Building health resilience through climate services:

An analysis of the current state of implementation and future policy directions

Executive summary

Climate services for health are various forms of tailored and actionable climate information that enhance health decisions to protect population health and health systems amid escalating risks from climate change and variability (World Meteorological Organization, 2023). In recent years, there has been significant development in, and documentation of, various forms of climate services for health, including early warning systems, risk maps, seasonal calendars and climate-related health impact projections, which support strategic planning, preparedness and timely interventions (World Health Organization, 2023). Whilst climate services for health are frequently based on a tool (a model) or a product (a dashboard), not all climate–health tools and products are being transformed into actionable climate services for health. For these tools and products to be used meaningfully for decision-making, there is a need for fit-for-purpose governance structures, capacity building, effective dissemination and user-oriented actions. It is only with these supports that the resulting service is able to bridge the disconnect between tool and decision-support and ensure timely, informed, targeted and equitable decision-making.

This report examines the development, integration and operationalization of existing climate services for health into decision-support structures within healthcare systems, exploring barriers and enabling factors that shape their implementation. It draws on a rapid literature review of 45 studies and four country case studies (Bangladesh, Colombia, Malawi and Senegal) to assess the active implementation across five key components: governance, leadership, stakeholder engagement, data integration and dissemination. The report also identifies and analyses three implementation typologies that describe how needs vary depending on service type, scale, intervention complexity and local context. Literature and case studies are grouped into three categories: 1) centralized or top-down approaches, where national agencies manage climate–health information; 2) decentralized or bottom-up approaches, where local authorities customize information for communities; and 3) hybrid or phased approaches, which combine different mechanisms across national, sub-national and community levels to ensure a systematic climate service rollout. This report does not evaluate the existing climate services for health presented in the case studies.

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Key findings

Leadership is a critical enabler, but current efforts – as demonstrated in the literature – are hampered by fragmented support, late government involvement and limited co-creation. Strengthening leadership requires active sponsorship and mechanisms for scaling locally relevant tools to national systems.

Leadership involves active support from senior decision-makers to secure resources, set mandates, remove obstacles and empower staff to incorporate climate services into routine health programmes.

- Challenge: Often, leaders do not prioritize climate-informed services. In countries implementing these services, government and research institutions show leadership, and support growsonce once the benefits are recognized. However, many tools remain in academic settings with little collaboration with ministries, hindering ownership, sustainability and large-scale adoption.

- Facilitators: Leadership in implementing climate services for health is easier when clear mandates reduce fragmentation, facilitating cooperation and resource allocation. An example is **Senegal's** establishment of a Health–Environment Division, providing dedicated leadership and a clarified mandate.

Governance is a necessary driver for scaling and sustaining climate services for health. The literature highlights fragmented and informal coordination, short-term funding and insufficient monitoring and evaluation as core challenges. Strengthening governance in a systematic and replicable way requires robust policy frameworks, formalized partnerships, sustainable financing and mechanisms for accountability and learning.

Governance encompasses the structures, funding, coordination and oversight essential for guiding climate–health initiatives, promoting cross-sector collaboration, ensuring accountability and aligning efforts with national objectives.

- Challenge: Implementation often suffers from unclear agreements, procedures and policies on data sharing, privacy and regulation. Lack of national guidance hampers cross-sector collaboration, while short-term funding linked to academic or project grants challenges sustainability. Insufficient planning for infrastructure – like data stewardship and system capacity – also hinders integrating climate services into routine health practices.

- Facilitators: Governance factors supporting climate services for health include formal arrangements like memoranda of understanding (MoU) between ministries of health and meteorological services that define mandates, roles and responsibilities. These agreements foster shared goals and aligned priorities and accountability, creating a stable basis for collaboration. Governance frameworks enable coordinated data-sharing, joint analysis and synchronized decision-making, translating climate data into timely health actions within a consistent policy environment. In **Malawi**, an MoU between the Department of Climate Change and Meteorological Services (DCCMS) and the Department of Disaster Management Affairs (DoDMA) formalizes joint planning, while inter-ministerial committees review forecasts and risk maps regularly to facilitate necessary decisions.

Stakeholder engagement is essential for ensuring climate services for health are relevant and accessible. While user-centred approaches are commonly described in the literature, there is a need for more systematic co-design, regular feedback and inclusive engagement, particularly with marginalized and at-risk populations.

Stakeholder engagement involves building trust and actively involving health professionals, policymakers, communities and at-risk populations to make climate services for health relevant, trusted and widely adopted.

- Challenge: Many climate services for health are developed through user-centred processes but often lack co-design with relevant ministries. In most case-study countries, these services are data-driven rather than demand-driven, relying on analytics and historical data instead of practitioner needs.

- Facilitators: Stakeholders stress the importance of standard methods for consistent results across experts and events like dengue and malaria, and to promote standardization. Creating dashboards and decision-support rooms encourages interinstitutional use, feedback and data sharing. Regular processes, like **Colombia's** monthly Climate and Health Bulletin, maintain active interagency communication through multi-sectoral collaboration among the National Institute of Health (INS), Institute of Hydrology, Meteorology and Environmental Studies (IDEAM) and the Ministry of Health and Social Protection (MinSalud).

Data integration is vital for effective climate services for health; but, as the literature makes clear, challenges remain related to data quality, stewardship, infrastructure and governance. Strengthening data integration requires investment in local platforms, harmonized standards and robust governance mechanisms to ensure data is accessible, reliable and actionable.

Data integration involves converting raw weather, climate and health data into clear, actionable information for use in daily healthcare practice.

- Challenge: Barriers stem from gaps in data coverage, quality and granularity, but advances in collection and storage improve availability. More critical issues are weak governance and limited stakeholder engagement, which hinder effective data use even when datasets exist. Climate–health data integration needs interoperable standards and shared agreements balancing privacy and access. Strengthening integration requires investment in local platforms, harmonized standards and governance to ensure data is accessible, reliable and actionable.

- Facilitators: Our evidence suggests strong data governance – covering ownership, quality controls and metadata – is vital for accuracy and traceability. Integrated data platforms support analysis, alerts and response. Investing in application programming interfaces (APIs), ontologies and secure exchange improves real-time sharing and collaboration. Data integration is crucial for effective climate services for health, but challenges in quality, stewardship, infrastructure and governance persist. The **Colombian** National Institute of Health's VIGIFRA system combines three dashboards – SATAES, MASSAES and five climate-sensitive health dashboards – to monitor environmental and health data. It issues daily alerts for health risks like dengue, diarrhoeal diseases, hepatitis A, respiratory infections and snakebites, offering predictive insights that aid resource allocation and public health actions.

Dissemination of climate–health services appears most effective in the literature when information is tailored to user profiles, delivered through diverse and accessible channels, and supported by feedback mechanisms. Academic and government approaches can be complementary, but participatory design and local adaptation are essential for maximizing impact and uptake.

Dissemination focuses on how information should reach users quickly and reliably through accessible channels such as alerts, dashboards and community radio.

- Challenge: It's vital to deliver information across different levels and institutions. Challenges include establishing standardized communication channels and interoperable reporting among various entities (national, regional, local) and health system components (surveillance, response, planning, delivery). Timely dissemination should customize content for decision-makers at all levels to ensure relevant action.

- Facilitators: Co-designed dashboards, bulletins and alert systems that link climate signals with health indicators promote consistent messaging and coordinated responses. Strong governance with clear roles and feedback fosters trust and uptake. Adaptable strategies ensure information reaches frontline workers, programme managers and stakeholders, influencing resources and strategies. Academic and government approaches can complement each other, but participatory design and local adaptation are key to maximizing impact and uptake. A strong example of best practice is the **Bangladesh** Red Crescent Society's (BDRCS) Heat Early Action Protocol, put into effect in Dhaka in April 2024. It was activated based on forecasts of prolonged extreme heat exceeding 38°C and heat index predictions. This data-driven approach allowed for prompt action, including public awareness campaigns, water distribution, cash assistance for vulnerable populations, cooling stations and ambulance services in areas at high risk.

Our report shows that climate services for health are used across various contexts and service types, with different degrees of adherence to ideal principles. The literature review indicates that most evaluated services and tools are predominantly top-down or hybrid approaches, often lacking engagement with local stakeholders and their needs. The four country case studies reveal different typologies based on service type, scale, intervention complexity and local conditions, illustrating top-down, bottom-up and hybrid approaches. For example, Bangladesh employs a top-down model with strong national coordination but struggles with local adaptation. **Colombia** uses a hybrid approach that combines national priorities with district input and collaborative governance. **Malawi** also uses a hybrid model emphasizing community involvement and two-way information sharing, along with national coordination. **Senegal** follows a top-down method with centralized leadership but faces challenges in implementing responses locally.

Key recommendations

Leadership

- Government: Prioritize stronger government leadership, especially from meteorological, health and disaster departments. This leadership should align priorities, mobilize resources, streamline governance and foster cross-sector collaboration to implement, fund and scale climate–health services nationwide. This involves establishing accountability, incentivizing interagency coordination and integrating climate–health into national health and emergency plans.
- Donors: Create innovation and exchange platforms (e.g., workshops, conferences) with ministries of health (MoH), national meteorological and hydrological services (NMHS), disaster risk management agencies, finance ministries, academia, nongovernmental organizations (NGOs) and the private sector to showcase the added value of climate services for health and stimulate demand for the development of climate services for health.
- Academia / private developers: Ensure all new climate–health tools include a national steering group (with implementation agencies) to guide co-development into operational climate services.

Governance

- MoH and NMHS: Develop MoUs and establish multi-stakeholder leadership models to clarify roles, secure co-development partnerships and advocate for both project-based and sustained funding.
- MoH and NHMS coalitions: Create structured mechanisms for regular community engagement and feedback on the design and effectiveness of climate services.
- MoH and NMHS: Institutionalize monitoring and evaluation (M&E) frameworks with clear metrics to track impact, capture lessons learned and align services with national priorities.

Stakeholder engagement

- Donors and MoH: Allocate funding for sustained capacity building at multiple levels (data managers, analysts, policymakers, health workers) to enable effective use of climate information within the health sector.
- MoH and NMHS: Establish staff exchange programmes (e.g., MoH secondments to NMHS and vice versa) to strengthen cross-sector collaboration and mutual understanding.

Data

- MoH and NMHS: Jointly advocate for and invest in local data infrastructure for collection and processing, ensuring harmonized formats, standards and sub-national integration.
- Donors: Support long-term investment in interoperable data systems to minimize data gaps as a barrier.

Dissemination

- All actors (MoH, NMHS, developers, donors): Ensure climate–health information is presented in formats accessible to decision-makers and communities.
- MoH and NMHS: Establish clear responsibilities for monitoring, timely information flow and action based on early warnings.