an online consultation survey, a virtual workshop, and peer-review process.

Whilst every effort was made to ensure representation from across the globe, experts based in institutions from South America were not available and only a few experts based in the Africa region were available. This consultation process was not an exhaustive attempt at building a research agenda, but rather an exploration into some of the key priorities in health systems resilience building towards climate change. The intention is that this report acts as a springboard for further discussion and refinement of priority results-oriented adaptation research for climate resilient health systems globally and in different regions.

Figure 1. Timeline of major WHO reports and initiatives in Health Systems Strengthening and Resilience Building.

Health systems consist of “all organisations, people and actions whose primary intent is to promote, restore, and maintain health” (WHO). A health system which is climate resilient is able “to anticipate, respond to, recover from and adapt to climate-related shocks and stresses, while minimizing negative impacts on the environment and leveraging opportunities to restore and improve it” (WHO 2020). Overall climate resilient health systems should: 1. Protect the health of populations from the effects of climate change; and 2. Avoid widening health inequities.



Key Messages

We need greater efforts to improve our understanding of health systems climate resilience globally, which rejects any further framing of health and climate as vertical or independent issues.

To support progress on achieving climate resilient health systems we need **ambitious** adaptation research reflective of the **urgency** of the climate crisis and at a scale to inform both policy and practice at local and sub-regional, as well national and global levels. Climate resilience building efforts need to be aligned with all health systems strengthening efforts – including the expansion of universal health coverage and primary health care (Kadandale 2020). These efforts must embody the **values of equity, quality care, solidarity, and sustainability**.

“Doing only what is ‘currently’ deemed a quick win or feasible is inadequate. The focus must be on what we need to know – rather than what we can know based on current data and information. On what needs to be done now to have lasting impact into the future - rather than what is currently feasible.” (Expert Informant)

Research is required on adaptation measures that are **comprehensive** and embrace the **complex dynamic interactions** of health and climate change, rejecting any further framing of investigations on any of these as vertical or independent issues.

New knowledge is needed on **demystifying health system complexity** through better mapping of interdependencies within the building blocks of the health system itself alongside the other sectors it depends on for its functions from a climate change perspective. Research agendas must convene researchers and decision-makers around a **shared narrative** and **collective action pathways forward** to achieving **socially just**, climate



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resilient health systems capable of climate change adaptation, absorption, and transformation. Health systems must be **equitably oriented to keep people healthy** - regardless of the sudden shocks and multiple challenges from climate change impacts.

*“We need a health system that keeps people healthy rather than dealing with sick people”
(Expert Informant)*

How we do health systems implementation research is as important as the research itself.

When embarking on adaptation research within health systems it is critical to first consider **how the research will be used, by whom and what kind of changes we expect it should bring about**. Actions that are more likely to lead to change involve working from the outset at the **appropriate scale and level** to **co-produce** implementation research **with decision-makers and other users**.

Effective adaptation research for health systems requires better understanding of the needs of health sector decision makers to ensure that research addresses **key knowledge needs**. **Prioritization processes** for countries, including at the subnational level, will help to define which of the WHO 10 Action Points (leadership and governance; health workforce; climate change vulnerability, capacity and adaptation assessments; integrated risk monitoring and early warning; health and climate research; climate resilient & sustainable technologies and infrastructure; emergency preparedness and management; climate-informed health programmes; management of environmental determinants of health; climate and health financing) in the WHO Operational Framework for building climate resilient health systems (WHO 2015) should be tackled first and where there are key leverage points.

Many adaptation research projects will benefit from **transdisciplinary** teams that include policymakers, implementers (private and public), researchers (health system planners, public health professionals and practitioners, urban planners, meteorologists, climate modellers, communications experts, sociologists, anthropologists), and civil society organisations and communities. **Harmonising language, key concepts, tools, methods and approaches** between different stakeholders and sectors is important to facilitate research collaboration, achieve research synergies, allow for comparison of results and support effective communication of key findings. Ensuring **roles and responsibilities are clear, transparent, and accountable** is important to progress with the urgency needed.

“Health system providers are not aware of climate and weather information out there. This is one of the first barriers to having climate-informed health programmes.” (Expert informant)

Ensuring **buy-in** from all stakeholders, for example, populations and communities disproportionately affected by climate change such as, but not exclusive to, Indigenous Peoples, racialized and marginalized people, people living with disabilities, and those living in poverty, is critical to ensure that research is translated into action. The global health policy and systems research community will play an important role in helping to foster and contribute to



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these efforts (Marten et al. 2021). Emphasising the health co-benefits of actions to adapt to climate change and/or reduce greenhouse gas (GHG) emissions simultaneously and how **improving health is improving progress on development overall** is important to achieve this buy-in. Pitching research projects around the **risks from climate change** may help increase collaboration among ministries within and outside of the health sector and prevent a project being relegated as a 'health' issue only.

The most effective relationships for adaptation research will ensure that **stakeholders from the most appropriate level and scale** are brought together. This may often be at the local and subnational level typically between policy makers (such as a provincial or state Ministry of Health), local researchers, practitioners, healthcare workers and trusted local civil society groups who can broker relationships with communities. But it may also be at the national level if designed and pursued correctly with the right partners. Good practice from across research disciplines requires external researchers engaging health systems resilience research to ask of themselves: what is their positionality, how are they mitigating against elite capture, how are they respecting indigenous or local knowledge, how do they embed themselves in the context to ensure long-term acceptability, change and success, what lessons from the local level are important to amplify within what timeframes? For example, when investigating the resilience of health facilities and clinics in indigenous communities, partnerships with indigenous researchers and respect of indigenous knowledge is key.

As health systems strengthening work is complex, is shrouded by imperfect data, and takes time, there is a need to create opportunities for **regular dialogues** that help different actors share and connect their work and lived experiences together into a larger overall narrative. These must **extend outside of traditional health or climate circles to influence other sectors** (such as education, water, agriculture etc) and thereby achieve multiple benefits **to health and well-being**. Greater use of **qualitative information** will be increasingly important, as will **longitudinal studies** that capture the **dynamic properties** of resilient health systems over time across settings globally. Fostering a culture of **innovation, implementation, and iteration** will help build on lessons and best practice. Health authorities require information about whether adaptation measures they take do, for example, make health facilities more resistant to weather disasters and are actually working and increasing resilience. Adaptation research should support **forecasting of anticipated threats**, for example through the development of early warning systems, to see what measures can be put in place to anticipate and where possible mitigate the **evolving trends and threats** to health systems, especially service delivery.

Sustained and substantial investment in adaptation research for health systems must be strengthened at the global stage.

There is a need for regular **comprehensive climate change and health vulnerability, and adaptation assessments** at the national and subnational level. This is essential to strengthen the call for adaptation research and action. Currently there is a critical **gap in knowledge mobilisation on the lessons learnt** at the local level all over the world. There is a need for more systematic collection and synthesis of locally led implementation research that can inform and **influence global policy debates** on climate adaptation and resilience within health systems. This undoubtedly requires **greater representation from researchers in the Global South**; greater **consistency in research methods and approaches** to be able to collate and compare findings from different settings; and importantly **investing funding in strengthening and widening local research capacity and supporting infrastructure and good management practices**.

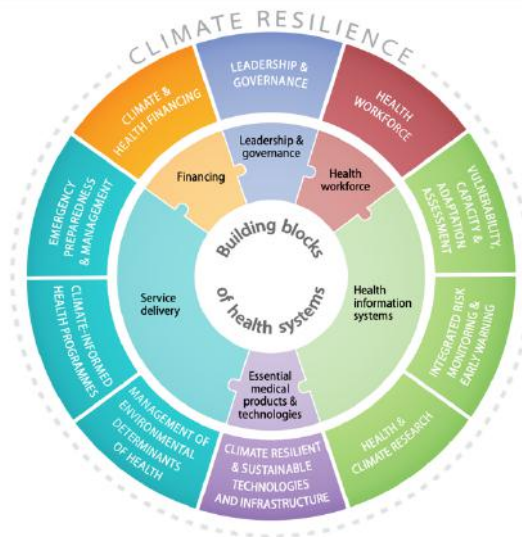


Health continues to receive **insignificant amounts of international climate finance** (0.5%) which is arguably the leading constraint to increasing efforts to understand and support greater action towards strengthening climate resilience within health systems.

Priority areas for adaptation research

In 2015 the WHO released the Operational Framework for Building Climate Resilience Health Systems that provides guidance to health authorities to support efforts to prepare for climate change (see Figure 2).

Figure 2. WHO Operational Framework



We use the WHO Six Building Blocks and the 10 Action Points from the WHO Operational Framework for an overarching guiding framework to organise the wide-ranging areas of adaptation research highlighted during the consultation process. Experts emphasised the importance of ensuring better synergy and a systems-thinking approach to conduct research within and across the six building blocks, with an emphasis on knowledge exchange and mobilisation, research on thresholds associated with climate-related stresses and shocks, and the importance of linking community resilience to health systems resilience. Whilst this report's focus is on adaptation, we recognise the important knowledge needs around reducing GHGs in health systems and efforts needed to scale up mitigation actions in concert with adaptation research supporting action (see the WHO Guidance for Building Climate Resilient and Environmentally Sustainable Health Facilities for a comprehensive outline of the adaptation and mitigation actions required).

The following adaptation research areas were identified as **priorities** by experts via a survey and during the virtual workshop. The **full list** of adaptation research areas can be found in Annex 2.



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Climate and health financing

“In addition to meeting the existing large demand of financing curative interventions within healthcare systems, there is a need to consider a potential increase in healthcare costs due to climate-sensitive diseases, and develop new models to finance preventive intersectoral approaches. This can include leveraging climate change specific funding streams.” (WHO 2015)

Financing remains a significant constraint for health and climate research and action. Ebi et al. 2019 provide the critical recommendation to: **“Raise national investments in climate change and health research to more than 1% of health and social research budgets in high-income countries and 5% in middle-income countries, and investments in health adaptation for population health and health system resilience to at least 5% of multilateral, bilateral, and donor adaptation funding for LMICs. Further, national or international funding should be provided for countries to include a health representative in their UNFCCC delegation, to strengthen high-level awareness and advocacy” (Ebi et al 2019).**

Within this consultation process, experts suggest adaptation research should give priority to the following question:

- How best to finance climate resilient and sustainable health systems: what is the role for climate finance in general, and what is the role for loss and damage or other entitlement approaches in particular?

Leadership and Governance

“In addition to the core functions of ensuring good governance, evidence-informed policy and accountability within the traditional health system itself, the climate resilience approach requires leadership and strategic planning to address the complex and long-term nature of climate change risks. It particularly calls for collaboration to develop a shared vision among diverse stakeholders, and coordinated cross-sectoral planning to ensure that policies are coherent and health promoting, particularly in sectors that have a strong influence on health, such as water and sanitation, nutrition, energy and urban planning” (WHO 2015)

Overall, there is a need for **greater involvement of the health sector in UNFCCC adaptation processes** (Ebi et al 2009). Strategies to achieve this include identifying and supporting climate change and health “champions” from local to national levels. Experts engaged in the consultation process raised several core questions that need to be asked of leadership and governance of health systems including: *What risks are health systems particularly vulnerable to? How and when are decisions currently made? How could they be earlier and more effective/efficient? What new risks or new severity of risks do decision makers need to be appraised of? Are decision makers even aware of what climate risk information is already available to them? Do they understand it, can they make decisions based on it? How can adaptation assessment be better incorporated into adaptation decision-making? (Berry et al 2018).*

Two priority adaptation research areas that attempted to cover these core questions were:

- Identifying the most effective means to break down silos, improve and govern cross sector functionality in multi-sectoral efforts to protect health and health systems from climate change.
- Identifying the most convincing and usable types of climate change and health risk-information (for acute as well as slow onset) needed to take leadership and initiate and sustain policy and program activities to address issues of immediate, medium-term and imminent future risk.



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Health information systems

“This building block focuses particularly on health information systems, including disease surveillance, as well as the research that is required to continue to make health-related progress against persistent and emerging threats. In the context of climate change, there is a specific need for: (i) information on vulnerability to climate risks, existing and expected future capacity of the system to respond, and identification of adaptations; (ii) integration of climate information into disease surveillance, providing an opportunity to develop early warning systems and more accurate target interventions; and (iii) guidance and utilization of the rapidly emerging body of research on health and climate change” (WHO 2015)

Health and climate research

Research and information on **trends and associations between climate and health outcomes** (respiratory diseases, non-communicable diseases, mortality and injury, vector borne diseases, water and food borne diseases, malnutrition, mental health, displacement, reproductive and sexual health) are the **cornerstones for further work** to conduct vulnerability and adaptation assessments and develop early warning systems.

The knowledge gaps identified as part of this consultation process could all feasibly be considered in this specific section on health and climate research. They have intentionally been categorised under the 10 Action Points in an attempt to improve the likelihood of the research areas being explored further by the research community by mapping them against an accepted guiding framework. Specific climate health research needs identified by experts under this category, included:

- How are health systems already being impacted by acute and chronic climatic stresses and shocks and what adaptations are required to address repeated exposures?
- What are the projected impacts on health systems from climate change in the context of other important non-climate drivers of health outcomes and health system functioning?
- How to improve health information systems to be able to integrate ecological determinants of health and meteorological data on a timescale that is useful for health decision making?
- What are the best practices and methods for development, sharing and analysis of climate information (scenarios & forecasts) and health information to ensure alignment along temporal and geographical scales to support efforts to climate priority climate change and health knowledge gaps?

Climate Change vulnerability, capacity and adaptation assessments

The foremost urgent research need is that **health authorities across the globe need to conduct climate change and health vulnerability and adaptation assessments**. Regular updates of these are then needed to inform robust planning for climate change impacts on health and health systems. This would enable countries to conduct a strategic prioritisation of climate risks at the country level (WHO 2015) as well as specific health impacts from climate change in sub-national locations in order to address the most effective adaptation efforts (Ebi et al 2019).

Further priority adaptation research areas that emerged during the consultation process were:

- Methods and tools for supporting broadly participatory, transparent and consultative assessments that include the input from people and communities that are disproportionately impacted by the impacts of climate change, including those on health equity.
- Development of methods and tools for stress testing different types of health systems and facilities based upon current and expected climate change impacts.



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- Effective methods to co-develop and implement rapid all-hazards assessments of the local context with communities.

Integrated risk monitoring and early warning

Preparedness and adaptation efforts will be significantly improved if the **cooperation between the health sector, meteorological services and community-based and event-based surveillance in access to and use of both climate and health data is strengthened** (WHO 2015). How this strengthening can be best achieved emerged as a critical adaptation research question.

Experts indicated the importance of co-designing integrated risk monitoring systems that consider both **existing** hazards and risks that may be aggravated as well as new and **emerging** hazards and risks due to climate change. Evaluating the **effectiveness** of integrated risk monitoring and early warning systems for a range of climate change hazards (e.g., extreme heat, infectious diseases, floods, wildfires, ice storms, droughts) and settings (rural, urban, remote, northern) in different contexts will help identify what works best where. In addition, research that looks to integrate the secondary, tertiary and cascading risks will be important to unpick the consequences climate risks have on essential health systems functions in the long-term.

Further priority adaptation research areas that considered the importance of specifically involving the public and translating risk information and early warning were:

- What are the best practices for communicating early warning of hazards to the public, community stakeholders and health sector decision makers to support appropriate behaviour change?
- How to bring in community leaders to get real time information to strengthen climate change and health risk assessments and surveillance or emerging and re-emerging threats over time?

Health Workforce

“Overall, health system functioning relies on a sufficient number of trained and resourceful staff, working within an organizational structure that allows the health system to effectively identify, prevent and manage health risks. Building climate resilience requires additional professional training in linking climate change to health, and an investment in the organizational capacity to work flexibly and effectively in response to other conditions affected by climate change. It also requires raising the awareness of links between climate and health with key audiences (including but not limited to health policy makers, senior staff, the media), and in particular empowering affected communities to take ownership of their own response to new health challenges” (WHO 2015)

The health workforce has limited training and knowledge of how climate change will impact health and health systems. Climate change has historically not been incorporated into syllabuses and curricula, though there is growing momentum to change this for the new generation of health professionals. Important questions for the health workforce include what the training and sensitisation needs are to improve knowledge (Covalan et al 2020) and to understand what the workforce can do with this knowledge (e.g. greater community engagement, etc); and what climate change impacts on health staff means for service delivery and care of patients specifically, and trauma to health care staff (Rameshshanker et al. 2021).

Three priority adaptation research areas that attempted to cover these core questions were:

- Better understanding of how frontline health staff are impacted directly and indirectly by climate change.



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- Investigation of climate change implications for workforce planning, workforce capability, capacity building and sustainability.
- Development of health professional curricula tailored and widely accessible to different users.

Climate resilient & sustainable technologies and infrastructure

“The challenge of climate change includes the selection of more climate resilient intervention options both within the healthcare and in health-determining sectors, from renewable energy in health facilities to climate resilient water and sanitation infrastructure. It requires attention to utilization of innovative technologies (such as remote sensing for disease surveillance) and involves reducing the environmental impact of healthcare as a means to long-term sustainability” (WHO 2015)

One of the priority adaptation research questions over the next few years centred on the lessons learnt from implementing the 2020 WHO Guidelines on Resilient and Environmentally Sustainable Health Care Facilities.

- For example, what are the specific requirements for climate proofing small versus very large health facilities and infrastructures?
- How to continually apply climate projections for the development of new health facilities or the upgrading of existing health facilities and management practices?

Service delivery

“Service delivery refers to building and expanding traditional systems of healthcare delivery to enhance climate resilience with attention to: (i) the integration of climate change considerations, particularly the use of meteorological information, into existing programmes for control of climate-sensitive diseases (e.g. vector-borne diseases); (ii) improved management of the environmental determinants of health, such as water and sanitation, nutrition and air quality, taking into account the modifying effect of socioeconomic conditions; and (iii) disaster risk reduction, emergency preparedness and management, in relation to the health consequences of extreme weather events, such as heat waves, floods and droughts” (WHO 2015).

Service delivery comprises three key components with regards to climate change and resilience building. Numerous adaptation research areas were offered for each:

Emergency preparedness and management

- How are current climate related extreme weather events and disasters impacting health systems, what are critical thresholds related to very severe impacts, including combined and cascading events. What are projected impacts as the climate continues to change?
- What best practices exist for health systems to prepare for these events including how best to link health facility emergency/disaster plans with community plans to reduce climate change impacts?

Climate-informed health programmes

- How to link up the formal health sector with local civil society groups or informal health care more effectively and sustainably?
- What particular considerations are needed to improve the climate resilience of programmes in areas in which conflict and the climate crisis collide?
- How to ensure access to health services for undocumented people, people on the move, people living in illegal settlements etc?
- How to mainstream climate change information into health programme and policy development and implementation?



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Management of environmental determinants of health

- Greater efforts to understand the disproportionate impacts of climate change on specific populations and communities including the impacts on health equity.
- Better understanding of current and projected impacts of climate change adaptation and GHG mitigation measures on key determinants of health and on health equity outcomes.
- Best practices for designing health adaptation measures and GHG mitigation measures to reduce health inequities among populations and communities and enhance climate resilience.
- Strengthening the evidence on the health impacts - including service delivery and management practices - of climate change via water, sanitation and hygiene exposure pathways, and ensure the concomitant development of indicators to measure progress on climate resilient WASH and health service delivery and management practices.

Conclusion

The health of people and the planet is fundamental for the prosperity of all alive today and for generations to come. This consultation process aimed to identify 'knowledge to action needs' or barriers to research driving climate action in health systems, and by doing so, to identify the opportunities for action and understand who needs to do what. Four key stakeholder groups were identified: researchers, policymakers, practitioners, and communities. Each had specific needs. Yet they articulated the imperative of convening around a shared narrative, drawing on experiences - both similar and distinct - in order to foster innovation and share learning over the next decade. There was a clear call to develop research capacity (which currently does not receive substantial amounts of funding) and to collate different strands of local evidence and pool this together to have larger policy relevance in global policy debates. As COP26 fast approaches, health and social justice must feature at the heart of the climate talks to unite us in protecting and promoting well-being and moving towards the vision of improving resilience to climate change by 2030 to ensure a future in which all beings thrive, not simply survive.



Annex 1. Barriers and opportunities for action on adaptation research

These users:	... are identifying these 'knowledge to action needs' (or barriers to research driving climate action).	Consultation discussions surfaced these opportunities to overcome these barriers...	...and recommend different actors take the following actions to ensure research drives effective climate action.
Researchers	The funding landscape does not always provide for long-term funding	Donors should lengthen funding duration	Researchers should harvest and collate lessons learnt so far to advocate for longer funding to support improved knowledge generation
	Different sectors use the terms and concepts differently	There is an opportunity to harmonise language and terms	ARA membership could lead on a further consultative process to convene actors around shared language
	Lack complete data	Develop stronger qualitative methods and systems-thinking approaches and ensure they are working at the correct scale	Experts with more qualitative expertise to help share tools and models for engagement
	Tend to work in silos	Ensure that teams are multi- and transdisciplinary, drawing on different perspectives	Collaboratively work through international research consortiums
Policymakers	Limited knowledge of linkages between climate impacts and health systems resilience	Consortium to ensure greater provision of training	International, national and local research consortiums to improve knowledge mobilisation and sensitisation to key policy makers, supported by investments from donors
	Not being involved early enough	Ensure that policymakers are brought in from the outset to co-design and co-produce research agendas	All research groups to map actors early to ensure co-design and development
	Competition between ministries	Convene ministries together around risks	Better understand the political economy of health systems strengthening for climate resilience and stakeholders should emphasise the risk as the entry point
	Capacity for health-climate work can sometimes be low, e.g. lack of health expertise within GCF accredited agencies limiting ability to access climate finance	Joint convening is critical and building regional centres of expertise	WHO to provide strong accompaniment with clear guidelines, and knowledge mobilisation and strengthening to ensure there is health expertise in all of the agencies able to access climate finance
Implementers	Lack of clarity on who does what where	Identification and clarification of decision-making space	Policy-makers and decision-makers to develop clear roles and responsibilities for all stakeholders with accompanying accountability mechanisms



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<i>e.g. Health workforce</i>	Limited knowledge of climate-health nexus	Provision of training	International, national and local research consortiums to improve knowledge mobilisation and sensitisation to health providers, supported by investments from donors
Communities	Findings are rarely translated	Better participatory involvement with communities which avoid elite capture	International, national and local research consortiums to improve knowledge mobilisation and sensitisation



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Annex 2. Full list of result-oriented adaptation research areas identified as part of the consultation process

Six Building Blocks	10 Actions Points	Action-oriented research priority area (* = prioritised by expert consensus)
Financing	Climate and health financing	<p>*How to finance resilient health systems? Is there a role for climate finance? Loss and damage or other entitlements approaches?</p> <p>Identify integrate and innovate towards building and continued climate focused health systems planning with added financial forecasting. Need to develop a clear rationale to fund health activities via climate finance (e.g. with the Green Climate Fund)</p> <p>Analysis of the political economy of climate change and health – what needs to change?</p>
Leadership and Governance	Leadership and Governance	<p>*What are the most convincing and useable types of risk-information needed to help decision makers act on issues of future risk and immediate risks?</p> <p>*Identifying the most effective means to break down silos, improve and govern cross sector functionality</p> <p>*Integration of health into national adaptation plans: what are the barriers and how can they be overcome?</p> <p>Identification and clarification of the decision-making space to enact change within health systems (and beyond): who is allowed to do what, who are the key figures that can enact change, what skillsets do they need.</p> <p>Identification of the most effective way to motivate the health sector itself to take climate change seriously and with urgency.</p> <p>How best to task share and task shift with a shared responsibility as per drawn up targeted policy formulations</p> <p>Identify the most effective accountability mechanisms within the health system</p>
Health information systems	Health and climate research	<p>*How to improve health information systems to be able to integrate ecological determinants of health and meteorological data on a timescale that is useful for health.</p> <p>*Improve the usability of climate information (scenarios & forecasts) by translating it for health planning.</p> <p>*How are health systems already changing with chronic climatic stress and what is the repeated exposure teaching us about how to adapt (especially from community contributions)?</p> <p>Ensuring better documentation of past climate change impacts on health systems to learn lessons for future scenarios</p>



		<p>What are the long-term impacts or hazards on health of different interventions? How to better understand the balance of short-term interventions with respect to long-term resilience building</p> <p>What is the role of government social protection systems . social care to mitigate health risks or address needs outside of a clinical setting?</p> <p>Conduct separate study on climate extremes (flood, salinity, drought) resilient health system.</p> <p>Beyond seasonal variability, what evidence is there that extreme weather events are influencing health outcomes?</p> <p>What are the key climate health risks (e.g. climate sensitive infectious disease) in specific areas of conflict today (e.g. northern Nigeria, Afghanistan) and what needs to happen to address these risks?</p> <p>What are the implications of different emission (RCP) and socio-economic (SSP) scenarios for health system resilience?</p> <p>How can routine health information monitoring support development of indicators and monitoring over the next 5 years?</p> <p>Identification of indicators that reflect the dynamic properties of health systems changing: why and how are health systems able to change?</p> <p>How to use the health information system at different levels to be able to measure progress at different levels?</p>
	<p>Vulnerability, capacity and adaptation assessments</p>	<p>*How to co-develop and implement rapid assessments of the local context that includes more than just the local elite?</p> <p>Better evidence on and better awareness of the long-term, indirect health impacts of climate shocks and stresses</p> <p>What are the long-term impacts of slow onset or cyclical disasters chipping away at health systems, and how to adapt to this?</p> <p>How to more effectively identify vulnerable populations and infrastructure, and assess coping capacity and knowledge gaps.</p> <p>What are the specific health impacts in many locations, the most appropriate adaptation strategies to address these emerging threats, and how to scale up these activities most effectively and rapidly?</p>
	<p>Integrated risk monitoring and early warning</p>	<p>*How to bring in community leaders to get real time information to strengthen assessment and surveillance?</p> <p>Evaluation and cost-effectiveness analysis of early warning systems</p>



Health Workforce	Health Workforce	<p>** Better understand how frontline health staff are impacted directly by climate change and what this means for the health system and work force sustainability, and what the training and sensitisation needs are to reduce this impact whilst also understanding what the workforce can do with this knowledge (eg. greater community engagement, etc)</p> <p>*Systematically review medical training materials and see to what extent adaptation is being added.</p> <p>*Support systems for health workers and decision makers to engage with communities – in keeping with ARA principles.</p> <p>How can we establish flexibility/competences required for clinical staff to respond quickly/with resilience to risks? (e.g. varying drug supply mechanisms, varying service delivery (outreach/remote clinics))</p> <p>What can the health sector learn from the disaster management sector (if anything) for dealing with surge needs, as well as staff capacities during extreme events?</p>
Essential medical products and technologies	Climate resilient & sustainable technologies and infrastructure	<p>*What are the lessons learnt from implementing the WHO Guidelines on Resilient and Environmentally Sustainable Health Care Facilities?</p> <p>*What are the specific requirements for climate proofing small versus very large health facilities and infrastructures?</p> <p>*How to continually apply climate projections for the development of new health facilities or the upgrading of existing health facilities and management practices?</p> <p>Identification of the most effective ways to obtain real time information generation and dissemination system.</p> <p>How to standardise reporting on disease surveillance and cope with data disruptions?</p> <p>Increase the evidence base of the best practices in telemedicine and digitalisation to integrate climate resilience and environmental sustainability within health system strengthening</p>
Service Delivery	Emergency preparedness and management	<p>What are the most effective communication strategies to combat disinformation?</p> <p>How can dealing with climate risks negatively impact the delivery of basic services and management practices?</p> <p>How do extreme weather events (the new normal) disrupt health systems and how to prepare for this?</p> <p>Improve the understanding of extreme events that are more frequent.</p>



	Climate-informed health programmes	<p>What health and climate topics are best delivered by who?</p> <p>What are the second and third order impacts of extreme weather/a climatic shock on health systems and which pose the biggest risk - the hazard itself or the cascading impacts? What needs to be put in place to safeguard essential services?</p> <p>**How to link up the formal health sector with local civil society groups or informal health care more effectively and sustainably?</p> <p>**How to ensure access to health services for undocumented people, people on the move, people living in illegal settlements etc?</p> <p><i>What can be learnt from indigenous knowledge on climate change response and how to incorporate this better into health programmes?</i></p> <p>What mechanisms for referral are needed in areas in which conflict and the climate crisis collide?</p> <p>**How do climate hazards undermine disease control strategies?</p>
	Management of environmental determinants of health	<p>Understand the disproportionate impacts of climate change on specific populations and communities including the impacts on health equity.</p> <p>What are the current and projected impacts of climate change adaptation and GHG mitigation measures on key environmental determinants of health, such as WASH, and on health equity outcomes?</p> <p>What are the best practices for designing health adaptation measures and GHG mitigation measures to reduce health inequities among populations and communities and enhance climate resilience?</p> <p>Strengthening the evidence on the health impacts - including service delivery and management practices - of climate change via water, sanitation and hygiene exposure pathways, and ensure the concomitant development of indicators to measure progress on climate resilient WASH and health service delivery and management practices.</p>



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Annex 4: Descriptive analysis of expert participants

Of the 68 potential experts identified, 26 were able to participate in this study. The participants consisted of 13 females and 13 males. The majority of participants were full-time academics (n = 16). Others had their main occupation in a governmental organization (n=2), the WHO (n=3), or non-profit organizations (n = 5).

Map of experts' geographical location



Map of expert's nationality



Gender breakdown



Type of expert

