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# Landscape of Anticipatory Action for Health in a Changing Climate

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# EXECUTIVE SUMMARY

Anticipatory Action (AA) is assistance that is provided before the onset of a disaster, triggered by a forecast or warning information. AA frameworks can address the growing health risks associated with climate change. These frameworks promote rapid action when extreme weather events or disease spikes are forecasted, rapidly deploying health systems and humanitarian capacity to reduce risks in the most critical moments. Strategic investment in AA and coordination across sectors has promise to improve the effectiveness of health investments and reduce the health impacts of a changing climate.

To date, we find two major types of AA frameworks: hazard-driven frameworks and disease-driven frameworks. Hazard-driven frameworks aim to avoid the health consequences of floods, storms, heatwaves, and other extreme weather events. Disease-driven frameworks make use of disease surveillance or epidemiological models, often for vector-borne and waterborne diseases. We find that hazard-driven frameworks often lack integration with government health ministries and initiatives, which is likely reducing their effectiveness in preventing negative health impacts. On the other hand, operationalizing disease-driven frameworks requires coordination and cooperation between health ministries and nongovernment actors, which has created disincentives or delays for the design of disease-driven frameworks.

We recommend sustained investment in both hazard-driven and disease-driven AA frameworks to support health systems to manage the evolving disease burden with climate change. In places with distinct and forecastable heatwave events, increased investment in hazard-driven AA frameworks—designed with behavior change theory to maximize effectiveness—is particularly warranted. For extreme flooding and storm events, hazard-driven AA frameworks can also be appropriate; however, these should be designed (or redesigned) in coordination with the health sector. When it comes to vector-borne and waterborne diseases, disease-driven frameworks should be developed using surveillance and disease modeling. For example, weather

forecasts and disease surveillance information can be used to modify the location, timing, or scale of existing large-scale health sector interventions, such as spraying for mosquitos. For large-scale nutrition interventions, investments are needed in systems that can provide support quickly to populations in need.

AA and climate services for health should also build upon long-term investments in community wellness. Local community practices, such as information sharing, infrastructure investments, and livelihood decisions already aim to achieve a sustainable and healthy lifestyle. Any new programs associated with “AA” should build on community efforts, even if these do not explicitly use the term.

Major challenges for the design and scale-up of AA for health include (1) lack of institutional collaboration and mandates for forecasting health impacts, (2) lack of funding for sufficient surveillance and action, and (3) lack of coordination in scaling the most effective forecast-based actions. For example, health professionals are not trained to understand probabilistic forecasts or climate projections, while meteorologists often lack knowledge of health data thresholds. Furthermore, there is often no well-maintained system where climate data is systematically linked to health outcomes, making it difficult to assess the long-term health impacts of extreme weather events and prepare accordingly.

Overall, AA can be a means to efficiently allocate scarce resources in the public health sector. For example, AA can be incorporated into public health measures that are already happening to improve their effectiveness by changing the timing or location of these initiatives. Coordination among actors will be necessary to achieve this goal, and we recommend experimentation with novel forecasting methods and the use of drills/simulations to practice large-scale, forecast-based activations.

# KEY FINDINGS

**Forecasts and data systems must be precise and connected to decision-making.** Investments in disease surveillance, impact-based forecasting, and AI-enhanced prediction models can help health actors prepare for outbreaks and climate shocks. Yet forecast data must be linked to decision-support systems and tailored to operational needs (e.g., where to target heat alerts or cholera prevention).

**AA should not operate in isolation from other health interventions.** Humanitarians, civil society, and ministries of health should coordinate, use evidence of what works, and build on health interventions that have already been planned. Evaluations and shared evidence are essential to refine future AA actions. Multiagency practice simulations of AA frameworks can help encourage joint ownership and identify areas for improvements.

**Social protection and health systems offer infrastructure for scaling AA effectively.** Building on existing public health infrastructure and social protection systems enables AA to scale quickly and reach the most vulnerable. Governments and humanitarian actors should collaborate to build anticipatory social protection mechanisms, plan for financial mobilization, and test delivery systems through regular drills and exercises. Long-term planning and institutional commitment are needed to make these systems robust and sustainable.

**Research and innovation must guide the future of AA for health.** Despite promising examples, there is a critical gap in evidence on what anticipatory health actions are most effective. Future research should explore undertested interventions (e.g., adaptive insurance, behavioral nudges, culturally rooted communication) and examine population-specific outcomes.

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# ACRONYMS

AA	Anticipatory Action
AA-TWG	AA Technical Working Group
ARC	Africa Risk Capacity (initiative)
BDRCS	Bangladesh Red Crescent Society
BMD	Bangladesh Meteorological Department
B-SPARED	Building on Social Protection for Anticipatory Action and Response in Emergencies and Disasters (Philippines)
CATI	Case-area target interventions
CERF	Central Emergency Response Fund
CESU	City Epidemiology and Surveillance Units (Philippines)
CHF	Swiss franc
CMAM	Community-based management of acute malnutrition
CPP	Climate Preparedness Programme (Bangladesh)
DA	Department of Agriculture (Philippines)
DDM	Department of Disaster Management (Bangladesh)
DepEd	Department of Education (Philippines)
DGHS	Directorate General of Health Services (Bangladesh)
DL	Danger level
DOH	Department of Health (Philippines)
DOLE	Department of Labor and Employment (Philippines)
DPWH	Department of Public Works and Highways (Philippines)
DRC	Democratic Republic of the Congo
DREF	Disaster Relief Emergency Fund
DRR	Disaster risk reduction
DRRM	Disaster risk reduction and management
DSWD	Department of Social Welfare and Development (Philippines)
EAP	Early action protocol
FAO	Food and Agriculture Organization of the United Nations
FbF/A	Forecast-based Financing/Action
HCTT	Humanitarian Coordination Task Team
HNAP	Health-National Adaptation Plan (Bangladesh)
ICA	Colombian Agricultural Institute
ICT	Information and communications technology
ICPAC	IGAD Climate Prediction and Applications Centre
IFRC	International Federation of Red Cross and Red Crescent Societies
LGU	Local government unit

MoDMR	Ministry of Disaster Management and Relief (Bangladesh)
MPCG	Multipurpose cash grant
MSME	Micro, small, and medium enterprise
NCCP	National Cholera Control Plan (Bangladesh)
NDC	Nationally determined contribution
NEAP	National Early Action Protocol (Bangladesh)
NGO	Nongovernmental organization
NGP	National Greening Program (Philippines)
NOAA	National Oceanic and Atmospheric Administration
NREP	National Renewable Energy Program (Philippines)
NVMW	National Volcano Monitoring and Warning (Philippines)
OCV	Oral cholera vaccination
PAGASA	Philippine Atmospheric, Geophysical, and Astronomical Services Administration
PhilHealth	Philippines Health Insurance Corporation
PHIVOLCS	Philippine Institute of Volcanology and Seismology
PNECHOL	National Program for the Elimination of Cholera and the Control of Other Diarrheal Diseases (DRC)
QC	Quezon City
QCESD	Quezon City Epidemiology and Surveillance Division (Philippines)
QCHD	Quezon City Health Department (Philippines)
ROI	Return on investment
SOPs	Standard operating procedures
TWG	Technical working group
UN	United Nations
UNGRD	National Unit for Disaster Risk Management (Colombia)
UN OCHA	United Nations Office for the Coordination of Humanitarian Affairs
URC	Uganda Red Cross
URCS	Uganda Red Cross Society
USD	United States dollar
WASH	Water, sanitation, and hygiene
WFP	World Food Programme
WHO	World Health Organization

# INTRODUCTION

All aspects of human health are affected by climate change, driven by the increasing number and intensity of extreme weather events around the world. In the year 2020, heat-related deaths of people older than 65 years increased by 85% compared with 1990–2000, and the global land area affected by extreme drought has doubled since the 1950s. The number of people experiencing food insecurity associated with heatwaves and droughts in 2021 was 100 million more than in the past (Romanello et al. 2021). These trends are projected to worsen in the future, further stressing an overburdened health system. In addition to tripling heatwave deaths and further increasing food insecurity, climate change is projected to facilitate the transmission of infectious diseases such as cholera and dengue fever, and cause billions in economic losses (Romanello et al. 2021).

To address the health impacts of climate change, humanitarians are scaling up the use of Anticipatory Action (AA). AA refers to programs that use forecast or warning information to trigger quick deployment of information or resources and provide assistance before the impacts of a disaster (Coughlan de Perez et al. 2015). In order to be timely, AA programs often have pre-arranged funds and plans that specify which forecast or warning information should trigger action. For example, evacuation based on weather forecasts has saved millions of lives. However, weather forecasts have been underutilized as a tool to prevent negative health impacts of disasters, often because people do not have the mandate or resources to act based on a forecast. Box 1 offers additional details on AA programs and their design.

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## **BOX 1.** [What is Anticipatory Action?](#)

Anticipatory Action (AA) refers to actions taken to reduce the humanitarian impacts of a forecasted hazard before it occurs, or before its most acute impacts are felt (International Committee of the Red Cross 2025). What distinguishes AA from long-term disaster risk reduction is the use of forecast or warning or heightened risk information to scale up action. AA builds on long-term disaster risk reduction efforts, and it can also help make post-disaster response more effective (e.g., by pre-positioning supplies based on a weather forecast).

There are many different ways that AA systems are designed, but the overall goal is to act earlier and thus prevent or at least mitigate acute and imminent humanitarian impacts before they fully unfold. Key characteristics often include:

- The decision to implement actions is based on forecasts or predictive analyses of when and where a hazard will occur.
- Actions are implemented before the hazard's impact, or before a shock's most acute humanitarian impacts are felt, with a view to reduce these impacts. Examples of actions include providing cash or drought-resistant agricultural inputs.
- Roles are pre-agreed for different stakeholder groups.
- Threshold levels are discussed in advance regarding when actions should be triggered (with release of necessary funds or resources). These usually combine forecasts with data on impacts of past events, exposure, and vulnerability.
- Financing is often pre-arranged to ensure that actions can be implemented immediately once the triggers are met and before hazard impacts unfold.

For more information and resources: <https://www.anticipation-hub.org/>

Formal AA systems can provide the necessary mandates and earmarked resources for early action. Such formal AA systems have now been designed by humanitarian organizations in approximately 70 countries, with research and evidence on AA in areas such as its linkages to social protection (Poole et al. 2022), food security (Lentz et al. 2020), and conflict-affected populations (Wagner & Jaime 2020). A review of 15 empirical studies on the costs and benefits of AA found that AA led to improved outcomes for households, and better results from a donor, humanitarian, or development agency perspective, than no intervention. However, the precise cost-benefit ratio varied among studies depending on the efficacy of the actions and the governance of the program, which underscores the need for further research on how to design AA systems most effectively for specific contexts (Weingärtner et al. 2020). More research is needed on *which* AA programs are most useful in a given context (e.g., mosquito spraying vs. bed net distribution based on rainfall forecasts).

There are still numerous and serious health impacts after predictable disaster events, including illnesses, premature deaths, malnutrition, and impacts on mental health (Cissé et al. 2022). Better use of weather warnings and associated AA could avoid these health impacts in a world with increasing climate hazards, directly improving health outcomes for vulnerable communities by preventing the impacts of extreme weather events. AA can enable the health system to prepare for surges in demand during emergencies, and it can also promote multisectoral collaboration that specifies roles and responsibilities for information sharing and action before and during emergencies.

Given this potential, governments and humanitarian actors are increasing their investments in early warning systems and AA (Coughlan de Perez et al. 2022). The humanitarian sector has developed 119 official frameworks for AA in 43 countries, with many more in development. These formal frameworks are intended to outline the roles and responsibilities for taking action when a relevant weather or disease forecast is issued, to ensure that AA happens when risks are high. For this report, we reviewed all 49 published summaries of these frameworks by the Red Cross Red Crescent Movement and United Nations agencies (see Annex 1 for names and links to each document). We also interviewed 66 people working in AA and health in Bangladesh, Colombia, the Philippines, and Uganda, as well as global

actors. These interviewees came from international organizations, universities, national health agencies, national meteorological agencies, national civil society organizations, and neighborhood health facilities.

Based on this data, we provide an overview of the landscape of AA to understand which types of investments and frameworks are most suitable to which contexts. This global review offers a typology of approaches to AA for health, based on the financing, mandates, and design structures of different AA approaches for different national contexts and health outcomes. We then provide recommendations for humanitarian and government actors who are working on the development of AA systems to protect and promote health in a changing climate.

# TYOLOGY

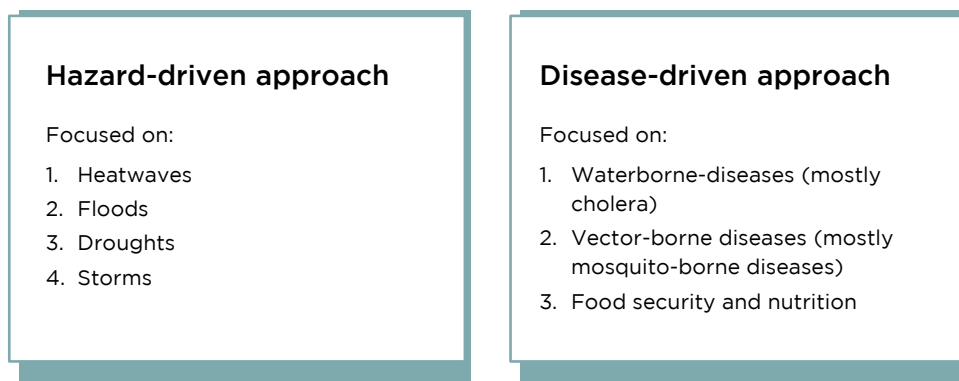
Anticipatory Action (AA) is an approach designed to avoid or reduce negative impacts of predicted events on people and their assets by taking action based on forecasts and risk analysis. For example, enabling access to cool environments has saved lives during heatwaves (Widerynski et al. 2017), and the scale-up of targeted public health interventions based on disease surveillance has been effective and cost efficient in many contexts (Herida et al. 2016). People who received anticipatory cash before floods in Nigeria were less likely to employ negative coping strategies, such as selling household assets (Balana et al. 2023). AA is designed to complement long-term disaster risk reduction initiatives, as it focuses on the window of time between information (a forecast or heightened risk information) and the consequences of a disaster. However, few studies provide quantitative information on the benefits of AA (Dunsch et al. 2025; De Brauw 2025; Chaves-Gonzalez et al. 2022; Weingärtner & Wilkinson 2019).

There is increased interest in developing AA systems that can prevent health impacts associated with extreme weather around the world, given (1) increasing extreme weather due to climate change, (2) increasing resource constraints for climate and health action, and (3) interest in multisectoral collaboration. Many actors hope that acting early could enable greater cost-effectiveness by leveraging collaboration between the public health and meteorological sectors.

To date, there have been two major ways in which people have approached the design of AA for health in a changing climate (Figure 1). First, there is a hazard-driven approach, which departs from a hazard, such as a heatwave, and determines how to use heatwave forecasts to trigger actions to reduce the event’s health impacts. This approach is characterized by models that rely on hydrometeorological forecasts, a focus on distinct extreme weather events, and an association with disaster risk management frameworks of the humanitarian sector, governments, or insurance agencies. This approach can also lessen the health impacts of the secondary/tertiary effects of the hazard event.

In contrast, a disease-driven approach departs from health outcomes directly and instead builds anticipatory systems that anticipate negative health outcomes, rather than a hazard event. For example, integrated outbreak risk-prediction models for cholera can indicate when outbreaks are most likely to occur, using a combination of disease surveillance data and rainfall observations and forecasts. This approach is characterized by integrating surveillance information to anticipate how diseases will spread and usually is initiated with leadership from government public health agencies.

**FIGURE 1.** Typology of common approaches to AA for health in a changing climate



All but one of the 49 published AA frameworks used a hazard-driven approach. Within the United Nations Office for the Coordination of Humanitarian Affairs (UN OCHA), one informant described, “What is happening more and more is the inclusion of health-related activities when there’s a broader activation as part of a multisectoral framework.” For example, many of the UN OCHA-facilitated AA frameworks include work on health, often led by World Health Organization (WHO), but only one framework uses health triggers specifically (an AA framework to address cholera in the Democratic Republic of the Congo (DRC)). The Red Cross Red Crescent movement has not yet approved an early action protocol (EAP) for health, mainly due to methodological issues around triggers, although one is in progress and several more are likely in the coming years.

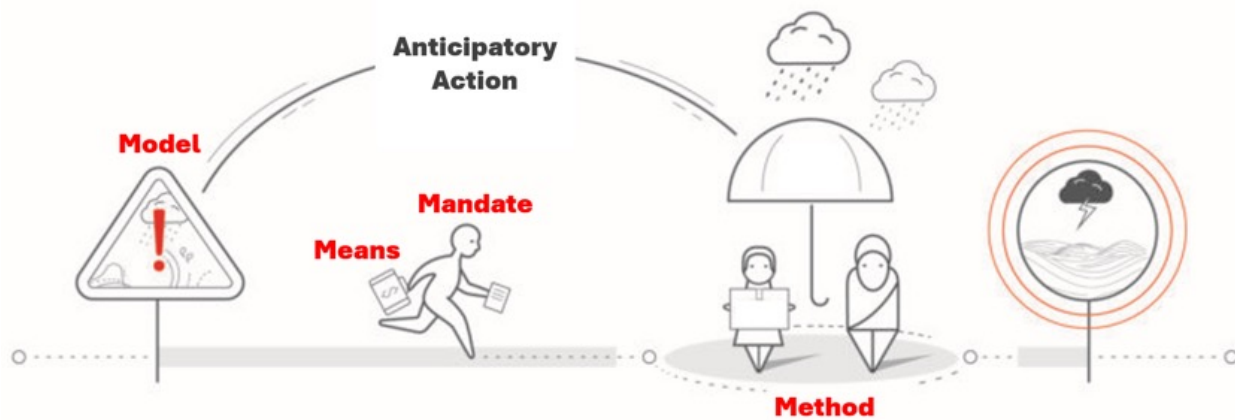
These AA efforts are part of a broader effort to develop climate services for health, which “identify, generate and build capacity to access, develop, deliver, and use relevant and reliable climate knowledge to enhance health decisions” (Shumake-Guillemot & Fernandez-Montoya 2019, 15). Climate services for health include everything from early warning systems to risk information systems that inform decisions to promote health.

Based on the findings in this landscape report, we recommend that both hazard-driven and disease-driven approaches are valuable approaches to climate services for health and can be complementary: hazard-driven planning is critical for extreme events and mass casualty events, while disease outbreak modeling is also needed for long-term health promotion and outbreak prediction, prevention, and management. We recommend investments in AA frameworks that use both types of approaches.

In the following sections, we will examine four characteristics of these two types of AA frameworks (see Figure 2):

1. Model: What information is used to trigger AA?
2. Mandate: What are the specific roles of each actor?
3. Method: Which actions are taken?
4. Means: What are the enabling factors, including finance?

**FIGURE 2.** Characteristics of Anticipatory Action (AA) frameworks: The 4 Ms



Following this, we will provide case studies of AA systems for several common health outcomes, making recommendations for how AA can help achieve positive outcomes in the future. We suggest AA designs for different contexts that

are likely to help prioritize scarce resources and improve effectiveness in the increasingly complex environment of climate-aggravated health threats.

# A HAZARD-DRIVEN ANTICIPATORY ACTION APPROACH TO HEALTH

## Model

The hazard-driven approach defines a specific weather or climate event of concern and triggers action based on a hydrometeorological forecast of that event. Actors in hazard-driven Anticipatory Action (AA) frameworks typically access forecasts through national meteorological services, for example, Bangladesh Meteorological Department (BMD) and Flood Forecasting Center (FFWC) in Bangladesh, which provide weather alerts for

heatwaves, cyclones, and floods. Sometimes global forecasts are also used. For example, a humanitarian organization-led EAP in Bangladesh leverages Global Flood Awareness System (GloFAS) warnings for pre-activation of an AA trigger. Triggers in this approach tend to be generic hazard triggers, which do not mention a specific health risk (see Box 2 for examples).

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### BOX 2: Examples of a hazard-driven trigger

#### Floods in Djibouti, Red Cross

“This first simplified EAP will address floods mainly as a result of flash floods and seasonal rivers and runoff from hills forming streams in the basement valleys. The trigger will be met when the 7-day forecast (Annex 1) issued by Djibouti met agency forecast rainfall above 50mm in the next 7 days for the city of Djibouti and its suburbs AND the IGAD Climate Prediction and Applications Centre (ICPAC) East Africa hazard watch<sup>3</sup>, the forecast shows a “heavy rainfall” alert for the next 7 days for Djibouti city and its suburb.”

#### Drought in Chad, United Nations (translated from French)

Activities in “Window 1” are triggered if the IRI [International Research Institute] forecast published in March or April reaches a threshold of 42.5% probability that total precipitation during the period July-August-September will be below average.

Activities in “Window 2” are triggered if the IRI forecast published in May or June reaches a threshold of 42.5% probability that total precipitation during the period July-August-September will be below average.

Activities in “Window 3” are triggered if the analysis of biomass observation data published in September reaches a threshold of at least 80% anomaly.

Hazard forecasts are sometimes combined with vulnerability and exposure information to identify priority locations for action, such as prevalence of thatched-roof houses. Types of risk information used in current triggers can be found on the [Anticipation Hub website](#), categorized as follows:

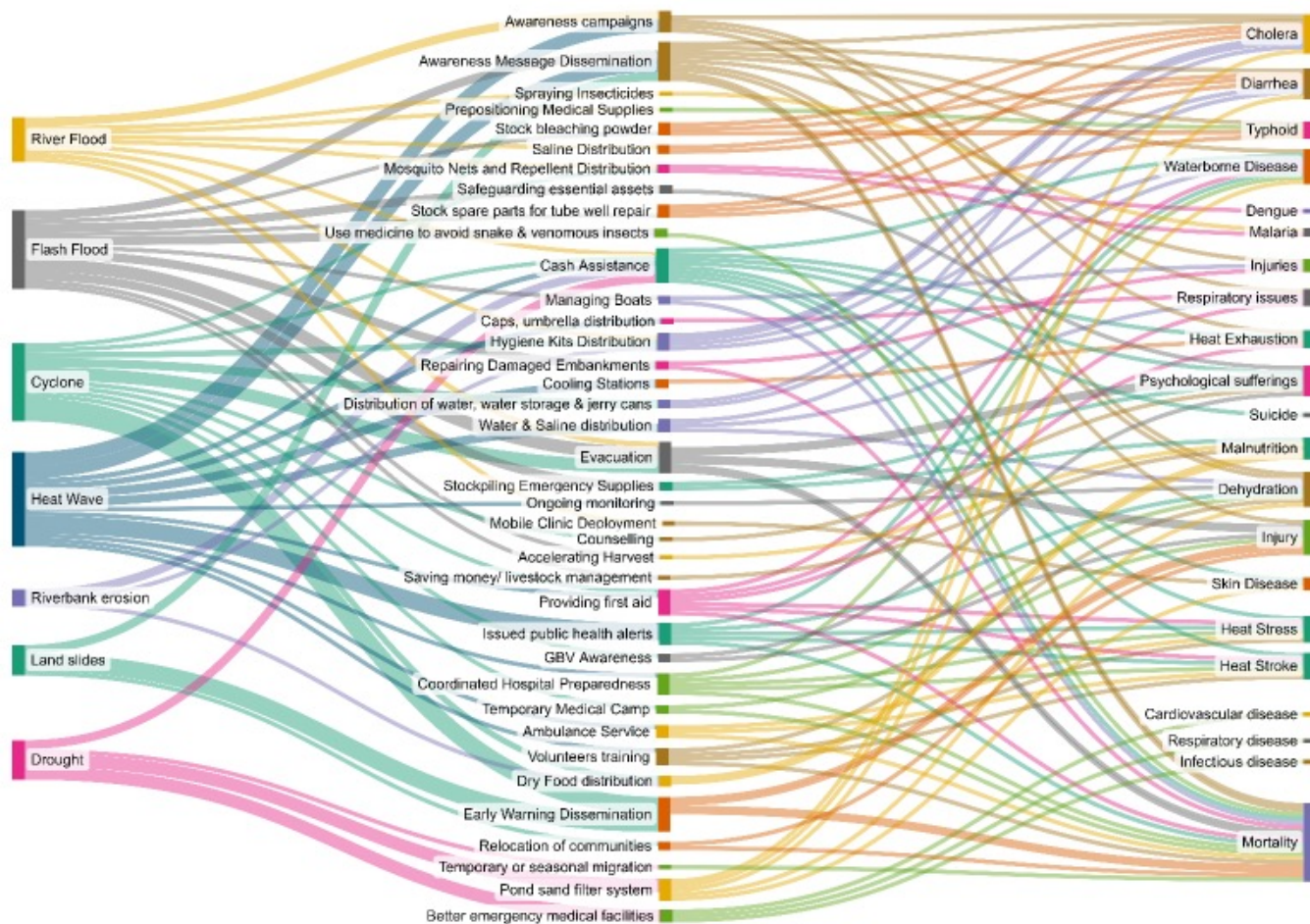
- Access to services and infrastructure
- Food security and nutrition status
- Geographic location
- Health status
- Institutional capacities
- Livelihoods
- Livestock
- Protection
- Shelter and infrastructure
- Sociodemographic factors

Each of these weather-related triggers is linked to a number of health impacts that the humanitarian agency is intending to prevent. An example is shown in Figure 3. It illustrates how the implementation of AA for various hazards in Bangladesh aims to reduce health impacts. The health impacts that a hazard-driven approach addresses vary widely; they are depicted in Figure 4 from all hazard-driven AA frameworks. Waterborne disease is the most frequently mentioned concern, and many actions also seek to reduce the risk of death during an extreme weather event. Many of the UN agencies have concentrated on [food security](#), [nutrition](#), [maternal health](#), and [interpersonal/gender-based violence](#), while many of the Red Cross frameworks have focused on vector-borne diseases ([malaria](#), [dengue fever](#)) and other [noncommunicable diseases](#).

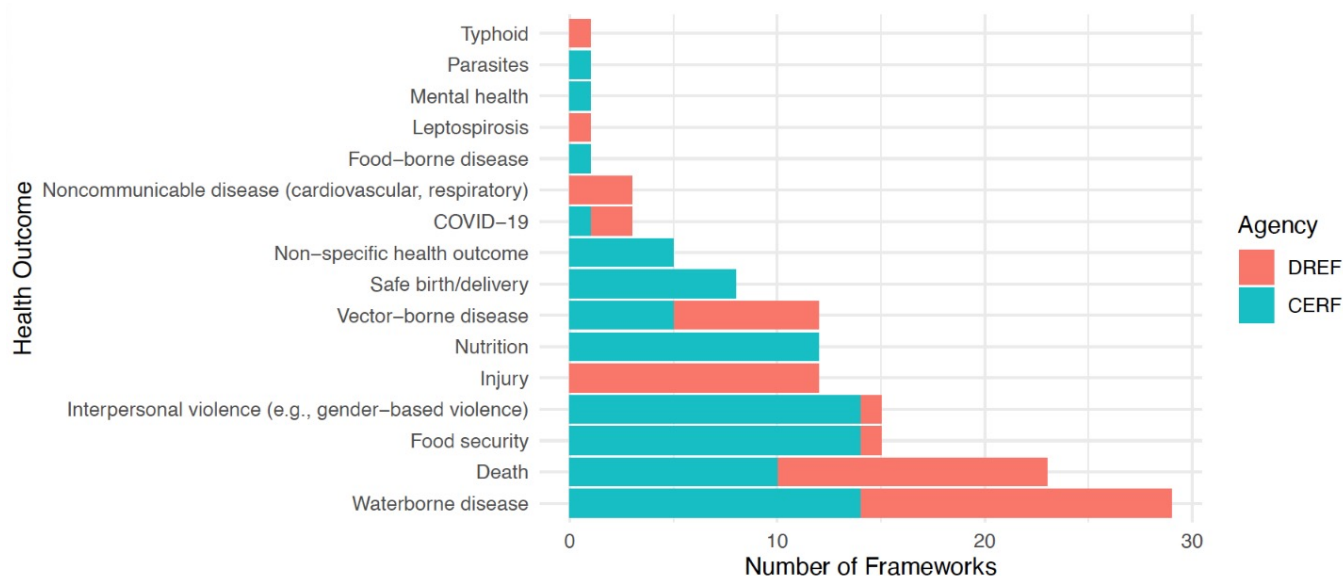
One key area of flexibility afforded by the hazard-driven approach is the ability to address multiple health impacts caused by or associated with one event, or a multihazard event. For example, the actions to prepare for the impacts of a cyclone can be coordinated to address the risk of injury as well

as waterborne disease simultaneously. This approach can also consider and protect against secondary/tertiary levels of health impacts of disaster, such as ensuring access to medical care while people are evacuated.

**FIGURE 3.** Anticipatory Actions (AA) implemented for various hazards in Bangladesh and the stated link between these actions and health impacts to be reduced



**FIGURE 4.** Health outcomes mentioned in all 49 summaries of Anticipatory Action (AA) frameworks published by the United Nations and IFRC



Central Emergency Response Fund (CERF) funding in teal and the Red Cross Red Crescent Movement Disaster Relief Emergency Fund (DREF) funding in red.

## Mandate

The humanitarian sector has spearheaded the development of many hazard-driven AA frameworks internationally; in these frameworks, the humanitarian agency is typically the lead actor and implementer, and they make use of humanitarian funding mechanisms. See Figure 5 for an overview of how often different agencies were mentioned as having each role in the published AA frameworks from the Red Cross Red Crescent Movement and the United Nations.

For example, in Bangladesh, a dedicated task force on Forecast-based Financing/Action (FbF/A) brings together government agencies (e.g., disaster management authorities, meteorological departments) and humanitarian actors (Red Crescent, UN, nongovernmental organizations (NGOs)) to harmonize plans. A technical committee led by the national meteorological agency often monitors forecasts and advises when to trigger action. Integration with existing disaster management structures is also common. For

instance, the Bangladesh Red Crescent Society coordinates its cyclone early actions with the government’s Cyclone Preparedness Programme (CPP), local government committees, as well as international partners such as the International Federation of Red Cross and Red Crescent Societies (IFRC) and German Red Cross (IFRC 2018, GoB 2024). These mechanisms—joint task forces, technical working groups, and interagency collaboration platforms—are commonly used to ensure hazard-driven AA frameworks operate cohesively across organizations and sectors.

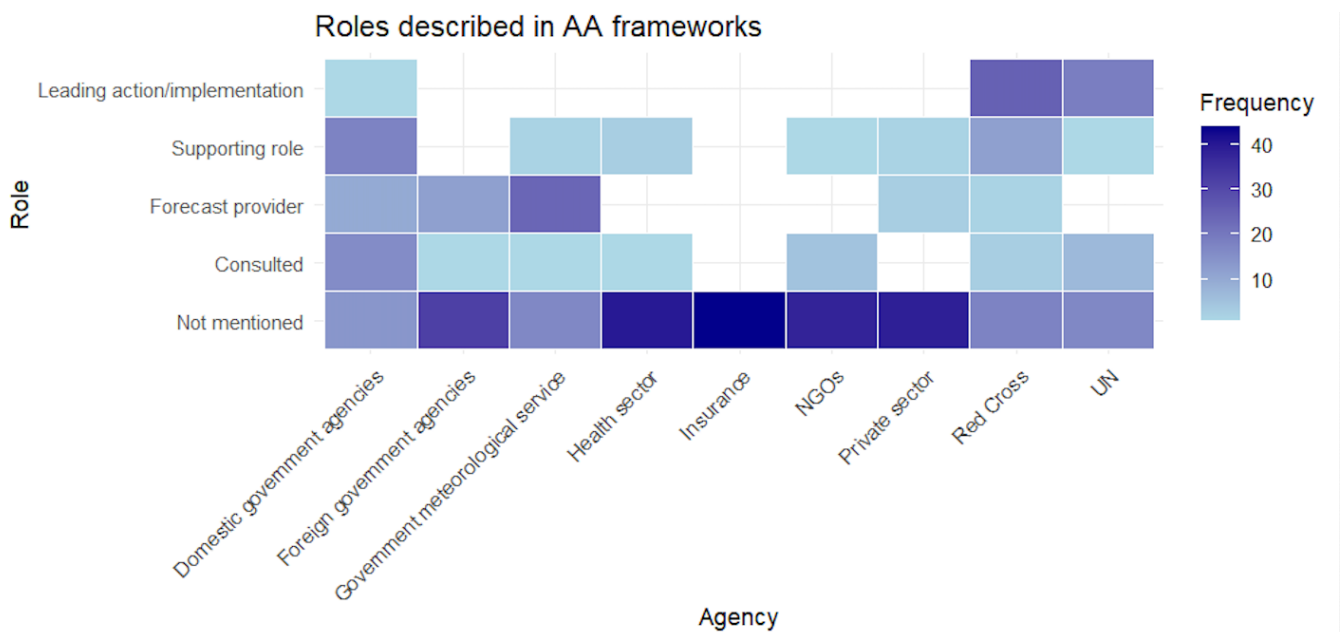
The mandates for government agencies in these hazard-driven frameworks are variable, with many frameworks seeming to operate without coordination with government agencies. Government agencies that oversee disaster management and hydrometeorology are mentioned in many frameworks as supporting actors or forecast providers, although several frameworks rely on forecasts from international governments or private-sector entities like universities. For example, in the case of flooding in Bangladesh, a national protocol

is managed by the National Taskforce on FbF/A, supported by the AA Technical Working Group (AA-TWG). The Taskforce will lead coordination efforts with relevant committees in line with the Standing Orders on Disaster (SOD), while the AA-TWG will work with national clusters and working groups under the Humanitarian Coordination Task Team (HCTT) to ensure a harmonized implementation. The Flood Forecasting and Warning Centre (FFWC) will oversee forecast monitoring and provide technical support throughout the process. Similar coordination mechanisms are outlined for cyclones as well; however, they are less established for other hazards. But how this coordination mechanism works has not been tested yet. In the case of humanitarian-led AA EAP 2024 (under the Strategic Plan for 2017–2020), the Bangladesh Red Crescent Society (BDRCS) has collaborated closely with key national stakeholders,

including the Cyclone Preparedness Programme (CPP), the Bangladesh Meteorological Department (BMD), and the Department of Disaster Management (DDM), to ensure coordinated and effective actions.

Nine of the published frameworks—all of which are in Africa—did not mention any government role at all. This was more common for some hazards than others; almost all frameworks for cyclones and extreme storms failed to mention the health sector, even though they included discussion of reducing health impacts of the storm. There are few other actors mentioned in these frameworks; for example, the insurance sector was never mentioned in any of the 49 published AA frameworks.

**FIGURE 5.** Frequency of roles described in Anticipatory Action (AA) frameworks by the Red Cross Red Crescent and the United Nations



This figure only includes hazard-driven frameworks. Note that these published frameworks are summaries of longer plans, and therefore this represents only the information provided in the summaries.

Even though not all AA frameworks included roles for government agencies, key informants stressed that collaboration with national authorities is the key foundation to successful AA work, and when not in

place could hinder frameworks that otherwise do have the necessary triggers and data to be effective. One informant explained that many AA plans focused on health, but were designed as hazard-

focused frameworks under the purview of the disaster risk management departments:

For a long time the majority of the AA was very health oriented, with most of the initiatives very focused on health such as WASH [water, sanitation, and hygiene]/hygiene actions to reduce waterborne disease for cyclones and floods. So in that way we have been doing quite health-oriented AA for a long time; it just sat with the disaster management team within National Societies and didn't include health officials. And that might be why for a long time we didn't see a lot of evidence for curbing disease!

In fact, a key informant in Uganda explained that the origin of the approach is associated primarily with the humanitarian sector:

I started engaging in AA around 2012/2013 with Uganda Red Cross (URC), so URC was the pioneer of this concept that we used to call forecast-based financing, and then we were developing a system that would be able to address the impact of floods.

Despite AA frameworks failing to engage with government agencies, there are numerous government policies that are relevant to the AA approach. Table 1 provides an example list of policies from Colombia that govern disaster risk management and climate change nationally. Of note is the 2024 Circular No. 070, which provided for the scope and implementation of AA. This official recognition of AA has increased buy-in and enthusiasm for AA in Colombia, and it is believed this might also unlock funding for government and nongovernmental AA initiatives.

**TABLE 1.** Overview of several policies related to disaster risk management in Colombia. These disaster-related policies are relevant for the design and operationalization of hazard-driven Anticipatory Action (AA) planning.

POLICY	OBJECTIVE
CONPES Document 3700 of 2011	Institutional strategy for integrating policies and actions on climate change in Colombia. National Council for Economic and Social Policy.
Law 1523 of 2012	Adopting the National Policy on Disaster Risk Management, establishing the National Disaster Risk Management System.
National Climate Change Adaptation Plan, 2016	The ultimate goal of the Plan Nacional de Adaptación al Cambio Climático (PNACC) is to reduce the risks and socioeconomic and ecosystem impacts associated with climate variability and change in Colombia.
National Climate Change Policy of Colombia, 2017	Incorporating climate change management into public and private decisions to move toward a climate-resilient, low-carbon development pathway that reduces climate risks and leverages opportunities arising from climate change. The long-term aspiration is carbon neutrality.
CONPES Document 4058 of 2021	Public policy to reduce disaster risk conditions and adapt to climate variability phenomena.

**TABLE 1.** Continued

POLICY	OBJECTIVE
Law 109 of 2022	Approving the Regional Agreement on Access to Information, Public Participation, and Access to Justice in Environmental Matters in Latin America and the Caribbean, known as the Escazú Agreement
Update of Colombia’s Nationally Determined Contribution (NDC) for the period 2020–2030	The NDC adaptation to climate change and actions for low-carbon, adapted, and climate-resilient development.
Law 2294 of 2023	Issuing the National Development Plan 2022-2026 “Colombia: World Power of Life.”
Law 1523, 2012 on the National Unit for Disaster Risk Management	National Policy for Disaster Risk Management and the Establishment of the National Disaster Risk Management System.
Circular No. 070, September 18, 2024	Scope and implementation of the concept of “AA” under Law 1523 of 2012. Under the purview of the National Unit for Disaster Risk Management.
National Plan for Management of the El Niño Phenomenon, 2023	National Unit for Disaster Risk Management Institute of Hydrology, Meteorology and Environmental Studies (IDEAM).

Much of the implementation of AA is done by local actors. Although localization of AA is not the focus of this report, there is a general recognition from AA practitioners—international and national—of the importance of locally led anticipatory approaches (Locally Led Anticipatory Action Working Group 2024). See Box 3 to learn more.

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**BOX 3:** Localization and Power Within Early and Anticipatory Action: Evidence from a UN early action intervention for extreme flooding in South Sudan

A qualitative study analyzing the process of a UN early action intervention in response to extreme flooding in South Sudan in 2022 identified parallels with issues raised in broader discussions on humanitarian localization (Easton-Calabria 2025). Many of the same power structures and unequal sites of decision-making discussed surrounding localization were found—yet existing within international organizations implementing the intervention. The concept of “internal localization” was developed to promote discussions on the multiple nationalities and often concentrated geographies of power and decision-making within the staffing and structure of international humanitarian agencies.

A lack of “localization” within implementing agencies in some instances led to delays in the early action implementation in South Sudan. While some level of delay is likely normal, this is particularly problematic for Anticipatory Action (AA) due to the very short timeline of action. A significant issue impacting timeliness appeared to be the lengthy bureaucratic nature of UN project procurement and implementation alongside challenges in South Sudan with the cluster system and other coordination mechanisms and delegations of responsibility. As work on AA continues—and particularly in instances of collaboration between multiple complex actors such as international agencies and governments—identifying both successful and fragmented flows of agency communication and addressing these accordingly before AA frameworks are triggered are critical to their success (Easton-Calabria 2025).

## Method

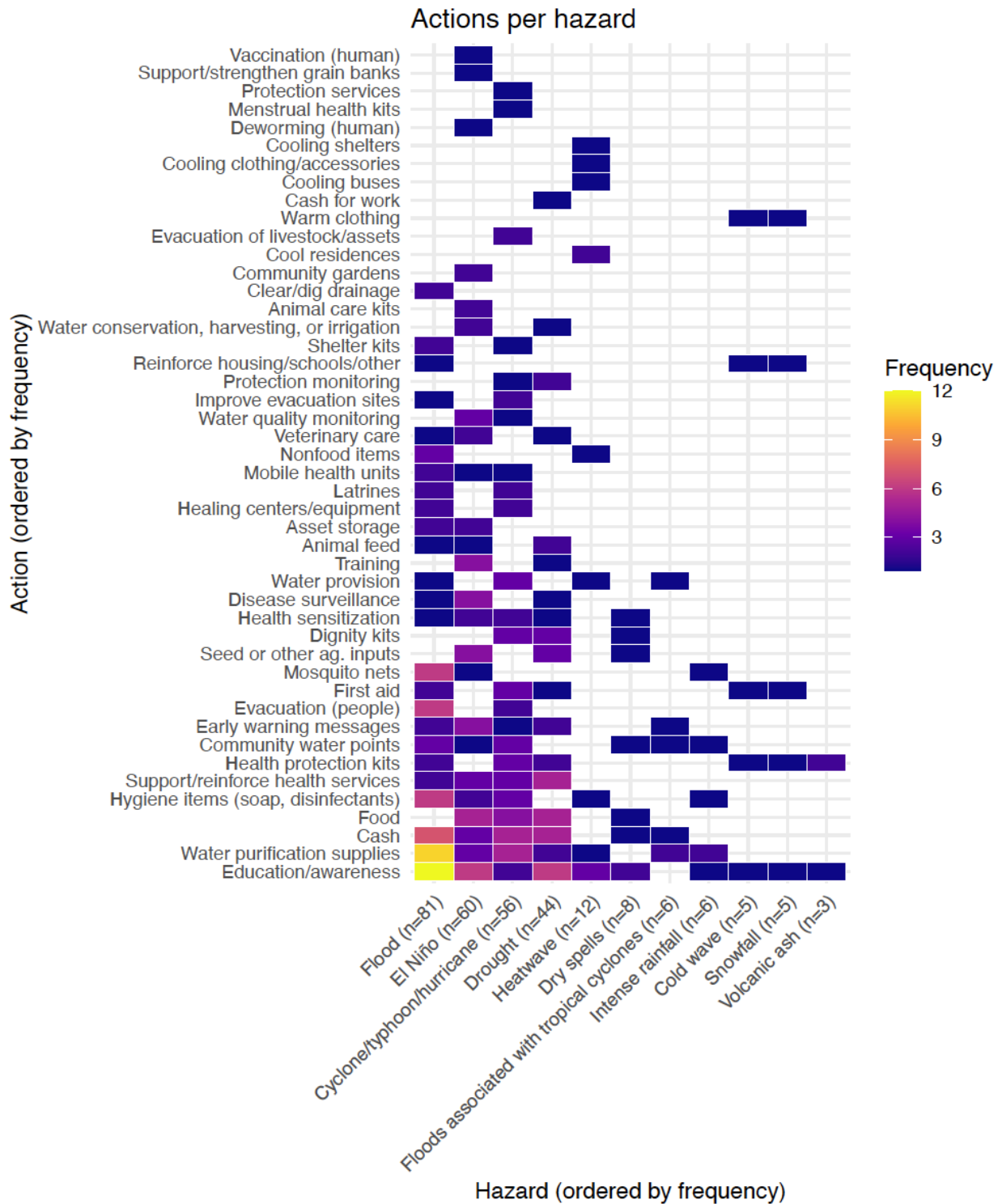
In the hazard-driven approach, most AA frameworks specify more than one action to be carried out when an event trigger happens. Some of the most common actions mentioned in these frameworks are water provision, cash distribution, and education/awareness raising. Figure 6 provides an overview of the number of actions planned for each hazard in the 49 published frameworks. As an example of a multipronged AA intervention, the Dry Corridor AA Framework for El Salvador by UN OCHA mentions 17 different actions to be taken based on El Niño forecasts, ranging from early warning messages to water quality monitoring to provision of mosquito nets. This framework explicitly mentions the health sector, and one of their actions is to distribute “equipment and quick training of the local health personnel for the early identification of health complications, alleviating pain, and preventing death, so that they can bring health services closer to the most vulnerable communities affected by drought” (UN OCHA 2024, 6).

Key informants were often critical of the actions in these hazard-driven frameworks. They expressed concern that AA frameworks for health are being developed not due to their actual demand but instead based on existing abilities by agencies to carry out certain actions. Another informant

mentioned that health can be complex, and comorbidities can make this approach more complicated. For example, malnutrition and cholera can occur simultaneously, and the connections with climate can be nonlinear. An informant described the difficulty of trying to “shoehorn” a health focus into AA frameworks, explaining that health needs often necessitate more of a risk matrix approach that is difficult to parse into one particular trigger.

A related concern by informants about the effectiveness of actions in the hazard-driven AA plans was about their often small-scale nature, operating outside of the national health sector. For example, several frameworks implemented more than 10 actions in a small number of communities, yet research shows that patchy mosquito control efforts, for example, are less cost-effective than landscape-level efforts (Schwab et al. 2018). This small-scale approach risks a siloed implementation that may duplicate other efforts, undermine larger strategies and actions, and/or simply be less impactful than if these interventions were more harmonized nationally and/or in the wider humanitarian sphere.

**FIGURE 6.** Actions listed in published Anticipatory Action (AA) frameworks that have a hazard-driven approach, categorized by hazard. Lighter colors indicate higher frequency of use of that action for that hazard.





**Public sentiment.** Enabling and catalyzing factors vary in different contexts, but we find that having lived experience of a recent disaster is a major motivating factor for establishing an AA framework. For example, in Uganda, landslides in December 2024 catalyzed public support and investment to rethink how disaster preparedness can be improved. Having developed the early action protocol for floods in 2021, the experience of the recent landslides shows that the implementation of the EAP developed by Uganda Red Cross and partners was insufficient in scale to match the reach of the landslides. Actors are now considering which types of changes and improvements to make based on their recent experience.

**Individual champions.** Individual actors play an outsized role in the impetus to begin and the ability to complete an AA framework. Interviewees mentioned that workforce culture is important for maintaining involvement in AA. These tend to be individuals within government or humanitarian agencies who are motivated to pursue the design and roll-out of AA systems.

**Political will.** Informants also emphasized that a conducive policy environment is critical for success. There are examples of laws in the Philippines and Colombia (and one under deliberation in Uganda) that mention AA in legal frameworks. This creates an environment that encourages the development of AA frameworks.

**Hazard forecasts.** To develop a hazard-driven framework, hazard forecasts must also be available and be of sufficient quality that they can be trusted to trigger AA. Quality requirements depend on the type of action and costliness of action being proposed. As a general rule of thumb, higher-cost actions are selected when forecasts show a low risk of “action in vain,” which is a low false alarm ratio. Further details on forecast evaluation are provided by the Anticipation Hub.

**Existing community-led mechanisms.** While our analysis focused on formal AA frameworks and EAPs, many community early warning systems provide early warning messaging without financial support from outside entities. Building on existing structures can catalyze the success of an AA framework, further detailed in this report on [locally-led AA](#).

## Summary

Hazard-driven AA approaches have focused on mobilizing all sectors of society to take action based on forecasts of extreme weather conditions. There are varying degrees of collaboration between government and civil society on these actions, and some countries with frequent hazards have designed collaborative frameworks. For example, Table 2 depicts a coordinated framework between government and BDRCS actors for monsoons in Bangladesh. Examples of high-potential designs are provided in the case studies section.

**TABLE 2.** Comparison of national and humanitarian-led EAP for the same hazard: monsoon floods in Bangladesh

	<b>NATIONAL EARLY ACTION PROTOCOL (NEAP)</b>	<b>BANGLADESH RED CRESCENT EARLY ACTION PROTOCOL (EAP)</b>
MODEL	<p>Multiscenario model from the Government Flood Forecast and Warning Center. Forecasts of the river danger level (DL) for many stations nationally:</p> <ul style="list-style-type: none"> <li>• Pre-activation: Water within 1 m below DL and &gt; 50% probability of DL exceedance</li> <li>• Activation: &gt; 75% probability of DL exceedance and forecasts indicate DL is likely to be exceeded for 3+ days</li> </ul>	<p>Two-step trigger model:</p> <ul style="list-style-type: none"> <li>• Pre-activation: Global Flood Awareness System 15-day forecast (<math>\geq</math> 50% probability, 1-in-5-year flow)</li> <li>• Activation: Government Flood Forecast and Warning Center 5-day deterministic forecast, DL +0.85 m exceedance for at least 3 days</li> <li>• Single main station (Bahadurabad) monitoring</li> </ul>
MANDATE	<ul style="list-style-type: none"> <li>• Flood Forecasting and Warning Center requests Department of Disaster Management to attend a Task Force meeting and Task Force leads coordination</li> <li>• AA-Technical Working Group coordinates with national clusters and working groups under the Humanitarian Coordination Task Team for implementation</li> <li>• Coordination with Disaster Management Committees and sectoral agencies</li> </ul>	<ul style="list-style-type: none"> <li>• Led by BDRCS with technical support from Red Cross actors</li> <li>• Coordination with Ministry of Disaster Management and Relief, Department of Disaster Management, and Flood Forecast and Warning Center for government engagement and forecast data sharing</li> <li>• Collaboration with sectoral partners (Google, World Food Programme (WFP)) for flood forecasting and early action alignment</li> </ul>
METHOD	<ul style="list-style-type: none"> <li>• Multipurpose cash grant disbursement</li> <li>• Flood monitoring and early warning dissemination</li> <li>• Repair of embankments</li> <li>• Shelter and evacuation route preparation (repair, sanitation, electricity, gender-sensitive facilities)</li> <li>• Evacuation of at-risk families</li> <li>• Formation of volunteer and medical teams</li> <li>• Pre-positioning of emergency medicines, water purification tablets, anti-venom</li> <li>• Livestock vaccination and fodder stockpiling</li> <li>• Dry food and fodder distribution, hot meal arrangement at shelters</li> <li>• Emergency healthcare and mobile charging station installations</li> </ul>	<ul style="list-style-type: none"> <li>• Unconditional cash grant</li> <li>• Early warning dissemination for early action (evacuation support)</li> <li>• Evacuation transportation by boat</li> <li>• Provision of basic first aid</li> </ul>

**TABLE 2.** Continued

	<b>NATIONAL EARLY ACTION PROTOCOL (NEAP)</b>	<b>BANGLADESH RED CRESCENT EARLY ACTION PROTOCOL (EAP)</b>
MEANS	<ul style="list-style-type: none"><li>• Disaster Management Fund (DM Fund) (Ministry of Disaster Management and Relief, Department of Disaster Management)</li><li>• Social Safety Net Programs</li><li>• Humanitarian Assistance Programme (Ministry of Disaster Management and Relief)</li><li>• Annual Development Plan (ADP) (Local Government Divisions, Economic Relations Division)</li><li>• Annual Ministerial Budget (Ministry of Disaster Management and Relief)</li><li>• Anticipatory Action Contingency Fund (NGO Affairs Bureau, NGOs, Humanitarian Agencies)</li><li>• Climate Fund (Ministry of Environment, Forest and Climate Change)</li></ul>	<ul style="list-style-type: none"><li>• UN CERF fund</li><li>• Finance from IFRC Disaster Relief Emergency Fund (DREF) through forecast-based action allocation</li><li>• Partnership with Bangladesh Post Office for cash transfers</li></ul>

# A DISEASE-DRIVEN ANTICIPATORY ACTION APPROACH TO HEALTH

## Model

The model for a disease-driven approach forecasts how a climate-sensitive health situation might change in the future, rather than forecasting a meteorological hazard directly. Alcayna et al. (2024) put forward several approaches to designing a trigger in a disease-driven approach:

- A. Real-time surveillance data and amplifying factors:** Triggers are expressed as a combination of surveillance/contextual information and an amplifying factor such as rainfall. Experts caution that this can become a response operation rather than Anticipatory Action (AA) because initial cases reported via surveillance can quickly turn into outbreaks.
- B. Outbreak risk-prediction models:** Mathematical models have tested statistical associations between climatic conditions and disease risk and can provide quantified probabilistic risk-prediction statements depending on the type of model developed. However, models are not able to predict disease outbreaks associated with newly emerging patterns, as they are trained with data from the past.

Such disease prediction models are not universally available, and in many contexts there is no operational system for predicting outbreaks of many diseases. For example, WHO reported in 2015 that monitoring and surveillance systems in Uganda were not conducted at the necessary geographical and temporal scales to identify trends in order to set up models for AA against climate-sensitive diseases (WHO 2015). However, Uganda has an effective community surveillance system, and key informants suggested that improvements could be made in the connectors to be able to channel that information upwards and ensure that action is taken. See an example of a disease-driven trigger in Box 4.

#### BOX 4: Example of a disease-driven trigger

##### [Anticipatory Action Framework–Pilot of the Democratic Republic of Congo: Cholera by UN OCHA](#)

The national authorities, National Program for the Elimination of Cholera and the Control of Other Diarrheal Diseases (PNECHOL), are responsible for the collection, validation, and sharing of epidemiological data in the DRC. A collaboration between the OCHA team and PNECHOL allows direct access to two databases used to monitor the trigger.

The pilot includes three scenarios, each of which can independently trigger an activation:

**Scenario 1:** An anomalous number of cases or deaths over three weeks in any health zone in a province where cholera is endemic (regularly occurring)

**Scenario 2:** Whenever there is an external event that increases the risk of cholera (e.g., floods, displacement), and CERF makes a regular rapid response allocation for this shock in an endemic province

**Scenario 3:** An anomalous number of cases or deaths over three weeks in any health zone within a province where cholera is not endemic

## Mandate

Mandates for disease-driven AA frameworks vary between countries, and we provide an overview of the strengths and weaknesses of how this coordination can be structured.

**Governments:** The disease-driven approach prominently features participation and often leadership of government agencies. Public health agencies are critical actors for disease surveillance and the study of dynamics of disease, and many key informants stressed the need for strong public health systems to make a disease-driven approach possible. Government actors have responsibilities and mandates to monitor diseases with the potential for an outbreak in normal times, which can also be exacerbated by extreme weather disasters.

Despite this eagerness, many respondents acknowledged that government public health systems are not always able to spearhead AA themselves. National government entities often lack familiarity with the AA approach. In Colombia, for example, El Niño forecasts offer several months' lead time before extreme weather and health impacts are felt nationally. Despite this, challenges remain for timely action. For example, stakeholder interviewees mentioned that for the 2023 El Niño, even with a four-month lead time, it was not possible to socialize an AA plan and implement its recommendations

effectively. Instead, the government's advance actions happened much closer to the onset of El Niño.

There are no universally accepted standards for which actors should take which responsibilities in disease-driven AA frameworks. In some cases, the disease modeling is carried out by international actors, with no national data inputs; in other cases, the disease modeling is a mandated output of the government health departments. The lack of mandates for forecasting disease caseloads means that development and maintenance of trigger models is not ensured.

**The potential for cooperation:** Key informants were enthusiastic about the potential effectiveness of an approach in which humanitarian and nongovernmental agencies collaborate with public health systems, although they recognize the challenges of this type of cooperation:

It's possible to have no peaks, and to prevent shocks from happening—that is unusual for AA. On the other hand, the way health is organized—it's a big machine, a big structure—it's hard to know where AA fits in.

Another informant shared:

Climate change is a well-known phenomenon that affects all sectors. Based on this reality, I strongly call for close collaboration between

the ministry of health and all sectors and actors nationally, regionally, and globally to effectively respond to the climate change.

**Health sector policies:** Public health policies that govern the disease-driven approach to AA are often different from those policies that govern the hazard-driven approach (examples of hazard-focused

policies are in Table 1 from Colombia). For example, in Bangladesh, there are many health sector policies that take a comprehensive view on how to manage the risk of disease and health impacts generally. Box 5 below provides a number of examples of such policies. These policies should be consulted and used to frame the design of disease-driven AA.

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**BOX 5.** Overview of several policies related to health in Bangladesh. Disease-driven Anticipatory Action (AA) planning operates in relation to health sector policies such as these.

### **Bangladesh Health-National Adaptation Plan (2018)**

The Bangladesh Health-National Adaptation Plan (HNAP) serves as a strategic framework to integrate climate resilience into the healthcare system. It outlines a five-year roadmap to enhance health sector resilience by incorporating climate risks into national policies and programs. Key strategies include raising awareness of climate-related health risks, strengthening community-based adaptation, training healthcare workers, and improving healthcare infrastructure. However, the HNAP identifies major barriers, such as weak stakeholder coordination, inadequate meteorological and epidemiological data, limited healthcare workforce retention in vulnerable areas, and financial constraints. The disease surveillance system is ineffective, lacking integration of climate data, which hinders outbreak prediction. To address these challenges, HNAP recommends a climate-informed health early warning system, improved data-sharing, funding for climate-health adaptation, and cross-sector collaboration.

### **National Health Policy (2012)**

This national policy acknowledges climate-induced health challenges and the need for preventive measures. This includes respiratory infections, cold and flu outbreaks, waterborne diseases, and vector-borne diseases such as malaria, dengue fever, and malnutrition. AA is not mentioned in this policy.

### **Guideline for Climate-Sensitive Disease Surveillance, Early Warning and Response System (2023)**

This guideline covers how to detect and respond to disease outbreaks that may be triggered or worsened by climate-related events (like floods, cyclones, heatwaves). The main focus is on proactive monitoring and rapid response. For example, it suggests the use of rapid diagnostic testing for cholera outbreaks linked to contaminated water, poor sanitation, and high temperatures.

### **Operational Plan: Non Communicable Disease Control (2017–2022)**

The objective of this plan is to mitigate the health and economic burden of noncommunicable diseases (NCDs) by enhancing prevention, improving healthcare access, and promoting early detection and management. Specific objectives include the development of a policy framework, strengthening surveillance mechanisms, promotion of healthy lifestyles, improving healthcare system readiness, and enhancing cross-sector collaboration. Climate change is not discussed.

### **4th Health, Population, and Nutrition Sector Programme (HPNSP) Operational Plan: Maternal Neonatal Child and Adolescent Health (MNC&AH) (2017–2022)**

The general objective of this operational plan is to provide equitable and accessible quality healthcare services at district hospitals, medical college hospitals, and specialized hospitals. However, this plan doesn't mention climate-induced health challenges or AA. Instead, this plan aims modernize hospital services and align them with global healthcare standards, ensuring sustainable improvements in Bangladesh's healthcare system.

**Roles and responsibilities:** Many actors are concerned about the risk of acting in vain, and they are hesitant to take action unless they are mandated to do so. Thus far, many agencies feel that they do not have a clear mandate to take action based on a forecast of increased disease, because this is not in their explicit mandate. A key informant explained that the International Federation of Red Cross and Red Crescent Societies has mandated all national societies to calculate the risk of acting in vain when they design an AA framework:

Anticipation means that you are not 100% sure that thing will happen. Now if you are not 100% sure and you have prepared the communities to take certain actions and they have wasted time and resources to take those actions and then that event does not happen, it will be a problem in two ways: 1) the resources that one has applied and we [humanitarian organization] have always met that same kind of problem to go back to your donor given the investment that you put to undertake that action and yet the event did not occur they [donors] ask questions on value for money. Secondly the community loses trust in your messages and say that you told us that this thing would occur and then it never occurred, you made us waste our time so that means that the next time you give the same message they will relax and probably by bad luck the event occurs, the impact will be very bad.

## Method

Disease-driven AA systems tend to focus on a comprehensive set of actions that is based on evidence from the health sector in terms of improving health outcomes. For example, the Anticipatory Action Plan for Cholera in the Democratic Republic of the Congo includes the following actions:

- Support to the health sector: deployment of rapid response teams (RRT), provision of surveillance tools to health facilities
- Health protection kits for cholera
- Disease surveillance
- Water purification: water treatment in affected households and neighboring households and establishment of chlorination points

- Household disinfection
- Cholera awareness in affected households and neighboring households
- Training community health workers and other healthcare personnel on cholera management

The Technical Working Group on Health for the Anticipation Hub is developing a set of flowcharts to “translate” health sector thinking for an AA framework. This flowchart could then be appended to an AA framework to help users understand what actions are feasible if risk factors become amplified.

## Means

Disease-driven AA requires the coordination of many actors, and there are several foundational elements to enable its implementation and ultimate success. These means are overviewed here.

*Financing* is a critical enabling factor for success in the disease-driven approach and is often cited as severely lacking. One key informant explained:

Until we have a view of how risk materializes from economic and financial perspectives, it will be difficult to scale up pre-arranged funding for public health related risks, including epidemics, in the same way funding has been scaled [through AA] for other disasters.... There are financing instruments to pay for disasters before they happen. A lot of it is pre-arranged—and at least up until now—we have seen a relatively good trend in terms of commitments ahead of disaster. The same has not happened for health.

Despite this historical lack of funding, there is strong enthusiasm among respondents for the development of a disease-driven approach to AA. One informant mentioned being encouraged by the recent decision of the African Union to increase national public health budgets as a countermeasure to the massive reductions in aid funding that occurred so quickly in early 2025. This was seen as a potential entry point for scaling up AA and health if pre-arranged financing could be agreed as part of these budgets.

Humanitarian-owned disease-driven AA frameworks are funded through the same mechanisms as hazard (i.e., UN OCHA cholera framework funded

through CERF) (see Figure 7 for funding amounts in humanitarian AA frameworks).

Public sector funding for disease-driven AA varies from country to country; public spending on disease control initiatives is spread across different budget lines and is difficult to track. For example, one study attempting to trace the budget lines funding dengue control in Sri Lanka found that most budget items were allocated at the hospital level and that personnel costs made up the largest fraction (Thalagala et al. 2016). In this case, costs ultimately fell under the Ministry of Health. Disaster management funds and public safety net funds can also play a part in disease-driven AA, depending on the design.

Evidence suggests that funding for addressing pandemics has risen since the COVID-19 pandemic; overall development assistance for health rose to an unprecedented level since 2020, and some projections anticipate national government health spending will be “equivalent to an addition of 1% of GDP” in 17 of the 137 low- and middle-income countries (Micah et al. 2023). However, this increase in funding does mean that it is channeled toward anticipatory activities, nor does it mean that it is adequate. Barriers to AA focused on epidemics include an absence of sufficient health infrastructure and funding in many countries that impedes containment efforts (RCRC 2024). A limitation of the DREF within the Red Cross Red Crescent Movement, which funds AA within the movement, is its inability to “fund government actors to undertake action” while the “limitations of funds for continuous monitoring [which is often undertaken by governments] may be particularly limiting for AA for epidemics systems as compared to systems targeting directly a hydrometeorological hazard, which benefit from a set of largely automated forecasting tools” (RCRC 2024, 26).

**Health data.** Because disease surveillance and historical records of morbidity and mortality are required to establish a disease-driven approach, stable systems of record-keeping are critical. Instability and data gaps can be problematic for this approach. Even in a well-resourced setting with strong surveillance systems, a lack of willingness to share data can also prevent the development of models and the design of disease-driven AA. (See further discussion in the [Anticipation Hub working group on AA and health](#).) Close coordination and trusted relationships between actors are needed for

success, which often represent new ways of working and new partnerships:

And then the other bit is to be able to see what is available in terms of the early warning system in the country. Do we have something that [is] specifically health focused?...What is working well and what can be improved because the basis is [to] start with what is already available and build on that to avoid forming parallel [systems]. (key informant interviews)

**Forecasts.** It is often unclear who has the mandate to issue or act on forecasts of disease outbreaks. Epidemiological models are developed by researchers as well as public health agencies, and the requirement to issue operational forecasts of disease is often unassigned. Appropriate forecasting that links weather information and disease outcomes needs to be reliably available for the disease-driven approach to be successful, and the skill of these forecasts (e.g., number of false alarms to expect) should be calculated and shared with all actors involved.

## Summary

The most common model of disease-driven approaches to AA builds on existing disease surveillance and early detection programs. In the case of waterborne disease, for example, AA programs have endeavored to help existing early detection systems move their support even earlier; similarly in the nutrition space, AA programs have focused on helping existing nutrition programs that might have been implemented based on real-time monitoring to activate earlier based on crop forecasts. Examples of high-potential designs are provided in the case studies section.

# CASE STUDIES

In the following section, we provide an overview of several common thematic areas for Anticipatory Action (AA), using both a hazard-driven and a disease-driven approach. Each of these topic areas is a promising avenue for AA to reduce health impacts of a changing climate. Throughout these examples, we make recommendations for further development of AA frameworks that would be most appropriate and effective in each case.

## Heatwaves

Heatwaves negatively impact human health in different ways based on context and vulnerability factors (Arsad et al. 2022). AA is one way to reduce the negative health impacts of heatwaves alongside other adaptive strategies to reduce the likelihood and prevalence of heat illness and other heat-related impacts (e.g., infrastructure improvements, public health campaigns, etc.). This section provides an overview of the evidence on AA targeting heatwaves, along with examples of AA frameworks in Bangladesh and Argentina using the 4Ms (Model, Mandate, Method, Means) framework.

### Evidence review

Extreme heat is one of the fastest-growing hazards globally, and there are increasing efforts to address the health impacts of extreme heat through AA. A hazard-driven approach is likely appropriate for heatwaves in extratropical climates that have defined heatwave events from a meteorological perspective. In these climates, there is often a high-pressure blocking system that remains in one place for a period of time, causing a multiday heatwave (often associated with dry conditions). In these circumstances, the heatwave presents as a distinct, multiday event with an approximate start and end date.

In tropical climates, however, heat action plans should be designed differently. Tropical regions of the world do not experience the same high-pressure blocking systems, and therefore they do not record multiday events of high heat as seen in the extratropics (Coughlan de Perez et al. 2023). There is a dearth of research and epidemiological studies on heatwaves in these regions, and greater investment

in understanding the dynamics of how extreme heat affects people in tropical regions will be critical for development of appropriate heat action plans. These regions might use a variety of different definitions of extreme heat that are most appropriate for health outcomes locally.

In places with multiday heatwave events, there are numerous initiatives to develop heat-health early action plans for these types of events, and new insurance products to provide healthcare coverage for individuals during these events (Rao et al. 2025, Singh et al. 2024). The substantial investment in the development of such plans has led to an evidence base documenting the cases of relative success and failure. Research on heatwave early warnings has found that warning systems alone might not be effective at saving lives (Weinberger et al. 2018). The 2022 Intergovernmental Panel on Climate Change (IPCC) report stated that “evaluations of heatwave early warning systems as a component within Heat Action Plans show inconsistent results in terms of their impact on predicting mortality rates” (Cissé et al. 2022, 92). However, few studies document the efficacy of specific heat preparedness measures. For example, a review of studies on cooling centers in the UK found no research measuring health outcomes after cooling center use (Dearman et al. 2024). Low knowledge on the effectiveness of heat health action plans in Europe limits evidence on both success and failures, but outcomes may be linked to the critical importance of “last mile” early warnings and actions, with failures related to limited engagement with vulnerable populations, local government involvement, and local risk perception (Martinez et al. 2019).

A recent review of heat action plans in India (Singh et al. 2024) emphasized that coordination goes beyond simple communication, and it should encompass a transformational agenda that addresses the root causes of vulnerability to extreme heat:

We find that current heat management governance structures, institutional capacities, and financial mechanisms carry with them the ‘institutional thinness’ of Indian climate governance and a hangover of relief-oriented

approaches in disaster management. This overlooks lessons from adaptive governance, which highlights the importance of flexible, forward-looking decision-making. Further, incremental actions such as water kiosks in public spaces and public awareness campaigns on heat impacts, while essential, often preserve the status quo, and need to be complemented with transformational, system-wide agendas such as targeted implementation of heat-resilient building codes or a better articulation of how cities can balance grey-green-blue infrastructure solutions. (Singh et al. 2024, 1)

### Example of high-potential design

**Model:** Meteorological threshold in a weather forecast. This threshold should be designed based on impacts in the specific location, considering the relative impact of daytime temperatures, nighttime temperatures, humidity, air pollution, and duration of the extreme event.

**Mandate:** Coordinated actions taken by civil society and health actors.

**Method:** Promote hydration, especially among elderly populations. Support vulnerable populations to change practices, including outdoor workers. Offer cool spaces for people to spend time.

**Means:** Funding provided by civil society funds as well as government social protection schemes.

### Case study: Bangladesh Red Crescent Society

Heatwaves have drawn special attention in Bangladesh in recent years.<sup>1</sup> An analysis of 54 years of data between 1970–2024 revealed a total of 15 distinct heatwave events in Dhaka city, with the highest temperature reaching 40.6°C. A total of 66 days exceeded the heatwave threshold temperature of 38°C, and the longest heatwave event persisted for six consecutive days, starting on April 11, 2023. In 2023, Bangladesh observed the highest temperature at Rajshahi (45.1°C). In 2024, the highest maximum temperature recorded was 38.5°C at Chuadanga and Ishurdi on April 3, 2024. A Bangladesh Red Crescent Society (BDRCS) forecast monitoring report indicated that Bangladesh set an all-time heatwave record as the BMD recorded 24 days of heatwave during April 2024, breaching 23 consecutive days of heatwave in 2019.

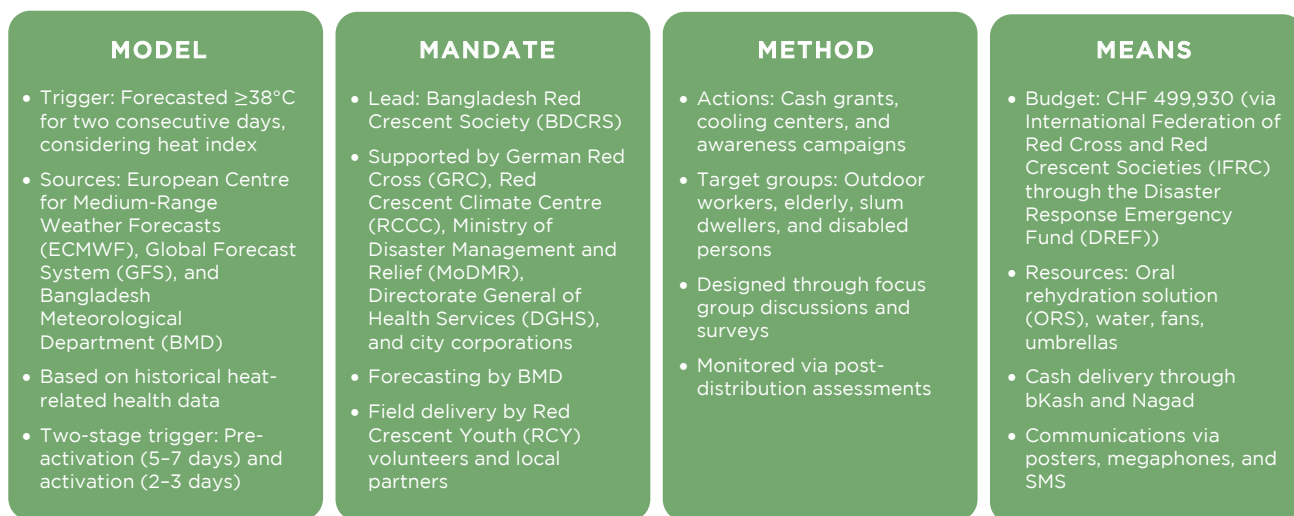
Based on previous experiences, government officials have recognized that additional measures are required to enhance preparedness for heatwaves. One respondent explained, “You see, we know, from our experience last year, that the heatwave is probably going to hit in one and half months or so. But we are still not doing anything for that.” Respondents from several organizations mentioned that the Government of Bangladesh is now working on developing a National EAP for Heatwaves.

Although a government-led EAP is still in progress, in 2024 an EAP implemented by the BDRCS was officially activated for the first time for predicted extreme temperatures in Dhaka and can be described by the 4M framework—Model, Mandate, Method, and Means (Figure 8).

**Model:** The EAP model relies on weather forecast data. The activation mechanism, as proposed in the heatwave feasibility study by BDRCS (2021), is summarized in Figure 8. The trigger threshold was predicted to be met during April 28 to 30, 2024. The activation committee of BDRCS formally triggered the activation on April 21, 2024 (IFRC, 2024b) with a 7-day lead time.

<sup>1</sup> Bangladesh Meteorological Department (BMD) defines heatwave when maximum temperature exceeds 36°C and classifies into four categories as Mild: 36–38°C, Moderate: 38.1–40°C, Severe: 40.1–42°C, Extreme: > 43°C.

**FIGURE 8.** The 4M framework as applied to heatwave early action in Bangladesh, led by the Bangladesh Red Crescent Society



**Mandate:** The mandate to implement the heatwave early action protocol (EAP) lies formally within the operational authority of the BDRCS, which carries out this role with the endorsement and financial support of the International Federation of Red Cross and Red Crescent Societies (IFRC) through the Disaster Response Emergency Fund (DREF). Humanitarian organizations active in Bangladesh, including IFRC, German Red Cross, American Red Cross, Swedish Red Cross, Swiss Red Cross, Red Crescent Youth (RCY), and Save the Children were also involved in the process. On the government side, Bangladesh Meteorological Department (BMD), Dhaka North City Corporation (DNCC), Directorate General of Health Services (DGHS), and Dhaka Metropolitan Police (DMP) were important parts of the heatwave support implementation work.

**Method:** Distribution of leaflets, safe drinking water, multipurpose cash grants (MPCG), and setting-up of cooling stations in severely affected areas of Dhaka city was initiated by BDRCS, with the following AA launched immediately:

- Distributing MPCG of Bangladeshi taka (BDT) 5,000 (approximately USD 40) to selected vulnerable households, with an extra 10% top-up provided to families that include persons with disabilities

- Three temporary cooling centers established in areas where exposure is highest. These cooling centers provide shaded resting spaces, access to drinking water, oral saline, and medical attention through trained paramedics.
- Mobilizing more than 250 volunteers in Dhaka to support the heatwave response activities
- Providing first-aid support and ambulance services to those affected by the heatwave
- Public awareness campaigns conducted intensively using loudspeakers and poster distributions in local languages to inform the public about heat stress symptoms, simple prevention methods, and available support services
- Outdoor workers and pedestrians supported by the direct distribution of umbrellas, caps, drinking water, and oral saline to help reduce heat exposure

**Means:** HW-2024 Early Action Protocol (EAP) was implemented by securing the necessary financial resources, logistical supplies, trained personnel, and strong operational partnerships. IFRC allocated CHF 499,930 under the heatwave EAP to support BDRCS and CHF 342,337 to scale up the nationwide

heatwave response to cover all phases of the intervention (IFRC 2024a and 2024b).

During the historic 2024 heatwave, the protocol reached over 300,000 vulnerable individuals in Dhaka and was expanded nationally to cover 35 to 40 districts. Post-distribution monitoring by BDRCS found that approximately 94% of households took measures to protect themselves from the heatwave (IFRC 2024b). Of them, approximately 66% received safe drinking water, 17% received a cap/umbrella, and another 17% received cooling station support from BDRCS. Additionally, most respondents reported using their MPCG support for essential needs, such as food, medical support, livelihoods, nonfood items, and safe drinking water. There is no published evaluation of the activation in terms of health benefits.

**Challenges:** Funding remains one of the most significant barriers to effectively integrating climate services into health management. Although climate change and heatwaves are identified as priority issues by various government bodies, poor coordination among ministries and weak institutional frameworks delay the implementation of comprehensive strategies. The National Health Strategy for Climate Resilience emphasizes interministerial coordination, yet institutional gaps continue to result in fragmented and delayed responses to heatwave emergencies.

Problems with access to quality climate data, and a lack of integrated meteorological and health data worsen the challenge of making real-time decision-making. In addition, heatwaves can be overlooked as a significant public health concern because neither decision-makers nor the public have complete information on the impacts of heatwaves.

Lack of communication or information has downstream impacts on healthcare providers, making it difficult for them to provide timely responses to the health impacts of heatwave. Lack of integration of real-time health data (e.g., disease surveillance, hospital admissions) limits the early warning systems' ability to effectively and efficiently steer preparedness for heat-related health emergencies. Box 6 shows an example of early warning systems for heat in Argentina, while Box 7 shows an example from the Philippines of monitoring systems for heat-related illness.

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**BOX 6.** Snapshot: Argentina

Argentina developed an early warning system for extreme temperatures, which issues daily alerts for extreme heat and cold (WMO 2023).

**Model:** The Ministry of Health, the National Meteorological Service, the National University of Entre Ríos, the National University of La Matanza, and the University of Buenos Aires collaborated on two studies that established a relationship between extreme temperatures and mortality. This data was then used to develop thresholds, piloted in 2017, and released nationally in 2021. Each city has its own temperature thresholds corresponding to yellow/orange/red alerts. There is interest to include power cuts and water shortages in future alerts (WMO 2023).

**Mandate:** The National Meteorological Service communicates alerts to health and civil protection agencies nationally, and they also issue public communications to the general population. The Ministry of Health issues recommendations for healthcare at the time of the alerts (WMO 2023). There are also direct communication lines to the Argentina Red Cross and National Parks Service (Herrera et al. 2021).

**Method:** Public communications are issued to encourage people to take protective measures, including to drink water, watch over vulnerable groups, and reduce physical activity. The national health and civil protection agencies communicate alerts to their provincial counterparts, who are responsible for monitoring vulnerable populations (Herrera et al. 2021).

**Means:** National funds support the early warning system and its coordination.

## BOX 7. Snapshot: Philippines

**Overview:** The Philippines currently monitors heat-related illnesses through its Event-Based Surveillance and Report System and is developing an extreme heat protocol headed by the meteorological agency Philippine Atmospheric, Geophysical, and Astronomical Services Administration (PAGASA) and the Department of Health (DOH).

**Model:** The DOH monitors heat-related illnesses through its Event-Based Surveillance and Response System. In response to rising temperatures, the government has been developing contingency plans to address extreme heat events. In March 2025, the Presidential Palace announced that it was working with the DOH and PAGASA to craft an action plan for heatwaves that could reach up to 49°C (Montemayor 2025; Ordonez et al. 2025).

**Mandate:** The DOH leads public health initiatives related to heat-related illnesses, while Philippines Health Insurance Corporation (PhilHealth) ensures financial protection through its benefit packages. The development of a comprehensive heat action plan involves coordination between the DOH, PAGASA, and other government agencies to establish early warning systems and response strategies (Philippine Daily Inquirer 2025).

**Method:** While specific early action protocols are still under development, the government has implemented various measures to mitigate the effects of extreme heat:

- **Public Health Advisories:** The DOH issues advisories to inform the public about the dangers of high heat indices and provides guidelines to prevent heat-related illnesses.
- **School Adjustments:** Schools have adapted by rearranging classes to keep children out of the midday heat and equipping facilities with fans and water stations. (Morella 2025)
- **PhilHealth Benefit Packages:** The Philippine Health Insurance Corporation (PhilHealth) offers benefit packages for heat-related illnesses. In-patient benefit packages cover conditions such as heat stroke, heat exhaustion, heat collapse, heat cramps, and sunstroke, with coverage amounts up to Philippine peso (₱)12,675.

**Means:** The Philippines utilizes a combination of government funds and international support to implement heatwave preparedness and response:

- **PhilHealth Contingency Funds:** PhilHealth provides coverage for heat-related illnesses such as heat stroke, heat exhaustion, and heat cramps under existing case rates, ensuring patients receive financial protection.
- **Department of Social Welfare and Development (DSWD) Quick Response Funds:** DSWD allocates Quick Response Funds to assist vulnerable populations during disasters and extreme weather events, including heatwaves, by providing emergency cash assistance and supplies.
- **Local Government Units (LGUs) Disaster Risk Reduction and Management (DRRM) Funds:** LGUs use allocated DRRM funds for local heat response activities such as operating cooling centers, public advisories, and health facility readiness.
- **International Support:** Development partners such as the Asian Development Bank and the German Red Cross have provided technical assistance for strengthening the country's heat-health early warning systems.

However, the effectiveness of response varies largely depending on the capacity of each LGU.



## Storms and flooding

The human health impact of storms and flooding occur during and after these weather events and include risks of injury or death as well as waterborne disease. The following information provides evidence around health outcomes of Anticipatory Action (AA) for storms and floods along with examples of AA currently happening in Bangladesh and Uganda using the 4Ms (Model, Mandate, Method, Means) framework.

### Evidence review

Weather forecasts for storms and flooding are increasing in accuracy, and the use of these forecasts is widely credited with the reduction in lives lost during extreme weather events (e.g., Ritchie 2024). The most common health measures in AA plans for storms and flooding are prevention of waterborne or vector-borne disease. This includes provision of mosquito nets, water purification tablets, water-holding vessels, soap, latrines, clean water, cash, and evacuation. For example, coordinated humanitarian action by the Bangladeshi government supported by both Red Crescent and United Nations agencies for Cyclone Remal in 2024 resulted in more than 400,000 additional people receiving health services related to the event.

Despite the large number of AA frameworks for storms and flooding, the health benefits of these frameworks have not always been clear. Most of the storm and flooding AA frameworks reviewed do not mention the health sector or coordination with health authorities. While a hazard-driven approach seems sensible for a clearly defined event such as a cyclone, for example, the lack of integration between humanitarian cyclone-focused actions and health authorities/frameworks could reduce the efficacy of the hazard-driven approach. Several studies did not detect any difference in health outcomes after the activation of flood AA frameworks. In Bangladesh in 2017, cash was provided to people in anticipation of a flood event, and the post-event evaluation did not detect any change in reported health outcomes among recipients and nonrecipients (Gros et al. 2019). Similarly, the evaluation of a flood activation in Mozambique in 2022 did not detect a change in health outcomes (Popat et al. 2024).

Based on a meta-analysis, there is limited evidence to support the effectiveness of hygiene kits (Yates et al. 2021). This doesn't imply they are ineffective but rather highlights a gap in research. The authors of the meta-analysis state that "hygiene kit distributions are governed by 'best practice' rather than 'evidence-based approaches'" (Yates et al. 2021, 248). Additionally, the variability in kit contents makes it challenging to assess the overall impact of

hygiene kit distributions (Yates et al. 2021). Individual items—such as soap—do have some evidence base, though there is still a gap in research observed. For example, one study from 1998 reported a 27% reduction in diarrheal episodes in households where soap was present compared to those without it, though newer evidence was not found in the literature review for this report (Peterson et al. 1998).

### Example of high-potential design

**Model:** Meteorological threshold in a weather forecast. This threshold should be designed based on impacts in the specific location, considering total amount of rainfall, flash flood potential, river flood potential, and any potential combination with storm surge flooding.

**Mandate:** Civil society organizations support a government-coordinated effort to evacuate populations. Provide cash through large-scale social safety net systems, and if WASH is the focus of the AA protocol, work with WASH and health sectors for scale-up of relevant actions.

**Method:** Multiagency evacuation plans, combined with the scale-up of gendered health support for affected populations. Cash transfers that use adapted safety net infrastructure to reach vulnerable people based on hydrological forecasts combined with community surveillance information. Scale-up of existing public health interventions for ensuring water safety and other health-promoting activities during and after the event.

**Means:** Government funding and support for evacuation, cash transfers, and safe water supply, supplemented by international humanitarian assistance in high-risk shortfall areas.

### Case study: Government of Bangladesh

Bangladesh has become a pioneer in Anticipatory Action (AA) to reduce flood impacts. The government and humanitarian partners have embraced forecast-based early actions as a complement to traditional emergency response. Notably, after collaborative advocacy, AA was incorporated into Bangladesh's Standing Orders on Disaster in 2019, giving it a formal mandate in national disaster policy (Rahman et al. 2024).

Government (Ministry of Disaster Management and Relief (MoDMR) and Departments): MoDMR is the lead government body for disaster policy and response. The Department of Disaster Management (DDM) under MoDMR and the Need Assessment

Working Group (NAWG) contributed to identifying at-risk populations and coordinating with humanitarian partners. The Flood Forecasting and Warning Centre (FFWC), while under the Ministry of Water Resources, provided the critical forecasts forming the trigger basis and worked closely with DDM to issue early warnings. Local government institutions (District Commissioners, Upazila and Union Disaster Management Committees) were responsible for executing evacuations, disseminating warnings, and supervising aid distribution on the ground. By 2024, government leadership in AA had strengthened: MoDMR co-chaired an Anticipatory Action Technical Working Group and took charge of convening stakeholders once a trigger was imminent, a marked change from 2020 when UN agencies led the activation (United Nations Bangladesh 2025).

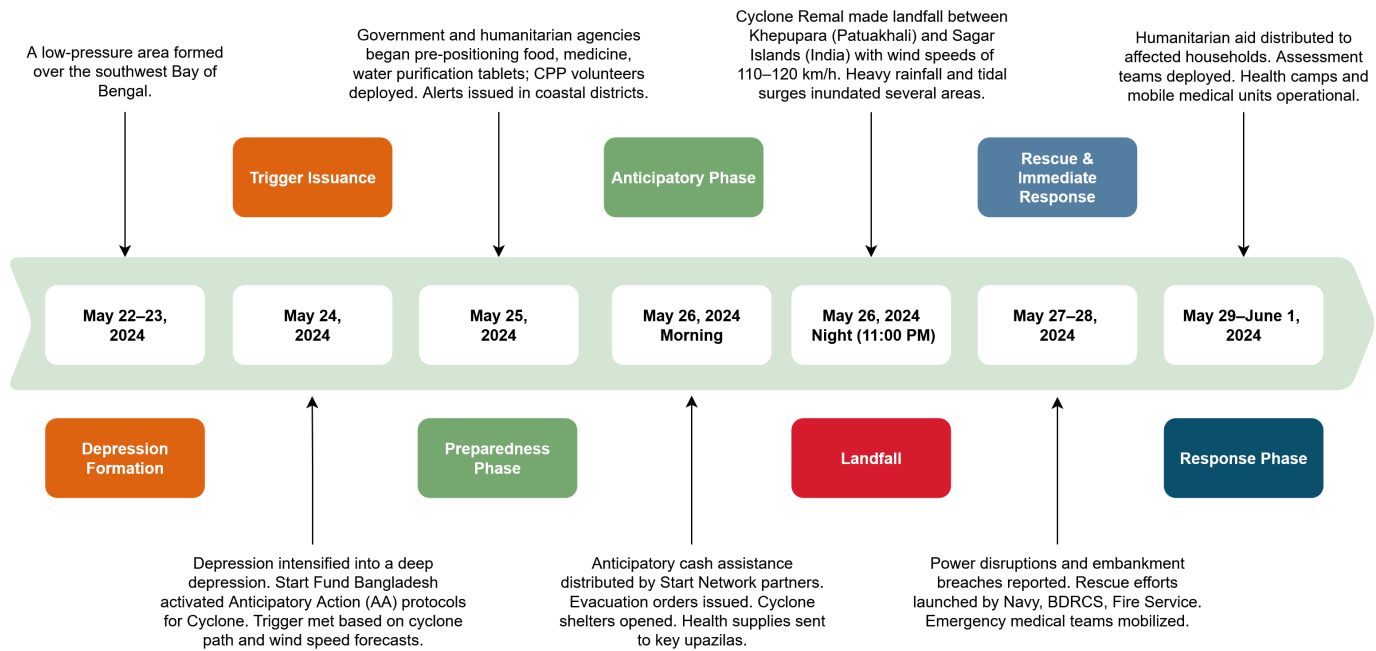
By 2024 AA for floods in Bangladesh moved from a donor-driven pilot to a nationally owned mechanism, backed by policy, multistakeholder coordination, and clear delineation of responsibilities among key actors (GoB 2019). Initially, in 2020, coordination was ad hoc and centrally driven by the UN due to the pilot nature of the activation. An immediate lesson was the need for a dedicated platform to manage AA across stakeholders. By 2021, Bangladesh set up an Anticipatory Action Technical Working Group (TWG) under the Disaster Emergency Coordination Group, including government ministries, BDRCS, UN agencies, and NGOs. This TWG met regularly to develop common trigger protocols, share data (e.g., vulnerability mapping), and plan who does what when a trigger hits. As a result, roles became more clearly defined over time; for instance, during the July 2024 flood trigger, MoDMR/Department of Disaster Management led the overall coordination, BDRCS and IFRC managed the field implementation in their EAP areas, WFP handled large-scale cash transfers through its networks, and other agencies (FAO, UNICEF, etc.) activated specific early actions in their sectors. There was still room for improvement; e.g., ensuring truly joint targeting so the same household could receive a package of multisectoral support, but the leadership shifted toward the national government. The establishment of forecast-based financing in Bangladesh's domestic financing through the Bangladesh Climate Change Trust Fund and others is also being explored, which would further cement government mandate and ownership.

On May 26, 2024, Cyclone Remal made landfall near Mongla and Khepupara, with wind speeds exceeding 100 km/h, resulting in severe tidal

surges, widespread flooding, and infrastructure damage across 19 districts and 119 upazilas (IFRC 2024c; United Nations Bangladesh 2024). It also affected around 4.6 million people and killed at least 16 (UNICEF Bangladesh 2024). The response to Cyclone Remal demonstrated the effectiveness

of AA. Key stakeholders, including BDRCS, IFRC, and various government agencies, undertook coordinated early actions based on early warning systems, standard operating procedures, and community-based preparedness mechanisms. These are presented in Figure 9 below.

**FIGURE 9.** Timeline of Cyclone Remal



The following sections review AA implemented during Cyclone Remal through both the government-led framework and the humanitarian-led framework. Using the 4M structure—Model, Mandate, Method, and Means—these frameworks highlight how national systems and humanitarian actors jointly operationalized early warnings, mobilized resources, and engaged communities to mitigate cyclone impacts.

**Government-led framework**

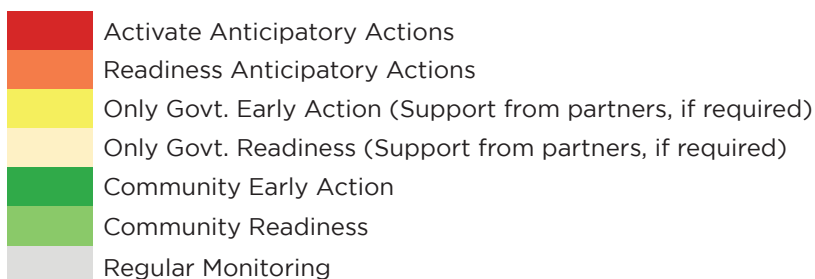
**Model:** The National Early Action Protocol (NEAP) sets cyclone-specific triggers based on three components: wind speed, storm surge, and rainfall. Thresholds are defined across four impact levels (low to very high) and linked to lead times and forecast likelihoods. Trigger matrices determine when to initiate community, government, or humanitarian responses. Activation occurs if any one hazard crosses its threshold. Despite forecast uncertainty,

AA proceeds under a “no regret” principle, accepting potential false alarms to ensure timely lifesaving responses in vulnerable coastal areas (GoB 2024).

The following decision trigger matrix (Table 3) outlines the trigger thresholds for activating AA under the NEAP. It presents impact levels based on wind speed, storm surge, and rainfall forecasts, combined with lead time and likelihood, to guide timely and coordinated responses by government and humanitarian actors.

**TABLE 3.** Decision trigger matrix for coordinated Anticipatory Action (AA) in Bangladesh, adapted and modified from the National Early Action Protocol (NEAP) (GoB 2024).

LEAD TIME AND LIKELIHOODS OF IMPACTS	WIND SPEED (KM/HR)				STORM SURGE (M)				RAINFALL IN 72 HR ACCUMULATED (MM)			
	62-88 Low	89-117 Medium	118-221 High	≥ 222 Very High	<1.5 Low	1.5-3.5 Medium	3.6-5 High	>5.0 Very High	<150 Low	150-200 Medium	200-250 High	>250 Very High
36-48 hr High (> 75%)	Green	Yellow	Red	Red	Green	Yellow	Red	Red	Yellow	Red	Red	Red
48-72 hr Medium (50-75%)	Green	Yellow	Orange	Red	Green	Yellow	Orange	Red	Yellow	Orange	Red	Red
72- 120 hr Low (25-50%)	Grey	Light Green	Orange	Orange	Light Green	Light Yellow	Light Green	Light Yellow	Light Yellow	Orange	Orange	Orange
> 120 hr Very Low (< 25%)	Grey	Light Green	Light Yellow	Light Yellow	Grey	Light Yellow	Light Yellow	Light Yellow	Light Yellow	Light Yellow	Light Yellow	Light Yellow



**Mandate:** The Ministry of Disaster Management and Relief (MoDMR) supervised national operations through the National Disaster Response Coordination Centre (NDRCC), co-leading clusters with UN and IFRC actors. Coordination was ensured from national to union levels via Standing Orders on Disasters (SOD), Union Disaster Management Committees (UDMCs), and CPP volunteers. Key clusters included shelter, WASH, health, and food security.

**Method:** MoDMR-led interventions included:

- Activation of 9,424 cyclone shelters across 19 districts (IFRC 2024a).
- Mobilization of over 78,599 CPP volunteers (IFRC 2025).

- Support to local governments in evacuation, logistical coordination, and real-time updates.

These interventions were aimed at reducing many health effects of cyclones, including injury, loss of life, and disease.

**Means:** The government leveraged structured disaster protocols and interagency coordination to maximize efficiency. Government infrastructure such as cyclone shelters and early warning dissemination mechanisms enabled timely response.

**Humanitarian-led framework**

**Model:** The anticipatory model followed by BDRCS, IFRC, and other humanitarian actors was aligned with the Government of Bangladesh’s National Early Action Protocol (GoB 2024) based on impact-based forecasts and predefined triggers. The Bangladesh

Meteorological Department (BMD) played a critical role by issuing early warnings, including the declaration of “Danger Signal No. 10” for the most at-risk districts (UNICEF 2024). These early warnings facilitated timely evacuation and the pre-positioning of relief supplies, ensuring humanitarian agencies could coordinate effectively within a 36–48-hour lead time. They also point toward an important model of integration between government systems and humanitarian interventions, with the humanitarian-led framework utilizing and benefitting from Bangladesh’s national early warning system.

**Mandate:** On May 22, 2024, when a low-pressure system formed over the Bay of Bengal, the Anticipatory Action Technical Working Group (AA TWG)—comprised of all major humanitarian agencies in Bangladesh—collaborated closely with the government-led Forecast-Based Action Task Force under the MoDMR to prepare and respond (United Nations Bangladesh 2024). Together, they utilized national and international meteorological models to monitor the system, forecast its progression, and support the issuance of early warnings. Technical assistance was provided to the Bangladesh Meteorological Department, Flood Forecasting and Warning Centre, and the Cyclone Preparedness Programme to ensure alignment with the harmonized Early Action Protocol for Cyclones (United Nations Bangladesh 2024). More than 2,500 staff and 181,000 volunteers were mobilized (IFRC 2024c). CPP volunteers, jointly supervised by the government and BDRCS, played a pivotal role in early warning dissemination, evacuation, and risk communication.

**Method:** Early actions implemented by BDRCS included:

- Dissemination of evacuation alerts and awareness via mosque-based public address systems, Information, Education, and Communication (IEC) materials, and community volunteers
- Provision of pre-positioned relief (e.g., 9,600 tarpaulins, 5,400 jerry cans, 1,900 sleeping mats, and 2,750 hygiene parcels) (IFRC 2024b)
- Distribution of 8,754 oral rehydration solution (ORS) sachets and deployment of mobile medical teams treating over 11,000 individuals (IFRC 2025)

- Cash support to 28,000 vulnerable households, prioritizing women-headed and disabled families (IFRC 2025)
- Reverse osmosis plants supplying 59,000 liters of clean water and hygiene kits for 13,750 people (IFRC 2025)

**Means:** Enabling factors included pre-arranged financing, strong volunteer networks, and coordination through the HCTT and sector-specific clusters. Financing for humanitarian action was provided through humanitarian networks. IFRC activated CHF 1 million from its Disaster Relief Emergency Fund (DREF) and later launched a CHF 12.5 million appeal for extended response (IFRC 2025). However, only 22% of the emergency appeal had been funded by October 2024 (IFRC 2025).

**Take-aways:** Cyclone Remal demonstrated the growing maturity of Bangladesh’s AA ecosystem, particularly regarding to collaboration between government and humanitarian actors. Forecast-based triggers, volunteer mobilization, and interagency coordination enabled lifesaving actions. The humanitarian model led by IFRC/BDRCS ensured targeted assistance, especially through multipurpose cash grants and mobile medical teams, while the government model ensured infrastructure coordination and mass-scale evacuation.

Each approach had distinct strengths and limitations. The government-led model benefitted from a well-structured national disaster management system, extensive shelter infrastructure, and strong coordination through Standing Orders on Disasters (SOD). However, it faced challenges related to bureaucratic rigidity, underresourced local healthcare systems, and gaps in decentralized execution. On the other hand, the humanitarian-led approach emphasized localized, people-centered interventions. This enabled swift volunteer deployment and the delivery of health services, including the treatment of approximately 11,000 individuals, the distribution of 8,754 oral rehydration solution (ORS) sachets, and psychosocial support services. However, the extensiveness of this approach was undermined by funding limitations, as only 22% of the emergency appeal had been met, restricting the scale and duration of response activities.

Persistent systematic challenges—such as limited financing and health service capacity gaps—highlight areas for reform and ongoing work. Building long-

term resilience requires stronger local governance, sustained financing, ongoing collaboration between government and humanitarian/development actors, and robust healthcare readiness. Lessons from Remal serve as a global template for scalable AA in climate-vulnerable contexts.

Box 8 provides another example, this time from Uganda, where an AA framework was developed that has health impact aims, among others.

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### **BOX 8.** Snapshot: Uganda Red Cross

Uganda Red Cross was one of the first organizations to formally develop an Anticipatory Action (AA) framework focused on flooding. Their aims were to:

- Save lives and prevent injuries
- Provide assistance to people at risk of losing homes
- Prevent waterborne diseases

In 2015, Uganda Red Cross provided jerry cans, soap, and water purification tablets based on a flood forecast, but an evaluation did not detect any change in reported diarrheal disease among recipients and nonrecipients (Jjemba et al. 2019).

**Model:** Uganda Red Cross Society (URCS) began implementing the Forecast-based Financing approach in 2014. URCS has developed several iterations of this program, now called AA. For flooding, the AA protocol of URCS relies on global hydrological forecasts as the country does not have local hydrological forecasting capacity. The Global Flood Awareness System (GloFAS), with a lead time of five days, is used with rainfall forecasts from Uganda National Meteorological Authority and the East African IGAD Climate Prediction and Applications Centre (ICPAC) to trigger early action. URCS identifies flood-prone populations based on historical experience.

**Mandate:** Uganda Red Cross Society's AA is grounded on the humanitarian mandate to reduce disaster risk and build community resilience. This model operates under the national disaster risk reduction strategy. URCS works in coordination with government authorities like the Uganda National Meteorological Authority (UNMA) and the Office of the Prime Minister (OPM).

**Methods:** Actions taken by the Uganda Red Cross upon receipt of these forecasts include the sensitization of communities at risk of flooding, distribution of water purification tablets, soap and water storage vessels (jerry cans), and facilitating the community in cleaning water sources. Furthermore, Uganda Red Cross promotes hygiene through awareness creation and assesses the water quality (IFRC 2021).

**Means:** Early actions are funded by Forecast-based Action by Disaster Relief Emergency Fund (DREF). Upon trigger activation, URCS mobilizes resources (human, financial, and logistical) to implement early actions.



## Vector-borne disease

A good example of disease-driven Anticipatory Action (AA) plans is those that are focused on vector-borne diseases. The following information provides evidence around health outcomes of AA for vector-borne disease, along with examples of AA currently happening in the Philippines and Colombia using the 4Ms (Model, Mandate, Method, Means) framework.

### Evidence review

Globally, public health agencies make large annual investments in the management of vector-borne disease. When considering the impact of climate change on vector-borne diseases, there is a long-standing need for new committed financial resources to “strengthen, rather than distract from or compete with, existing health structures and priorities” (Campbell-Lendrum et al. 2015, 5). This call for integration with existing programs and approaches was echoed in key informant interviews, which noted the risk of ongoing silos in approaching vector-borne diseases, as well as a risk that resources for AA could in fact detract from funding needed to ensure adequate healthcare systems overall in countries with a high vector-borne disease burden.

The Global Vector Control Response Plan 2017–2030 (WHO 2017) outlines both the feasibility of preventing vector-borne diseases and the significant need for ongoing management and planning to do so. Many countries have policies and programs for vector control, but they are not always implemented as planned or ideally envisioned. Efforts to act in advance of outbreaks are associated with activities such as disease surveillance rather than formal AA frameworks. In general, effective preventive approaches often target the vectors that transmit disease-causing pathogens, including through reducing human-vector contact and reducing vector survival (WHO 2017). Predictive modelling, surveillance and risk mapping, early warning systems, and AA like pre-positioned resources (e.g., vector control kits) are all important means for preventing vector-borne diseases (WHO 2017, Charnley et al. 2025).

The vector-borne diseases identified as key to address through AA are malaria and dengue, particularly due to their climate sensitivity and projected increase in a warming climate (Vogel et al. 2024). Other work similarly advocates for the need for AA to address these and other mosquito-borne diseases, noting that they are among the

largest causes of death in low-income countries—an estimated one million people per year (Panwar 2021). Latin America, the Dominican Republic, Barbados, Colombia, Peru, Cuba, Ecuador, Brazil, Argentina, and Mexico have developed early warning systems for dengue, malaria, Chagas disease, and leptospirosis. These systems are based on surveillance and monitoring, and they trigger information campaigns, fumigation, destroying of vector breeding sites, and distribution of insecticidal nets and repellents. Mosquito nets are considered to be highly effective for reducing the risk of mosquito-borne diseases, especially when treated with insecticides. Studies have found they reduce the risk of malaria by 56% (Yang et al. 2018). There do not seem to be available studies on the *timing* of mosquito net provision in AA interventions and resultant outcomes.

Predictive models for vector-borne disease are under development in many countries. The Malaria Anticipation Project (MAP) is implemented by Médecins sans frontières (MSF) in South Sudan and uses a pilot predictive model developed for the initiative; the model’s predictive performance is considered very high at 2 weeks’ lead time (75% classification accuracy) and strong even at 8 weeks’ lead time (70% classification accuracy) (MSF 2024). This suggests the viability of AA for anticipating malaria, although further evidence is needed as the initiative continues. The Government of Brazil has evaluated several dengue forecasting models, finding that many models underestimate the peak of recent epidemics. The government is now using an ensemble approach of many models to issue dengue forecasts (Araujo et al. 2025). In Barbados, a climate-health collaboration has resulted in the development of a “Caribbean Health Climatic Bulletin,” which is being used to scale up public messaging during times when climatic conditions are conducive to dengue spikes. They are now designing alert levels linked to specific AA (Stewart-Ibarra et al. 2022). Further collaboration between universities, research institutions, government agencies, and civil society is needed to operationalize predictive models that have been developed to incorporate climate information with surveillance information (Santos-Vega et al. 2024).

### Example of high-potential design

**Model:** Epidemiological model integrating surveillance and weather information to predict

outbreaks of vector-borne disease. These models range from simple statistical models to complex models that use machine learning, incorporating climate information (temperature, precipitation, humidity) as well as historical and neighboring dengue cases to make their forecasts (Chen & Moraga 2025). Some models also incorporate socioeconomic data, such as house type and density, into the forecast models (Jain et al. 2019).

**Mandate:** Government leadership supported by civil society mobilization of people or resources when needed.

**Method:** Given limited resources for vector control, determine the location and amount of control efforts that should be scaled up based on forecasts.

**Means:** Government funding optimized based on forecast information for greatest efficacy at controlling vector-borne disease, supplemented by humanitarian resources in certain cases.

### Case study: Philippines government

The Philippine government’s Anticipatory Action (AA) model for vector-borne diseases is structured around a decentralized yet coordinated approach to disease surveillance, environmental sanitation, community action, and interagency response. This model functions across multiple levels—from national health policy frameworks down to barangay<sup>2</sup>-level implementation. Central to the model is the partnership between the Department of Health (DOH) and local government units (LGUs), working through existing structures such as Barangay Health Centers, City Epidemiology and Surveillance Units (CESUs), and Barangay Health Emergency Response Teams (BHERTs).

**Model:** Disease surveillance triggers action to reduce the spread of dengue fever in the Philippines. For example, ordinance No. SP-3232, S-2023 created the Quezon City Epidemiology and Surveillance Division (QCESD) under the City Health Department, institutionalizing a dedicated unit for real-time disease monitoring and coordinated outbreak response (Quezon City Council n.d).

In February 15, 2025, the Quezon City government declared a dengue outbreak due to the rise in dengue cases. On April 10, 2025, cases dropped

2 A “barangay” is a small territorial and administrative district forming the most local level of government in the Philippines.

by 90% as 123 barangays were cleared from outbreak status (Quezon City Government 2025). The Quezon City local government utilized the multipronged and multistakeholder strategies, early detection, and community education campaigns. This includes the Department of Health's 5S dengue prevention strategy,<sup>3</sup> and communities were likewise encouraged to do the 4 o'clock habit—eliminating mosquito breeding sites by cleaning their surroundings at 4 p.m., when mosquitoes are most active, at dusk. In addition to these, barangay health workers continue to conduct lectures and education programs to raise community awareness and encourage collaboration among various community stakeholders to ensure a comprehensive control and prevention of dengue. The local health officials have been closely monitoring cases all year round, especially during rainy season and the unexpected rains during summer as the Department of Health has declared dengue to be a year-round risk (Quezon City Government 2025).

**Mandate:** The government's authority to act on vector-borne diseases is grounded in national health policies such as the Department of Health's National Dengue Prevention and Control Program and the Local Government Code of 1991, which mandates that local government units or LGUs lead the delivery of primary healthcare and disease prevention programs. Its programs center on five major components, namely surveillance, case management and diagnosis, integrated vector management, outbreak response, health promotion and advocacy and research (Guad et al. 2021). It employs the general strategies for dengue management, such as the "5Ss." To implement this, the DOH issues administrative orders and national guidelines, such as the Integrated Dengue Vector Management (IDVM) strategy and AO 2020-0016 (implementing the Disease Surveillance and Response System), which formalizes protocols for early detection and community-based response. Several guidelines have been outlined by the Department of Health for dengue management.<sup>4</sup>

At the local level—based solely on data from Quezon City—the mayor and barangay captains are held accountable for sanitation, waste management, and outbreak control measures. These responsibilities are reinforced through several key city ordinances that operationalize public health mandates on vector-borne disease prevention. Ordinance No. SP-2097, S-2011 established the Quezon City Comprehensive Dengue Prevention and Control Program Plan, providing a structured and long-term framework for dengue mitigation across the city. To promote early childhood protection, Ordinance No. SP-2330, S-2014 mandates that children in public day care centers wear scrub suits as long pants—a preventive measure aimed at minimizing mosquito exposure.

Complementing these efforts, the National Climate Change Action Plan (NCCAP) sets a broader strategic direction from 2011 to 2028, prioritizing food security, water sufficiency, ecological and environmental stability, human security, climate-smart industries and services, sustainable energy, and knowledge and capacity development (Climate Change Commission 2011). While national frameworks for AA are in place, it must be noted that the doctors interviewed were generally unfamiliar with the term "Anticipatory Action." Instead, they commonly use the term "preparation." In the case of early actions against dengue, the doctors mentioned that they follow directives from the Quezon City Health Department, which in turn adheres to guidelines from the Department of Health (DOH).

In addition to government programs, the humanitarian sector has developed several methods to scale up supportive actions when a dengue outbreak is forecasted in the Philippines. Red Cross entities developed a dengue forecasting model that uses weather information to forecast dengue caseloads every month, and this information triggers AA, such as dengue emergency medical units (DEMUs), mobilizing community health volunteers (CHVs), and social media campaigns promoting prevention and control measures. The Philippines Red Cross also carries out hygiene promotion

<sup>3</sup> 5Ss: S (1): search and destroy breeding sites through regular clean-up programs; S (2): self-protection measures. Pertains to the use of protective clothing, especially among children; S (3): seek early consultation through fever express lane to swiftly attend to individuals with dengue symptoms. Free dengue test kits were also available in facilities; S (4): support fogging and larviciding in hotspot areas; and S (5): sustain adequate hydration.

<sup>4</sup> These include: AO 2016-0043 Guidelines for the Nationwide Implementation of Dengue Rapid Diagnostic Test; AO 2012-006 Revised Dengue Clinical Management: Guidelines; AO 2001-0045 Guidelines on the Application of Larvicides on the Breeding Sites of Dengue Vector Mosquitoes in Domestic Water; DM 2017-0353 Implementation Guidelines for Initial Implementation of Nucleic Acid Amplification Assay - Loop Mediated Isothermal Assay (LAMP) as One of Dengue Confirmatory Tests to Support Dengue NSI RDT; DM 2015-0309 Reactivation of Dengue Fast Lanes and Continuing Improvement of Systems for Dengue Case Management and Services; and DM 2014-0112 Technical Guidelines, Standards and other Instructions for Reference in the Implementation of Sentinel-based Active Dengue Surveillance (Department of Health n.d.).

on safe usage of water and cleaning of mosquito breeding sites, and garbage disposal.

The Philippine Health Insurance Corporation (PhilHealth) has introduced Early Action Health Alerts, which are ongoing information dissemination efforts at the start of anticipated hazards such as an increased heat index. For example, PhilHealth released memos in March and April 2025 stating, “PhilHealth reminds everyone that there are inpatient benefits packages for common summer-related illnesses available at accredited hospitals nationwide” and then listed a variety of common illnesses associated with heat.

**Method:** The Philippines implements a combination of proactive health surveillance, vector control, community engagement, and risk communication. City and barangay health workers are trained to detect early warning signs using both syndromic surveillance and rapid diagnostic tools such as antigen tests for dengue. During outbreaks, Fever Express Lanes are opened in city health centers and hospitals to expedite diagnosis and medical attention for those suspected of having dengue. In high-risk areas, ovi-larvae traps are installed to monitor mosquito populations and inform targeted fogging operations. In Quezon City, this data is gathered and stored by the City Epidemiology Surveillance Unit (CESU). The data for fogging and spraying operations are kept by the Sanitation Department. Surveillance in Post Extreme Emergencies and Disasters (SPEED) was an award-winning innovation in syndromic disease surveillance that can be utilized for AA. Through mobile messages, trends in diseases can be quickly transmitted to a central database that can be accessed by authorities so they can start interventions before disease reaches alarming levels. Dengue prevention initiatives are actively implemented across all barangays through the “4 o’clock habit.”

Additionally, specific barangays have implemented various targeted actions, highlighting local adaptations of dengue prevention programs. This includes (nonexhaustively):

- Barangay Bagong Silangan Health Center: deploys IKOT boys (sprayer operatives) who conduct house-to-house area spraying
- Barangay Pinyahan Health Center: holds dengue lectures twice weekly to raise community awareness

- Barangay Balingasa: distributes one larvae trap containing larvicide solution to every household
- Barangay Cubao: conducts flip chart lectures focused on dengue education
- Barangay Project 6: operates a Viber Information Hub for timely dissemination of health messages from the Health Emergency Preparedness Office (HEPO)
- Barangay Krus na Ligas: provides a “fever fast lane” service on weekends to accommodate patients with fever and respiratory symptoms
- Barangay Pansol: promotes the “5S of Dengue:” Search and destroy breeding sites; Seek early consultation; Say yes to spraying; Stay hydrated; and Self-protection
- Barangay Old Balara: conducts dengue forums and maintains spot maps for case contact tracing

Table 4 provides an overview of recent actions taken for dengue fever in the Quezon City region of the Philippines. Information dissemination activities were wide-ranging, from public forums to Facebook campaigns, and the government also carried out large-scale mosquito reduction activities such as spraying.

From the table it is also important to realize a key point: dengue management in Quezon City—based on interviews with doctors from selected Barangay Health Centers—is deeply rooted in the long-term practice of community wellness. A clear example of this integration is the city’s waste management system, which includes waterways cleanup, waste collection in identified markets, schools, and institutions, as well as regular sanitation inspections of business establishments. Alongside a variety of other initiatives, these efforts are supported by the Department of Sanitation and Cleanup Works of Quezon City (DSQC), which provides daily waste collection services to all barangays and households.

**TABLE 4.** Examples of recent actions to manage dengue fever in Quezon City, Philippines. This table provides an indication of the number of government actors involved and the types of actions that are taken to manage dengue risk.

HEADLINE	ACTORS	ACTIONS
<p><a href="#"><u>Sabayang Clean-up</u></a> Nov 23, 2024</p>	<p>Quezon City (QC) Health Department (QCHD) Barangays in Districts 1, 2, and 4</p>	<ul style="list-style-type: none"> <li>• Clean-up drive</li> <li>• Information drive</li> </ul>
<p><a href="#"><u>Quezon City declares outbreak amid rise of dengue cases</u></a> Feb 15, 2025</p>	<p>Quezon City Government QCHD Mayor Quezon City Epidemiology &amp; Surveillance Division (QCESD) Barangay Spraying Teams Sanitary Inspectors Barangay Officials School Administrators</p>	<ul style="list-style-type: none"> <li>• All 66 QC Health Centers open weekends</li> <li>• Fever express lane and free dengue test kits in health centers and hospitals</li> <li>• Spraying and fogging in areas with clustered cases</li> <li>• Pre-clinic lectures, dengue awareness assemblies, and forums in barangays</li> <li>• Briefing of Barangay Officials and School Administrators</li> </ul>
<p><a href="#"><u>Dengue Outbreak Meeting with QC Barangays</u></a> Feb 15, 2025</p>	<p>Mayor QCHD Barangay &amp; Community Relations Dept. Committee on Barangay Affairs Chairperson Councilor School Division Superintendent QCESD Metro Manila Center Health Development</p>	<p>Press Conference</p>
<p><a href="#"><u>Dengue Outbreak Meeting with QC Barangays</u></a> Feb 15, 2025</p>	<p>Quezon City 142 Barangay Captains QCHD Barangay &amp; Community Relations Dept. Committee on Barangay Affairs Chairperson Councilor Hospital Director Schools Division Superintendent QCESD</p>	<ul style="list-style-type: none"> <li>• Meeting on the declaration of outbreak</li> <li>• Briefing on preventative actions such as clean-up drives, mosquito fogging, and encouraging citizens to clean at home</li> <li>• Listened to suggestions and recommendations from barangay captains</li> </ul>

**TABLE 4.** Continued

HEADLINE	ACTORS	ACTIONS
<p><b><u>Spraying and Fogging</u></b> Feb 15, 2025</p>	<p>QCHD QC Environmental Sanitation Division QCHD-trained barangay personnel</p>	<ul style="list-style-type: none"> <li>• Spraying, misting, fogging, and larviciding</li> <li>• Encourage citizens to follow QCHD and QCESD on Facebook for updates</li> </ul>
<p><b><u>Anti-dengue Misting and Spraying</u></b> Feb 17, 2025</p>	<p>QCHD Barangay Officials</p>	<ul style="list-style-type: none"> <li>• Anti-dengue misting and spraying in areas with confirmed dengue cases</li> <li>• Dengue community lectures and lay fora</li> <li>• Clean-up drives</li> </ul>
<p><b><u>“Alas Kwatro, Kontra Mosquito” – Department of Health</u></b> Feb 24, 2025</p>	<p>Department of Health Secretary Mayor QCHD Barangay Batasan Hills Chairperson District 2 Action Officer Purok leaders Volunteers</p>	<p>4 o'clock habit</p> <ul style="list-style-type: none"> <li>• Clean-up drive</li> <li>• Distribution of insecticide, insect repellent, cleaning materials, and brochures</li> <li>• House-to-house information campaigns</li> </ul>
<p><b><u>Tips to Preventing Dengue</u></b></p>	<p>QCESD</p>	<p>Social media infographics Website page Digital flyer</p>

**Means:** Financial and human resources for these anticipatory activities are drawn from a mix of national subsidies and LGU allocations under the Internal Revenue Allotment (IRA) system. The DOH provides technical guidance, training, and medical commodities—such as test kits, larvicides, and personal protective equipment—while LGUs are responsible for funding day-to-day operations and barangay-level logistics. Human resource mobilization includes barangay health workers (BHWs), public school teachers, sanitation officers, and a large number of volunteers trained under the Barangay Health Emergency Response Teams. Cities such as Quezon City and Manila also maintain dedicated surveillance units that coordinate with barangay focal persons for outbreak alerts and logistical mobilization. Additional support is often provided by partners such as UNICEF, the Philippine Red Cross, and local civic groups like the Rotary Club, which contribute to both educational campaigns and medical supply chains. These

partnerships extend the reach of AA and contribute to filling resource gaps at the community level.

To ensure these efforts are sustained, institutionalizing AA must be seriously considered, especially in areas like waste management and vector control. According to the doctors interviewed, regular garbage collection and initiatives like the 4 o'clock habit—which encourages daily cleaning of potential mosquito breeding sites—have become usual practices that are actively promoted and sustained within the community in Quezon City. However, monitoring these programs has become increasingly challenging. Some barangays have adopted creative strategies to maintain public engagement. For instance, A. Orquinaza of Barangay Old Balara interestingly shared that climate change and health-related questions were integrated into the Q&A portion of their community pageant (personal communication, April 14, 2025)—an innovative effort to raise awareness in a localized and engaging manner.

Barangay Health Centers, however, often contend with multiple patient concerns simultaneously, which stretches their limited resources and exposes structural weaknesses in healthcare delivery. Doctors from Krus na Ligas, Bagong Silangan, Batasan Hills, Balingasa, and Pansol report critical manpower shortages, with doctor-to-patient ratios reaching 1:25,000 (D. Demetria & R. Asuncion, personal communication, April 14, 2025; C. Palad, personal communication, April 14, 2025; K. Ariap, personal communication, April 14, 2025; M. Lim, personal communication, April 23, 2025; J. Alisuag, personal communication, April 14, 2025). Such imbalances severely compromise outbreak response, as noted by a physician from Old Balara. These staffing challenges are compounded by inadequate facilities and limited capacity-building programs for health workers, particularly in Batasan Hills and Holy Spirit (K. Ariap, personal communication, April 14, 2025; G. Trespeses, personal communication, April 15, 2025). Another pressing issue is the lack of consistent, localized information dissemination. Health communication in Quezon City remains largely centralized through the Health Department's Facebook page and the Health Education and Promotion Unit, while many barangays lack their own platforms for direct community engagement. This top-down approach limits resident participation and weakens responsiveness.

**Successes and impact:** Local evidence suggests that AA has contributed to significant outcomes in disease detection, outbreak control, and behavioral change. According to a press release from the Quezon City local government from February 15, 2025, CESUs have used real-time reporting of febrile illnesses and antigen testing to quickly identify clustering of dengue cases, allowing for more targeted fogging and household visits (Quezon City Government 2025). Fever express lanes also allow for the early detection and diagnosis of dengue in those with fevers, minimizing morbidity and possibly mortality in dengue cases. In Barangay Pansol, an interviewee explained that community health workers' outreach led to a notable increase in resident participation in clean-up drives and a reduction in reported mosquito breeding sites. In Project 6, digital Viber groups allowed for real-time reporting of symptoms and water-related issues, enabling barangay leaders to organize quicker responses, according to a key informant. In flood-prone areas like Krus na Ligas, meteorological data is used to inform the strategic pre-deployment of prophylactic medications after storms, which helped

reduce severe complications from leptospirosis. Lectures and flip chart seminars have been regularly implemented for information dissemination on the ground. During the pandemic, LGUs enlisted the help of Department of the Interior and Local Government (DILG) personnel for more detailed surveillance and reporting of disease data to fill personnel gaps. Several barangays have also noted increased involvement of youth, women, and civic groups in outbreak planning, and informants attribute this to the institutionalization of Barangay Health Management Councils (BHMCs), which include a wide range of community stakeholders.

**Return on Investment (ROI):** While national data on ROI for anticipatory health interventions is limited, international studies and local program reports suggest considerable savings in avoided treatment costs, hospitalization, and outbreak response logistics. According to WHO estimates, integrated vector management approaches can reduce dengue-related health expenditures by 30%–40% when coupled with community-based preventive action (WHO 2017). In urban barangays of Metro Manila, barangay leaders have anecdotally reported reductions in unnecessary emergency room visits due to early detection and the use of antigen testing kits. Furthermore, digital coordination and crowd-sourced surveillance reduce the burden on health staff and enable efficient triage of cases. These cumulative savings, while difficult to quantify uniformly across regions, make a strong case for institutionalizing AA in vector-borne disease management.

#### **Case study: Colombian Red Cross**

In Colombia, the Colombian Red Cross, with support from the German Red Cross, has been actively funding the development of a Dengue Emergency Action Plan. This protocol aims to enhance preparedness and response efforts by implementing Anticipatory Action (AA) to address and mitigate the impacts of dengue outbreaks, which are often exacerbated during El Niño events. By focusing on proactive measures, the initiative seeks to reduce dengue's health and socioeconomic burden in the country, ensuring a more timely and effective response to outbreaks driven by changing climatic conditions.

It is being developed closely with the Institute of Hydrology, Meteorology and Environmental Studies (IDEAM), the National Institute of Health, and the Ministry of Health. This multidisciplinary approach

integrates climate data, epidemiological surveillance, and public health strategies. The protocol is intended to support health authorities in implementing timely interventions under extraordinary conditions, thereby reducing the impact of outbreaks on affected communities.

**Model:** This protocol has established two key triggers for activation. The first trigger is based on assessing the early epidemiological conditions of dengue in the prioritized regions, explicitly using the endemic channel—a tool that defines risk levels based on historical data to identify potential outbreaks. When the cases move beyond the safe zone within this channel, which indicates increased risk, it signals the need for action. There is an approximately two-month delay between cases leaving the safe region and the onset of an outbreak. When this first condition is met, a second trigger is activated, relying on a predictive product called “El Boletín Clima y Salud,” developed by the National Institute of Health. This forecast provides predictions about the likelihood of increased transmission in the targeted areas two months in advance, enabling AA.

Given the limited resources for vector control, this protocol aims to prioritize and allocate efforts to the 10 departments in Colombia with the highest risk of experiencing a dengue outbreak. The risk assessment is based on a comprehensive vulnerability indicator that integrates multiple factors: exposure to the vector (considering the biological suitability of mosquitoes influenced by climate, breeding site availability, and human demographic factors), transmission intensity (affected by the persistence of the virus and the presence of susceptible individuals), and community and institutional resilience (including self-care behaviors, water access and usage, risk perception, and healthcare capacity). To accurately identify high-risk areas, a mechanistic model is being developed that captures the heterogeneities in entomological parameters, climate variables such as temperature and rainfall, and social determinants like overcrowding and WASH conditions. This approach allows for a spatially and contextually nuanced understanding of vulnerability, enabling targeted vector control efforts in communities most likely to experience outbreaks, thereby optimizing resource use and maximizing impact.

**Mandate:** The Ministry of Health, the National Institute of Health, and the Institute of Hydrology, Meteorology and Environmental Studies (IDEAM)

collaborate through the Technical Roundtable on Climate Variability and Change. These institutions jointly produce the Climate and Health Report, a monthly publication that analyzes climate forecasts concerning dengue and malaria. The report identifies which municipalities are at increased risk for these two diseases. It also includes recommendations for four additional health outcomes: snakebites, leptospirosis, acute diarrheal disease, and acute respiratory infections.

**Method:** When the mechanism is activated, AAs are implemented to reduce the risk of dengue transmission. These actions include targeted vector control activities such as larviciding and insecticide spraying in high-risk areas and community engagement campaigns focused on education about effective water management practices to eliminate mosquito breeding sites. Waste collection campaigns are also intensified to reduce standing water and environmental hazards that facilitate mosquito proliferation. These proactive measures aim to curb the early transmission stages, strengthen community resilience, and prevent the escalation of outbreaks in vulnerable regions.

**Means:** This mechanism will complement and support the existing government-funded efforts, ensuring a more coordinated and targeted response. Additionally, resources from the IFRC will be allocated to enhance these AAs, providing technical assistance, logistical support, and funding to strengthen vector control activities, community engagement, and environmental management. This integrated approach aims to optimize resource use, improve preparedness, and effectively reduce the risk and impact of dengue outbreaks in the prioritized regions.



## Waterborne disease

Waterborne disease Anticipatory Action (AA) plans focus entirely on reducing health impacts and rely heavily on surveillance systems. The following information provides evidence on health outcomes of AA for waterborne diseases, along with examples of active AA frameworks in Bangladesh and Democratic Republic of the Congo using the 4Ms (Model, Mandate, Method, Means) framework.

### Evidence review

Approaches for tracking and reducing waterborne diseases vary according to the context and the disease itself. One expert explained, “There are 32 organisms in water alone that cause diarrhea, let alone [those in] food.” Rotavirus, for example, is vaccine preventable. Cholera is virulent and more dramatic than diarrheal disease, affecting people of all ages, while diarrheal disease is common in children. Given the high frequency of diarrhea episodes in children, parents might not recognize this as a health concern, despite the fact that it contributes to malnutrition and long-term negative impacts in children. Surveillance and tracking of diarrheal disease in children are therefore difficult; many parents might not bring their children to the health clinic with these symptoms. As a result, documenting progress is a challenge; for example,

a 50% reduction in diarrhea (e.g., three episodes rather than six episodes in a year) might not be immediately noticed or recorded. Because diarrhea is a symptom rather than a disease, it can also be associated with a variety of comorbidities.

When it comes to water, sanitation, and hygiene (WASH) interventions, household water treatment has been shown in high-quality studies to effectively reduce diarrhea in emergency contexts, with exact levels of efficacy depending on the method (Ramesh et al. 2015). While water purification supplies can be rapidly deployed and effectively improve water quality, one literature review showed that adoption is low in acute emergency contexts, never reaching above 20% (Lantagne & Clasen 2011). However, when combined with education, levels of adoption increase. Additionally, programs introduced before emergencies saw better adoption and outcomes, suggesting prior exposure significantly enhances effectiveness (Lantagne & Clasen 2011).

For cholera, practitioners recommend that best practice is to target response in hotspots, following a case-area target interventions (CATIs) approach (Ratnayake et al. 2021). These are triggered by the identification of a cholera case, and CATI teams respond to the case by providing interventions to the household itself and neighbors within a certain

radius. This is similar to the ring vaccination method that was used to eradicate smallpox. Multisectoral interventions including both WASH and health are recommended, including antibiotics, for example. A randomized control trial of CATI in a stable hospital setting in Bangladesh found a 47% reduction in cholera (George et al. 2016). A Haitian study found that CATI's quick case responses could reduce final caseloads by 76%, and the duration of the outbreak by 61%, signaling the immense value of timely and early action (Michel et al. 2019). Measures included:

- Oral cholera vaccination
- Identification of additional cases
- Decontamination of patient premises
- Education on risk factors and methods of prevention and management
- Distribution of soap and oral rehydration salts
- Chlorination of water at the household level or directly at collection points
- Proposal of prophylactic antibiotics to close contacts of cholera cases

Given that cholera and childhood diarrhea do have spatial-temporal spikes, the potential for AA to anticipate and reduce those spikes is large. Targeted spatiotemporal interventions are recommended over blanket campaigns to direct scarce resources most efficiently (Ratnayake et al. 2021). However, most models that have attempted to predict cholera outbreaks have had limited success, and much of their predictive ability is derived from the simple method of following the first cases. Simple seasonality of disease can be used for scaling up regular seasonal preparedness in places where daily models are not effective at forecasting caseloads.

Globally, government agencies have developed elaborate surveillance and control measures to combat the spread of waterborne disease, and disease-driven approaches make use of these surveillance systems. However, these systems are generally scaled up after cases are detected, and the AA community is hoping to improve the development and use of waterborne disease predictive models:

If structure is still based on occurrences to take action, if the trigger to take action is an event, which is the case in health, most cases. You see, to declare Ebola outbreak, you need to first get an Ebola case. To declare cholera, you need to first get 10 cases. To declare all these different things in health, you need to first look at cases, confirmed cases. In the capacity of Anticipatory Action, that's response now. It's happened already, so you just start responding to the cases, and maybe preventing future cases, but it's in the response kind of sphere. (KII in Uganda)

Focusing on predicting cases in "cholera hotspots" is a major component of the Ending Cholera: A global roadmap to 2030 report (WHO 2017). Such hotspots are regions in endemic countries that have "recurrent and predictable cholera outbreaks, often coinciding with the rainy season" (WHO 2017, 8). AA systems can be designed to support these wider goals of eliminating such hotspots (WHO 2017).

### Example of high-potential design

**Model:** Epidemiological model integrating surveillance and weather information to predict outbreaks of waterborne disease. Models can be designed based on historical data on spatiotemporal patterns of cholera outbreaks or outbreaks of diarrheal disease. Verify model forecasts to ensure that the model is providing useful information.

**Mandate:** Government health authorities generally hold the mandate for disease monitoring, including cholera. Cases detected by health facilities or community health workers, for example, are to be reported to district or national authorities. For acute emergency response, governments collaborate with NGOs and the humanitarian response system to provide immediate disinfection and water treatment. This requires a collaboration between organizations working in WASH and health. Ultimately, such responses should also inform development interventions to invest in infrastructure for frequent cholera hotspots. Currently, most cholera forecasting models have been developed by researchers or institutions outside of the health ministry of governments, and the mandate for operationalizing such forecasts has not been clearly defined.

**Method:** Provide WASH and health interventions through case-area targeted interventions to people near the forecasted hotspots (either confirmed or suspected case) and nearby communities. Identify the cause of the waterborne disease and

the appropriate WASH/health measures. Direct resources to the level of community, household, health center, or school, including household disinfection, community water treatment, vaccination, active case-finding nearby, or prophylaxis.

**Means:** Government health sector budgets can be structured to provide scaled-up support in the times and locations of greatest risk in AA, as in the CATI approach. This can be complemented by humanitarian support scaling in similar ways.

### Case study: Government of Bangladesh

The National Cholera Control Plan (NCCP) (DGHS 2019) integrates surveillance and early warning systems to forecast cholera trends and guide response efforts. Bangladesh has a passive diarrheal disease reporting system, with active surveillance conducted only during outbreaks, and there is also a cholera surveillance system that has been operational since 1979. Bangladesh aims to eliminate cholera transmission as a public health threat through improved forecasting, surveillance, and preventive interventions.

However, despite comprehensive policies for disease surveillance and management, agencies face challenges in case detection and reporting due to a lack of diagnostic facilities at district and upazila levels and no routine cholera case reporting from peripheral health facilities. Despite progress, cholera mortality remains a challenge, exacerbated by frequent environmental disasters such as floods, cyclones, and landslides that damage WASH infrastructure and increase contamination risks.

Bangladesh [National Cholera Control Plan \(NCCP\)](#) was formulated in 2019 by the Directorate General of Health Services (DGHS). It is important to note here the difference between “control” and “elimination” in the context of cholera. The term “control” in this plan is defined as “A reduction in the incidence, prevalence, morbidity or mortality of cholera cases to a locally acceptable level (according to NCCP) and no longer considered as a public health problem and continued intervention is required to maintain controlled situation” (DGHS 2019, 7). In contrast, “elimination” is defined as “Any country that reports no confirmed cases with evidence of local transmission for at least three consecutive years and has a well-functioning epidemiological and laboratory surveillance system able to detect and confirm cases” (DGHS 2019, 7). The cholera

outbreak, as defined in NCCP is the “occurrence of at least one confirmed case of cholera by culture or PCR [polymerase chain reaction] and evidence of local transmission” or “an unexpected increase in the magnitude or timing of suspected cases over two consecutive weeks, with some cases being confirmed by the laboratory” (DGHS 2019, 7).

**Model:** The core of the NCCP model lies in strengthening cholera surveillance through 22 sentinel sites and developing an Early Warning, Alert and Response System (EWARS), which currently doesn’t exist. Surveillance responses include a) proactive and b) reactive responses. Proactive responses are envisioned to run throughout the year irrespective of any triggering cholera event and includes multiphased oral cholera vaccination (OCV), enhanced WASH services, effective coordination and monitoring, and communication and social mobilization. The reactive responses, on the other hand, will trigger when the surveillance mechanism identifies a suspected case; every 10th case will be tested with a rapid diagnosis test (RDT), and positive samples will be sent to the nearest public medical college hospital for confirmation by culture and sensitivity testing. An outbreak will be declared according to the NCCP definition (described above). Rapid response teams at national, district, upazila, district municipality, and city corporation levels will be trained and emergency preparedness plans put place, so that within three hours of notification of an outbreak, teams will activate. The Institute of Epidemiology Disease Control and Research (IEDCR) will be notified of all outbreaks to ensure the national team is always in communication with the local investigating team and, when required, can be deployed in the field.

**Mandate:** NCCP will be initiated by the Communicable Disease Control (CDC) unit of DGHS and led by the Ministry of Health and Family Welfare (MOHFW). Ministry of Local Government, Rural Development and Co-operatives (MOLGRDC), Ministry of Education (MOE), Water Supply and Sewerage Authority (WASA), Department of Public Health Engineering (DPHE), Dhaka North City Corporation (DNCC), and Dhaka South City Corporation (DSCC) are essential stakeholders for the implementation of this plan. The technical support of relevant partners/donors, such as World Health Organization (WHO), United Nations Children’s Fund (UNICEF), International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b),

WaterAid, and other nongovernmental organizations is also part of the implementation of this plan.

**Method:** NCCP is envisioned to be implemented through six strategic approaches. These are 1) developing a sustainable cholera surveillance system, 2) strengthening cholera case management, 3) implementing oral cholera vaccination, 4) increasing the access to safe water, sanitation, and hygiene intervention, 5) enhancing coordination and monitoring through multisectoral approach, and 6) advocating communication and social mobilization (ACSM).

NCCP will be executed through the following activities.

1. **Short-term activities (2019–2021)** to reduce 25% of cholera burden. This involves capacity development for cholera detection at all levels of health facilities, identification of hotspots/high-risk areas/populations, strengthening of case management for cholera as per WHO guideline, preferably through the mHealth platform in all health facilities, establish Early Warning and Response System (EWARS), development of standard operating procedures (SOPs) for emergency outbreak response, develop SOPs to provide/strengthen WASH services, establishment of supervision and monitoring system, and ensuring vaccine and logistics supply, etc.
2. **Mid-term activities (2022–2025)**, targeting 50% reduction of cholera burden. Key activities are mainly strengthening short-term activities. Examples include: a multisectoral coordination mechanism among stakeholders, revision of the strategy as per evaluation report after short-term activities, an OCV campaign along with WASH intervention in all identified cholera-prone areas, identification of hotspots/high-risk areas/populations, strengthening of supervision and monitoring system, etc.
3. **Long-term activities (2025–2030)**, aiming at 90% reduction of cholera burden. Activities are mainly those that further strengthen the mid-term activities and include multisectoral coordination mechanism among stakeholders, revision of the strategy as per evaluation report after mid-term activities, a sustainable surveillance system, and an OCV campaign along

with WASH intervention in the newly identified hotspots and outbreak areas.

**Means:** The NCCP outlines development activities from 2019–2030, with a total estimated budget of USD 3.58 billion. Out of this, OCV budget will be USD 0.43 billion; the WASH budget will be USD 3.13 billion (improved water USD 0.68 billion, sanitation USD 1.35 billion, and hygiene promotion around USD 1.1 billion). The surveillance budget is estimated to be USD 0.02 billion.

Box 9 introduces a short example of a cholera-focused AA framework from the Democratic Republic of the Congo.

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**BOX 9.** Snapshot: UN-facilitated Anticipatory Action (AA) in Democratic Republic of the Congo.

The OCHA-facilitated AA framework for cholera in the Democratic Republic of the Congo is enabled through a government partnership, in which government-collected surveillance data is shared with OCHA to capture disease dynamics and trends that could inform the likelihood of a country-wide outbreak.

**Model:** Three different scenarios can independently trigger an activation. Two scenarios are triggered based on observational epidemiological data provided by the National Program for the Elimination of Cholera and the Control of Other Diarrheal Diseases (PNECHOL-MD) for an endemic and nonendemic outbreak, respectively; and the third scenario allows CERF to trigger funding based on an external shock like rapid displacement or flooding in an endemic province.

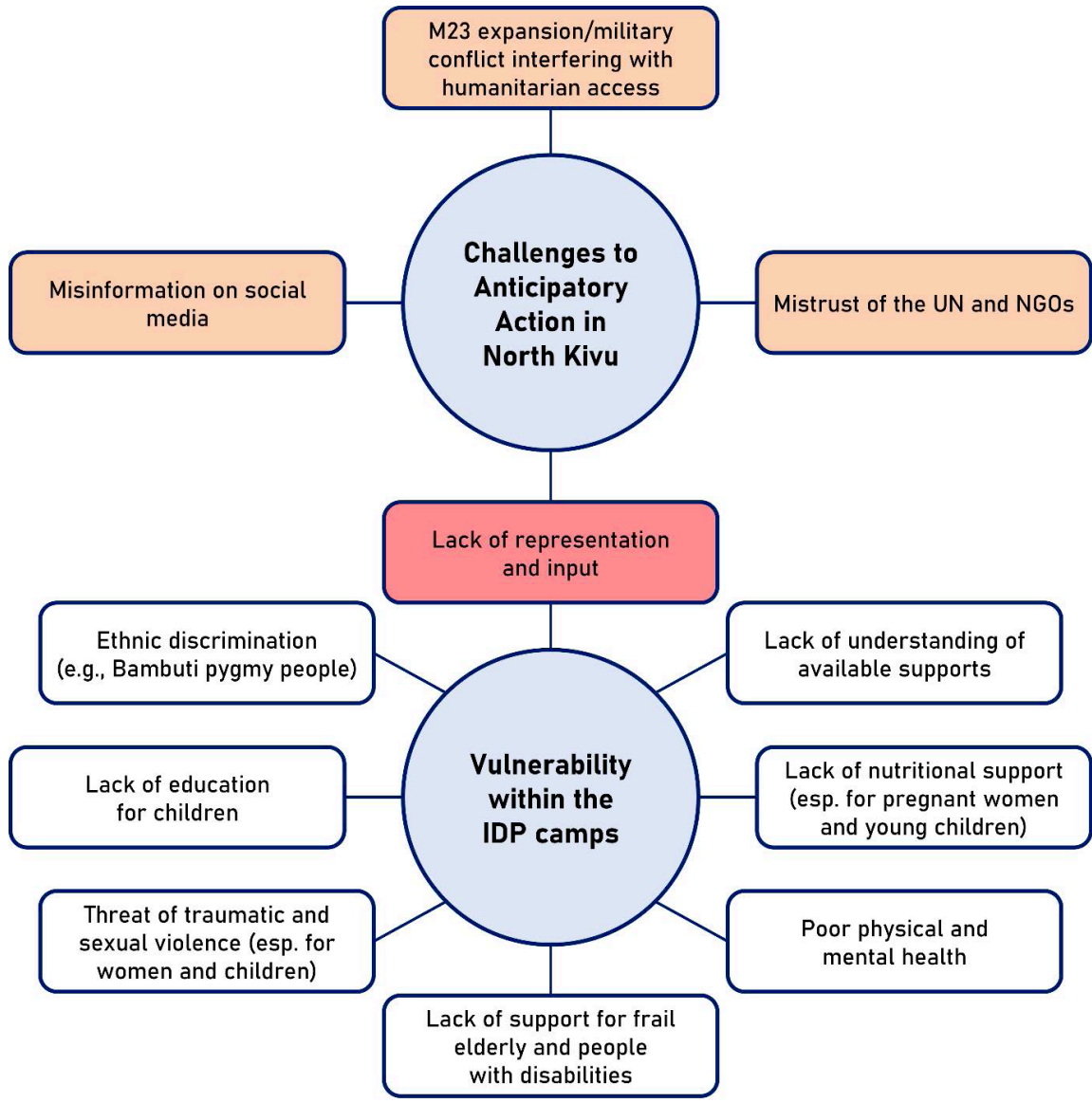
**Mandate:** This is the first AA framework for infectious diseases facilitated by OCHA, and includes UNICEF and WHO as key collaborators along with government and local implementing partners (UN OCHA 2023). While most humanitarian-led AA frameworks have not engaged with government surveillance systems, this is one of a few examples of efforts to bridge this divide. Data collected ranges from the national level to particular health zones, and even down to particular health facilities. While this partnership is working well, there have been struggles to expand this model to other countries, in part due to many governments' sensitivity in sharing cholera data due to a reputational risk.

**Method:** Anticipatory activities are grouped into “case-area targeted interventions” led by UNICEF (e.g., deployment of rapid response teams (RRT)), “quadrillage” led by WHO (e.g., establishment of chlorination points and sensitization), “surveillance and early detection” and “medical care for infected patients.”

**Means:** OCHA's actions are funded through the CERF.

**Evaluation:** The pilot was first triggered in December 2022 and benefitted from an independent study shortly after funding was disbursed. This study, based on interviews in the Goma Region at the time of activation, documented the range of challenges that the pilot faced in the complex crisis of Eastern DRC, as well as the significant vulnerabilities faced by the recipients of the AA (see Figure 10).

**FIGURE 10.** Overview of challenges to Anticipatory Action (AA) in North Kivu, DRC, and vulnerability within IDP camps (Source: Bowman and Manialawy 2024)



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**BOX 9.** Continued

The study also identified a range of recommendations for AA targeting infectious diseases by humanitarian partners:

1. Disease surveillance is mandatory. It needs to be long-term, sustainable, and include all major infectious diseases. There is broad consensus that this is not happening currently.
2. Systems must be designed for and capable of timely, flexible, and expandable resources for intervention.
3. There must be a permanent, longstanding infrastructure for treatment, including health centers, laboratories, and hospitals to coordinate interventions and assess their efficacy for future planning and development.
4. Information must be managed, coordinated, and disseminated in a timely manner.
5. Balanced and fair communication, recognition, and job sharing between partners.
6. Responsible and ethical governance that operates independently of personal or agency interests alone. This area was stated to be of grave concern to those interviewed but lies beyond the scope of this inquiry (Bowman and Manialawy 2024).



## Drought and nutrition

Hazard-focused Anticipatory Action (AA) plans that focus on drought often seek to mitigate or avoid negative impacts to nutrition and food security. The following information provides evidence on health outcomes of AA for drought along with examples of an AA framework in Colombia led by FAO, using the 4Ms (Model, Mandate, Method, Means) framework. It also highlights the unique approach of the Africa Risk Capacity (ARC) initiative as an example of government-led AA, as well as humanitarian and government collaboration through the ARC Replica scheme.

### Evidence review

Many AA frameworks for drought focus on livelihood protection, especially for people who work in agriculture and pastoralism. Index insurance programs provide low-cost insurance for drought events, although national-level insurance is likely only cost-effective when forecasts are highly accurate (Anand et al. 2024). Malnutrition is a key health outcome of concern, due to limited earnings and low purchasing power during drought or limited food supply for subsistence farmers/herders.

The most recommended approach for AA for malnutrition is to establish surge capacity in health systems, preparing the system to scale up rapidly to

meet increased demand in the event of a drought. In countries with stable governments and operational public health services, surge capacity consists of plans to be able to increase staff at health centers in the event of a drought forecast, the ability to speed up supplies through existing pipelines, and initiation of community screening to identify malnourished children.

Surge capacity is often designed as part of shock-responsive social safety net plans, which can also provide cash transfers to affected populations. However, cash transfers might need to be supplemented by other nutrition interventions, because specific products for supporting malnourished children (e.g., therapeutic food) are not readily available on the market. Experts recommend using drought early warning information to begin to scale up early, because once negative outcomes have already set in, cash transfers will be used to try to catch up with lost consumption, and the health and nutrition services will need to play catch-up with a caseload of malnourished children.

One example of such a program is the Community-based Management of Acute Malnutrition (CMAM) Surge approach in Kenya, which included information systems to monitor health system capacity against seasonal risk information, flexibility in product distribution systems, and enabling health

workers to manage spikes in caseloads (Fortnam et al. 2021). Government ownership was seen to be key to the success and sustainability of this program; the Kenyan Ministry of Health designed the CMAM Surge program nationally. However, sufficient government financing has been a challenge, and United Nations and NGO partners have been critical in supporting the financing and implementation of these programs (Fortnam et al. 2021).

### Example of high-potential design

**Model:** Seasonal forecasts of crop failure or reservoir levels provided by regional forecasting agencies based on their long-term rainfall observations and forecasts.

**Mandate:** Government-led initiatives to manage widespread drought effects through social protection systems and complemented by humanitarian assistance.

**Method:** Cash transfers to replace lost income, scale-up of health system staffing and supply chains, proactive community screening for malnutrition. Support for livelihoods, if possible.

**Means:** Government funding, with top-up from humanitarian assistance funds.

### Case study: FAO in Colombia

FAO Colombia began its work on Anticipatory Action (AA) with a pilot initiative implemented between 2018 and 2019. Since 2021, these efforts have evolved into a more robust and institutionalized approach to climate-related hazards such as El Niño, La Niña, and tropical cyclones. In coordination with the Ministry of Agriculture and Rural Development, FAO has made significant efforts to strengthen national and local capacities to act before disasters strike, thereby reducing risks to livelihoods and food security. To guide its efforts for the period 2024–2027, FAO Colombia has adopted a strategic roadmap for AA. This framework prioritizes strengthened coordination with UN system entities, the Red Cross Movement, and nongovernmental organizations, looking for a more integrated response to climate-related risks. At the national level, it seeks to embed the approach within government systems to facilitate greater ownership, policy alignment, and scalability. Simultaneously, the roadmap emphasizes capacity building at the local level, working with social

organizations, academic institutions, producer groups, smallholder farmers, and ethnic communities to enhance preparedness and resilience across Colombia (FAO 2024a).

From July 2023 to February 2024, in response to the declaration of the El Niño emergency, FAO implemented AAs in La Guajira and El Cesar, two departments of the Colombian Caribbean region mainly inhabited by indigenous communities. AAs were centered on the protection of agricultural livelihoods.

**Model:** In May 2023, the National Oceanic and Atmospheric Administration (NOAA) reported a 90% probability of the occurrence of the El Niño phenomenon. FAO used this forecast as a trigger to initiate a preparedness plan in close collaboration with the Ministry of Agriculture and Rural Development. The plan incorporated four key components: “(i) identification of months with the lowest expected precipitation in the prioritized areas; (ii) analysis of sowing and harvest calendars for the region’s principal crops; (iii) projections of drought impacts by month; and (iv) continuous monitoring of precipitation anomalies, calculated as the difference between predicted and historical climatological values, expressed in millimeters for each territory” (FAO 2024b, 3). In addition to data from international meteorological centers such as NOAA, FAO also relied on weekly and monthly alerts issued by the Institute of Hydrology, Meteorology and Environmental Studies (IDEAM), as well as data produced by FAO’s team of meteorologists. The official declaration of El Niño in Colombia occurred in November 2023; by that time, FAO had already activated its action plan.

**Mandate:** FAO implemented the initiative in close collaboration with the Ministry of Agriculture and Rural Development, the Colombian Agricultural Institute (ICA), the National Unit for Disaster Risk Management (UNGRD), and local authorities. With support from the UNGRD and the national army, for example, agricultural inputs and construction materials for water supply systems were delivered to all targeted municipalities. Additionally, animal health brigades were established in coordination with ICA.

**Method:** In the livestock sector, approximately USD 334,000<sup>5</sup> was allocated to protect 38,312

<sup>5</sup> The original source has this information in Colombian pesos. To present it in dollars, we used the average exchange rate for 1 US dollar for 2024, which was 4,073 Colombian pesos.

sheep and goats through the provision of feed concentrate, silage production, veterinary supplies, animal health and nutrition campaigns, technical assistance, and the training of community livestock promoters. These measures improved animal weight, reduced mortality, prevented diseases, enhanced reproduction, and increased milk and meat production, despite ongoing water shortages. In the water sector, USD 182.93 was invested in the rehabilitation and/or construction of 35 community water supply systems, benefiting approximately 20,000 people. Each system ensured a daily supply of 16 cubic meters of water, amounting to 204,400 m<sup>5</sup> annually across all communities. These renewable energy-powered systems were designed for a three-year lifespan, with community members trained in its maintenance. In the agricultural sector, between July and November 2024, USD 245.00 was invested to deliver 840 tons of agricultural inputs to 35 communities. Support included drip and

microirrigation systems, drought-resistant traditional seeds, tools, materials for infrastructure, organic fertilizers, and water-retaining products (FAO 2024b).

**Means:** These initiatives were made possible through the support of the German government (GFFO), via the Special Fund for Emergency and Rehabilitation Activities–Anticipatory Action Window, with a contribution of USD 1 million. An important enabling factor was FAO’s long-standing presence in Colombia and its sustained investment in building strong collaborations with local government entities. This prior engagement and the organization’s established partnerships facilitated the effective identification of target areas for intervention.

An example of a novel AA program can be found in Box 10, where the African Risk Capacity insurance model is explained.

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### **BOX 10.** Snapshot: African Risk Capacity

One example of a novel approach to Anticipatory Action (AA) for drought is African Risk Capacity (ARC), which provides sovereign drought insurance for national governments in Africa.

**Model:** This insurance pays out when a crop model indicates that the most recent season’s rainfall was not adequate for a good harvest. The timing of the payout is designed to enable immediate action by African governments in responding to people’s needs, and ARC has also developed a forecast-based trigger that would pay out even earlier in the season based on a forecasted crop failure.

**Mandate:** National governments hold the insurance policies of ARC, and these governments therefore receive the payouts and are responsible for implementing the predetermined action plans. ARC Replica coverage has been offered to nongovernmental actors, and several UN agencies and NGOs have purchased these Replica products in order to also receive a payout at the same time as the government.

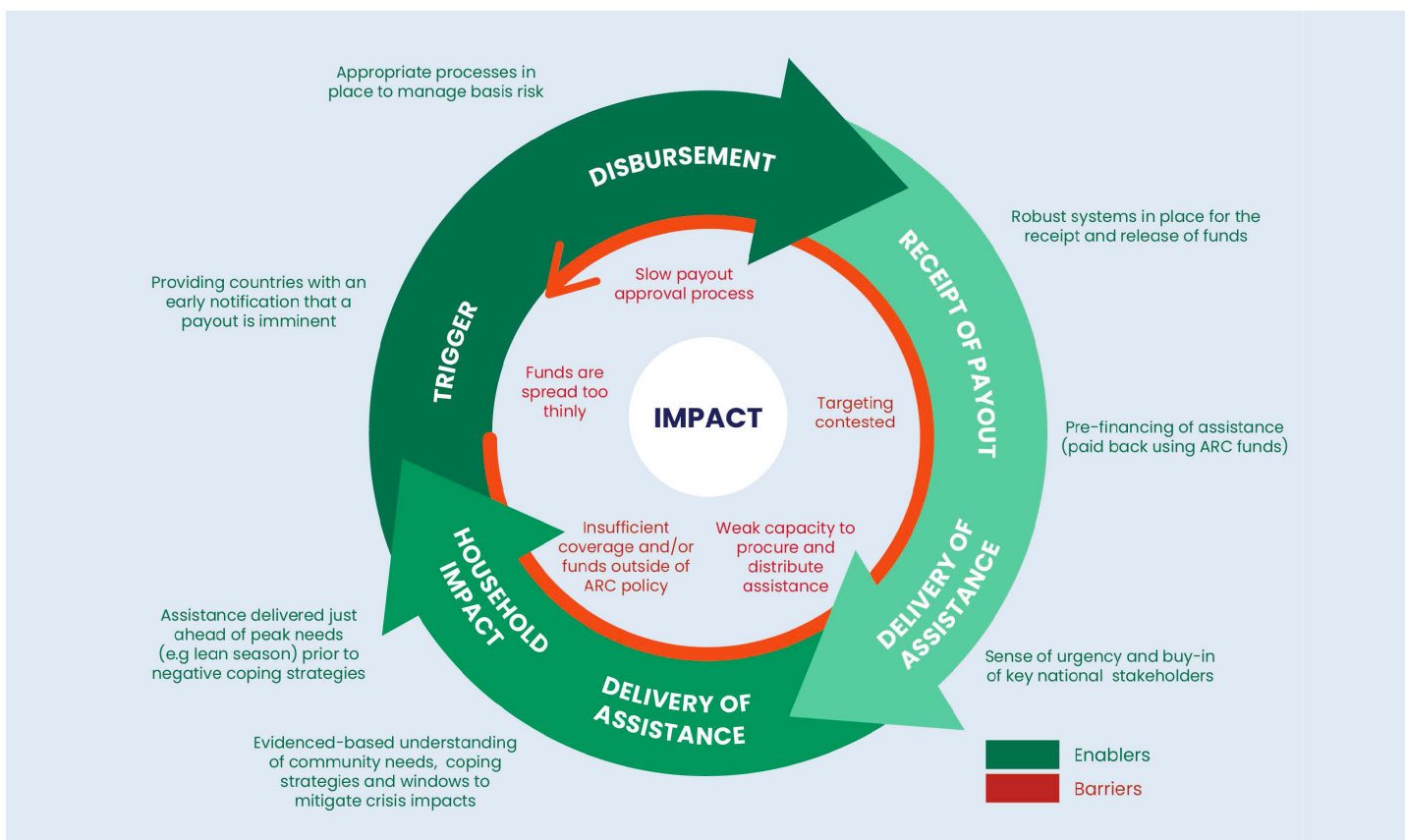
**Method:** Protecting nutrition is a key goal of the insurance mechanism, and governments often use the payout to provide emergency cash transfers to affected populations, for example. Other actions include funding of agricultural extension support for existing livelihoods, food aid, seed provision, and support for alternative livelihoods/businesses (Poole et al. 2024). ARC works with countries to determine the most feasible form of support, which is ultimately selected by the countries but confirmed with ARC before the insurance policy is purchased. At the time of a payout, changes can be made to the contingency plans, due to factors such as procurement difficulties or rationale that a cash injection may not be sustainable for local markets. The driving factors for changing aid modality are notably timing and targeting related. In some cases, ARC and country officials agree to change the pre-planned use of insurance payout funds in order to reduce the time to delivery of assistance while maximizing responsiveness to community needs. (Oxford Policy Management 2022).

**BOX 10.** Continued

After a failed harvest, affected people engage in negative coping mechanisms, such as reducing food intake and selling productive assets, and therefore the timing of external support is critical. The speed of drought aid is one of the determining factors of its success in preventing malnutrition, yet even ARC payouts have not always been able to reach people in time (Montier & Ward n.d.). Critical factors of delays include systems for the receipt and release of funds, and slow targeting processes and capacity to distribute assistance (Figure 11).

**Means:** Funding for the ARC premiums comes primarily from national budgets. Some countries receive support in the form of grants from international donors, and financial instruments (grants and loans) from the African Development Bank or the World Bank.

**FIGURE 11.** Determinants of success and speed of delivery in Africa Risk Capacity.



Enablers in green are listed on the outside, and barriers in red are listed on the inside. Figure from an ARC evaluation by Montier & Ward (n.d.), used with permission.

# OVERALL RECOMMENDATIONS

While Anticipatory Action (AA) holds much promise to reduce the negative health impacts of climate change, AA systems are only beneficial insofar as they provide support that is both timely and effective. We identified recommendations for AA for heat, storms/floods, infectious disease, waterborne disease, and drought/nutrition, as well as several general recommendations for the overall design of AA programming. These design elements are critical for success in most contexts, based on our review of the literature and advice from key informants around the world.

## Recommendations for humanitarians

**Flooding and waterborne disease:** Revise all existing AA frameworks for storms and flooding, which include actions intended to avoid health impacts of the flooding:

- Meet with public health officials to understand the broader context of health interventions and trajectories, and re-design the AA framework in collaboration with health experts.
- Include strong collaboration within new hazard-driven frameworks from the beginning.
- Establish rigorous evaluation plans and change actions that are unlikely to be effective.

**Heatwaves:** Continue to develop heat action plans that use heatwave forecasts, encouraging collaboration between humanitarians, government agencies, and the insurance sector. Focus on perspectives of vulnerable populations and ground design of the plan in behavior change theory for greatest results. Consider public health advisories, infrastructure adjustments, and social protection mechanisms.

**Vector-borne disease:** Map public health efforts for each nationally relevant vector-borne disease and identify gaps. Identify which ordinances are not being carried out and which plans exist but are not being operationalized. Examine the long-term capacity of humanitarian actors to bolster these existing efforts, and design AA frameworks that

relate explicitly to existing public health efforts. Identify ways to deploy more trained staff to ensure proper implementation of mandated programs.

**Climate services for health:** Advocate for investment in national disease surveillance systems. If creating a hazard-driven framework that relates to health, discuss with the Ministry of Health their priorities in the regions and what action can be taken. Discuss priority vulnerable populations and ensure actions can be completed in the lead times available.

**Nutrition:** Support government systems to provide sufficient and timely scale-up of programming relating to drought and nutrition. Develop properly equipped health hubs that can develop locally tailored programs for AA for health concerns, including nutrition and clean water access. Ensure coverage in areas that are hotspots for malnutrition.

## Recommendations for governments

**Simulations:** Carry out frequent event-based simulations (tabletop exercises) that involve departments (health and disaster management, for example) as well as external actors to simulate different flooding and extreme storm events. Use these simulations to build coordination in AA.

**Coordination:** Coordinate the many actors interested in contributing to heatwave resilience, focusing on long-term investments and root causes of vulnerability.

**Public health infrastructure:** Identify points of failure in how national plans are applied locally; track the relationship between public health actions and spatial scale. Create systems that can use forecasts of vector-borne disease to change the location, timing, or scale of support to improve the efficiency of government efforts.

**Climate services for health:** Establish mandates for outbreak-prediction models: who will run them, what data they will use, and how the results will be shared. Design disease-driven AA systems for waterborne disease outbreaks, building from existing structures

of health centers and disaster management committees.

**Ability to scale:** Develop anticipatory social protection systems that make use of social protection infrastructure to scale up support quickly to many people. Invest in building systems that can move finance quickly. Carry out annual drills for AA plans that ensure the systems are in place to act quickly. Invest in long-term support beyond emergency cash transfers.

## General recommendations

**Funding:** Use AA) as a means to efficiently allocate scarce resources. For example, AA can be incorporated into public health measures that are already happening to improve their effectiveness by changing the timing or location of these initiatives:

- Improving the cost-effectiveness of limited budgets is likely to be helpful to government agencies. For example, weather forecasts could help optimize existing mosquito spraying programs to spray at the most effective time and locations.
- Existing disaster response plans might include provisions to scale health programming up and out (e.g., the Philippines Department of Health has plans for regions to send doctors to other regions if they are affected by a disaster). Taking a similar approach to scaling up/out based on forecasts for AA could be effective.
- Emphasize the goals of faster emergency response, reduced hospitalization rates, and more efficient allocation of resources (medicines, health personnel, shelter).
- Leverage different streams of funding (e.g., government health programs, humanitarian emergency support) to work together towards a shared goal that links directly to government targets. Advocate for policies that enable resource (re)allocation or access to funding mechanisms for AA.
- Specifically, leverage social protection system infrastructure for AA support.

**Collaboration:** Increase cross-sectoral collaboration across public health, climate science, and the humanitarian sector:

- Cultivate a common language. As one informant explained, “I don’t see that there is a common language yet or necessarily a prolific dialogue among those actors—that is a big problem because we are not necessarily defining the problem in a way that is relevant for others.”
- Acknowledge that terminology differs between actors and work accordingly.
- It might seem tempting for humanitarians to quickly develop ad-hoc AA plans for health that are not coordinated with the health sector for reasons of speed and funding availability. However, it is not clear that such plans will be effective. A middle ground between a humanitarian-only, hazard-driven approach and a fully coordinated disease-driven approach is likely worth the effort.
- Invest in cross-border collaboration on disease management (Torjesen 2020).
- Encourage community collaboration as a vital component in AA for community wellness.

**Long term vs. short term:** Invest in long-term disaster risk reduction that reduces the overall risk of disaster (not forecast-based), and invest in health system strengthening to enable AA:

- Invest in long-term health infrastructure, including surveillance systems and wellness programs, which is needed for the success of AA as well as other initiatives.
- AA should be integrated with existing national plans and roadmaps to both benefit from and reinforce the larger-scale work taking place. Consider AA as just one of many tools on the public and disaster risk reduction continuum, and identify where implementing AA makes sense alongside global elimination of disease plans (e.g., the Global Taskforce for Cholera Roadmaps at national levels).
- Beware of stopgap programs that won’t last and aren’t durable.

- For chronic disease, focus on long-term resilience measures. Create pathways to transition away from seasonal AA by planning for infrastructure investments, building capacity, etc. Move from AA as a short-term risk/impact reduction strategy to building capacity for more sustainable proactive health measures. Build strong public health systems and infrastructure to address health issues exacerbated by the impacts of climate change. AA should not be seen as a panacea but in some cases as what should be a last resort.

**Leadership:** Invest in individuals, and invest in mindset change:

- Avoid presenting AA as a new idea; identify examples of how people are doing AA already (regardless of what it is called) and build on this. It is notable that many disease surveillance systems are premised on an anticipatory mindset; highlighting this can be a positive way to increase uptake of other or more formalized AAs.
- Build institutional multiagency spaces for coordination and collaboration.
- Ensure ownership and buy-in of AA planning at the most local level. Many indigenous practices already include AA.

**Forecasting:** Take advantage of the leaps and bounds of forecasting improvements:

- Invest in impact-based forecasting, especially making use of new machine learning and artificial intelligence methods to improve our ability to forecast both hazards and disease outcomes.
- Develop health forecasts that provide increased location precision to help actors know where to target health measures. For example, while it is relatively easy to identify communities impacted by floods, it becomes more challenging to pinpoint those affected by waterborne diseases or dengue, which are primarily caused by floodwaters. Create forecast systems that are linked to decision-support frameworks (Grant et al. 2024).
- Explore nontraditional sources of information to help develop models, such as school absence data as an indicator of health concerns. In places where data sharing is not feasible, explore

nonsensitive aggregated proxy measures for health outcomes.

- Leverage mobile technologies and community-based platforms for data reporting, dissemination of alerts, and risk communication.

**Drills and simulations:** Carry out frequent drills and simulations of forecasted extreme weather events or forecasted spikes in disease/malnutrition. Use these simulations to promote coordination and the development/improvement of AA frameworks:

- Based on simulations, establish concrete and achievable targets/outcomes for AA initiatives.
- Carry out post-event monitoring and evaluation of set targets and outcomes, and inclusion of lessons learned.

**Climate-health relationships:** Invest in research to better document how certain climate and weather events relate to health outcomes in different parts of the world:

- Study how extreme heat in different forms (one-day, seasonal, etc.) affects health outcomes in tropical regions, and design disease-driven AA plans that use these heat-health relationships as a trigger for public health and social protection actions.
- Hydrological forecasts are now more widely available and more accurate and should have stronger links to AA. Evaluate hydrological forecasts and promote the use of high-accuracy flooding forecasts.

**Effectiveness of AAs:** Many AA systems are designed based on assumptions of effectiveness:

- Develop and test heatwave preparedness actions beyond warning information, particularly for multiday heatwave events.
- Not all drought programs are (or should be) focused on nutrition, but this is a common association. Programs for extremely rare and unusual drought events can benefit from a hazard-driven approach, while programs aimed at more frequent/common events would benefit from a nutrition-focused approach. The latter approach should be well-integrated into public health planning for promoting nutrition.

**Experiment:** Try new approaches that have not been well-tested yet. This includes different forms of individual or group insurance based on forecasts, auto-enrollment of people in social protection benefits, and adaptation hubs as anchors for AA programming. Consider developing platforms of communication utilizing local cultural activities and rituals as avenues for community engagement.

## Recommendations for research

There is a gap in evidence demonstrating the effectiveness of, and good practices for AA targeting different areas of health, a problem underpinned by a lack of funding to support such research. Practitioners interviewed for this study described a lack of information on evidence-based AAs to undertake to reduce the risk of disease. “We don’t have good information on what different health actions are even happening, or if they make sense given what the event might be,” one informant shared. Consider the following recommendations:

- Continue to build the evidence base of “What works?” in AA for health outcomes, with particular attention paid to the objective and timing of interventions, differences in outcomes across populations (e.g., women, children, etc.), and data gaps that may have affected the decision-making process in AA framework design and implementation.
- Invest in research using novel methods and data to forecast health outcomes and design climate services for health.
- Document perspectives and trade-offs in the design of mandates for novel AA frameworks or climate services for health in different contexts.
- Building on this report, conduct in-depth research on existing AA frameworks and actions plans to identify the health-related activities within them and draw out themes or good practices. Invest in research that has comparison groups to understand which approaches are most successful.
- Promote the sharing of evidence and collaborative research through the AA and health TWG hosted by the Anticipation Hub. The TWG has started mapping malaria, cholera, heatwaves, and infectious diseases AA frameworks, most of

which are still under development, in an effort to better understand the landscape of AA for health.

- Ensure that AA frameworks targeting health outcomes have a strong evidence component, including evaluations as well as process research, to better understand both outcomes and the processes that led to them.
- Conduct a thorough evidence review of different terms related to/referring to practices that are anticipatory or related to AA in the health field to more comprehensively identify existing practice and outcomes.

Research the ways in which AA can be tailored to the needs of different communities. Together with disaster and disease management, community wellness activities that include food preparation, family nutrition, fitness, health education, and structural safety manifest a community’s idea of preparedness for the future. Thus it would be worthwhile to look into a community’s practice for health and wellness as valuable considerations in developing a participatory program for anticipatory health.

# CONCLUSION

Given the health consequences of a changing climate, health systems will need to be more efficient and effective in the coming years to maintain and improve health outcomes globally. AA is a promising tool that can offer health systems the ability to scale up and out at times of highest risk, leveraging scientific advances in forecasting and modeling of weather extremes and disease.

Based on our review of existing AA systems, relevant laws/policies, and key informant interviews, we identified two major categories of AA approaches: hazard-driven and disease-driven. We recommend continuing to pursue hazard-driven approaches for distinct extreme weather events, such as heatwaves, floods, and storms, with an emphasis on strengthening their integration with the public health sector. We also recommend increased investment in disease-driven AA systems for waterborne and vector-borne diseases, making use of improvements in epidemiological modeling. For greatest success, governments should assign mandates and responsibilities providing real-time disease forecasting and use these forecasts to improve the efficacy of public health interventions, in collaboration with the humanitarian sector.

While AA holds potential for promoting health outcomes, it requires a strong foundation in public health investments. Health infrastructure and connections with communities to promote community wellness lay the groundwork to be able to scale AA when a forecast arrives. Without these investments and connections, AA is limited in what it can achieve. Grounding AA in community wellness investments positions the community not merely as “recipients” of interventions but as active participants in shaping them. This orientation can foster a two-way dialogue between communities and institutions, ensuring that AA systems are not only technically sound but also socially rooted. Foundational investments should also include direct public health infrastructure as well as investments in the built environment to protect human health, such as resilient roads that allow for evacuations, or flood barriers for health facilities. Embedding integrity and transparency in infrastructure development ensures that AA is indeed “anticipatory” in design and reliable in practice.

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# APPENDIX 1: ANTICIPATORY ACTION (AA) FRAMEWORKS REVIEWED

DOCUMENT TITLE	COUNTRY	HAZARD	AGENCY
<a href="#">Costa Rica: Volcanic ash</a>	Costa Rica	Volcanic ash	Red Cross
<a href="#">Djibouti: Floods</a>	Djibouti	Flood	Red Cross
<a href="#">Tajikistan: Heatwave</a>	Tajikistan	Heatwave	Red Cross
<a href="#">Honduras: Tropical storms</a>	Honduras	Cyclone/typhoon/hurricane	Red Cross
<a href="#">Bangladesh: Cyclone (2018)</a>	Bangladesh	Cyclone/typhoon/hurricane	Red Cross
<a href="#">Niger: Drought</a>	Niger	Drought	Red Cross
<a href="#">Peru: Extreme cold and snow</a>	Peru	Cold wave	Red Cross
<a href="#">Philippines: Typhoon</a>	Philippines	Cyclone/typhoon/hurricane	Red Cross
<a href="#">Mozambique: Floods</a>	Mozambique	Flood	Red Cross
<a href="#">Bangladesh: Floods (2019)</a>	Bangladesh	Flood	Red Cross
<a href="#">Ethiopia: Floods</a>	Ethiopia	Flood	Red Cross
<a href="#">Bangladesh: Cyclone (2021)</a>	Bangladesh	Cyclone/typhoon/hurricane	Red Cross
<a href="#">Peru: Floods in the Lower Amazon jungle</a>	Peru	Flood	Red Cross
<a href="#">Kenya: Riverine floods</a>	Kenya	Flood	Red Cross
<a href="#">Mali: Floods</a>	Mali	Flood	Red Cross
<a href="#">Uganda: Floods</a>	Uganda	Flood	Red Cross
<a href="#">Bangladesh: Floods (2021)</a>	Bangladesh	Flood	Red Cross
<a href="#">Niger: Floods</a>	Niger	Flood	Red Cross
<a href="#">Zambia: Floods</a>	Zambia	Flood	Red Cross
<a href="#">Nigeria: Floods</a>	Nigeria	Flood	Red Cross

## APPENDIX 1: ANTICIPATORY ACTIONS FRAMEWORKS REVIEWED Continued

DOCUMENT TITLE	COUNTRY	HAZARD	AGENCY
<a href="#">Guatemala: Floods associated with tropical cyclones</a>	Guatemala	Floods associated with tropical cyclones	Red Cross
<a href="#">Mozambique/Africa: To coordinate early actions for preparation and response to cyclones in Mozambique</a>	Mozambique	Cyclone/typhoon/hurricane	Red Cross
<a href="#">Ecuador: Extreme rainfall related to the El Niño phenomenon</a>	Ecuador	Intense rainfall	Red Cross
<a href="#">Ecuador: Volcanic ashfall</a>	Ecuador	Volcanic ash	Red Cross
<a href="#">Mongolia: Dzud (2019)</a>	Mongolia	Dzud	Red Cross
<a href="#">Mongolia: Dzud (2020)</a>	Mongolia	Dzud	Red Cross
<a href="#">Kyrgyzstan: Heatwave</a>	Kyrgyzstan	Heatwave	Red Cross
<a href="#">Viet Nam: Heatwave</a>	Vietnam	Heatwave	Red Cross
<a href="#">Bangladesh cyclones-2023</a>	Bangladesh	Cyclone/typhoon/hurricane	United Nations
<a href="#">Fiji tropical cyclones-2023</a>	Fiji	Cyclone/typhoon/hurricane	United Nations
<a href="#">Malawi dry spells</a>	Malawi	Dry spells	United Nations
<a href="#">AA Ethiopia, drought</a>	Ethiopia	Drought	United Nations
<a href="#">AA Somalia, drought</a>	Somalia	Drought	United Nations
<a href="#">Bangladesh floods-2023</a>	Bangladesh	Flood	United Nations
<a href="#">Nepal monsoon floods-2024</a>	Nepal	Flood	United Nations
<a href="#">AA framework-Burkina Faso drought</a>	Burkina Faso	Drought	United Nations
<a href="#">AA framework-pilot of the Democratic Republic of Congo: Cholera</a>	DR Congo	Cholera	United Nations
<a href="#">Framework for AA, pilot in Chad, drought</a>	Chad	Drought	United Nations
<a href="#">Dry corridor AA framework, Guatemala</a>	Guatemala	El Niño	United Nations
<a href="#">Dry corridor AA framework, El Salvador</a>	El Salvador	El Niño	United Nations

DOCUMENT TITLE	COUNTRY	HAZARD	AGENCY
<a href="#">Dry corridor AA framework, Honduras</a>	Honduras	El Niño	United Nations
<a href="#">AA framework dry corridor, Nicaragua</a>	Nicaragua	El Niño	United Nations
<a href="#">AA framework drought in Niger-2024 version</a>	Niger	Drought	United Nations
<a href="#">Framework for AA, floods in Chad</a>	Chad	Flood	United Nations
<a href="#">AA and early response framework, Mozambique-cyclones</a>	Mozambique	Cyclone/typhoon/hurricane	United Nations
<a href="#">AA framework, pilot in Haiti, storms/hurricanes</a>	Haiti	Cyclone/typhoon/hurricane	United Nations
<a href="#">AA framework, pilot in Niger: Floods</a>	Niger	Flood	United Nations
<a href="#">Framework for AA, pilot in Madagascar, cyclones</a>	Madagascar	Cyclone/typhoon/hurricane	United Nations
<a href="#">AA framework for tropical cyclones, Philippines pilot</a>	Philippines	Cyclone/typhoon/hurricane	United Nations

# APPENDIX 2: EXAMPLE INTERVIEW GUIDE (FROM PHILIPPINES INTERVIEWS)

ABANGAN... BUKAS NA!

## GLOBAL LANDSCAPE REPORT

A project of the Research and Creative Work Division of University of the Philippines Resilience Institute through the support of the Rockefeller Foundation through Tufts University, USA

### 1. Are you familiar with Anticipatory Action (AA)?

- A. What climate change concerns do you experience in your community? (heatwave, typhoon, floods, tsunami, drought, landslides, sinkholes, forest fire, tsunami, pestilence, water shortage, food scarcity, etc.)
- B. What are the major health-related concerns that threaten your community?
- C. What specific activities or actions does your office take upon early detection of health-related concerns that could become a bigger problem for your community?

### 2. What are the LGU's/NGO's existing operational contingency or disaster response plans for major health-related events?

- A. In monitoring recorded cases of various diseases and health-related concerns, how and when is it decided that action is needed before an outbreak/epidemic occurs?
- B. What health-related concerns have such thresholds or response plans? (e.g., infectious diseases, noncommunicable diseases, nutrition and food security, mental health, injuries, mortality, access to healthcare, and sanitation)?
- C. How do government and nongovernment groups help deliver humanitarian aid in these initiatives?

### 3. Which government policies and standard operating procedures (SOP) affect timeliness in AA and DRRM?

- A. What are the determinants of speed as an essential element in timely action? In the context of DRRM, what factors does your office consider to determine when urgent action is needed?
- B. When funds need to be released for target communities, how fast does this usually happen? In your experience, is the release of funds quick enough to meet the needs of those affected?
- C. What government policies and frameworks can guide communities in creating AA plans?

- D. How are these policies currently implemented in communities, particularly in DRRM or preparedness efforts?
- E. How are these received by the community?

**4. Who is currently being prioritized in climate change and health initiatives and which groups are potentially underserved?**

- A. For refugees and displaced populations, marginalized people in urban/peri-urban/rural areas, and persons with disabilities, how are their vulnerabilities accommodated in AA plans and programs?
- B. Are there specific programs for certain sectors addressing climate change and health? If so, what are they?
- C. What communication platforms do you use or develop for information dissemination?

**5. What are the roles and mandates of the government and nongovernment actors, and how are the AA triggers compared to traditional humanitarian response?**

- A. What policies guide LGUs in preventing major impacts of climate change and health concerns?
- B. How much resources (e.g., funds, infrastructure, human resources) are allocated to realize these plans and policies?
- C. How do the LGUs integrate the citizens in mandated policies for AA?
- D. How can the current set of plans and policies be improved in your context?

**6. Now that you are more familiar with AA, what outcomes do you hope to see if your plan is implemented? Who in your community would be involved?**

The Feinstein International Center is a research and teaching center based at the Gerald J. and Dorothy R. Friedman School of Nutrition Science and Policy at Tufts University. Our mission is to promote the use of evidence and learning in operational and policy responses to protect and strengthen the lives, livelihoods, and dignity of people affected by or at risk of humanitarian crises.

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