

Global Public Health Situation Analysis

El Niño 2026

Implications for Public Health and Early Action



**World Health
Organization**

This document has been prepared by the WHO Health Emergencies Programme with inputs from technical departments and all regional offices across WHO. It also draws on inputs from partners, including IASC ENSO Cell, MSF HACE and WMO, using the information available as of the end of July 2026.

Further updates may be published as the situation evolves and health risks change.

Contents

Overview.....	1
Public Health Risks.....	4
Summary of Public Health Risks	4
Public Health Risks by Region: Where and When to Respond	11
Urgent Actions to Minimize Health Impacts.....	17
Areas Where WHO can Support Member States and Partners	20
Annex 1: Hazard-Specific Guidance	22
Annex 2: Detailed Information on Public Health Risks	26
Annex 3: Monitoring Service Availability and Health System Functionality	44
HeRAMS: a Case Study in Monitoring Health System Functionality	44
Annex 4: Community Protection Considerations for El Niño-Related Public Health Risks	48
Annex 5: Potential Monitoring Indicators.....	51
References	53

Overview

This document has been developed to support countries in preparing for, anticipating, and responding to El Niño health impacts. It aims to provide a support to country- and region-specific risk analyses, to inform planning and support connections between risk and operational tools. The purpose of this document is thus to advocate for **awareness** and the importance of **early action**. The document is not intended to be standalone operational guidance. Updates can be expected as the situation evolves.

This event arrives at a time of particular concern, with numerous compounding risk factors increasing global vulnerability to health emergencies includingⁱ:

- A warming world and record global temperatures,
- Severe humanitarian funding constraints,
- Global economic shocks and rising prices and disruption in liquefied natural gas and fertilizer supply chains,
- Pre-existing acute food insecurity across multiple regions,
- Multiple conflicts globally generating food insecurity and displacement,
- An Ebola outbreak in the Democratic Republic of the Congo also impacting neighbouring countries, all of whom are at risk from El Niño-driven changes, and
- Increasing incidences of diseases in some regions (such as cholera or dengue) that are sensitive to changes in climate.

El Niño conditions have developed in the tropical Pacific and are forecast to strengthen rapidly over the coming months, increasing the likelihood of heatwaves, droughts, heavy rainfall and other extreme weather events in many parts of the world, according to the World Meteorological Organization (WMO)ⁱⁱ. WMO has stated that forecast models show remarkable agreement, and there is high confidence in the outlookⁱⁱⁱ.

Throughout July-September 2026, WMO's multi-model ensemble indicated a rapid development into a strong El Niño event^{iv}. Conditions are forecasted by WMO to continue intensifying and to **exceed strong El Niño thresholds** in August-October 2026 (**Figure 1** and **Figure 2**) and expected to peak towards the end of 2026. WMO forecast models indicate the likely development of a positive Indian Ocean Dipole (IOD; a climate pattern causing warmer than average temperatures in the western Indian Ocean, while the eastern Indian Ocean becomes cooler than average), which could enhance El Niño impacts in some regions. As highlighted in the Inter-Agency Global ENSO Analysis Cell's 2026 report, El Niño events can produce more predictable seasonal weather patterns, creating a window of opportunity to act, before events become crises^v.

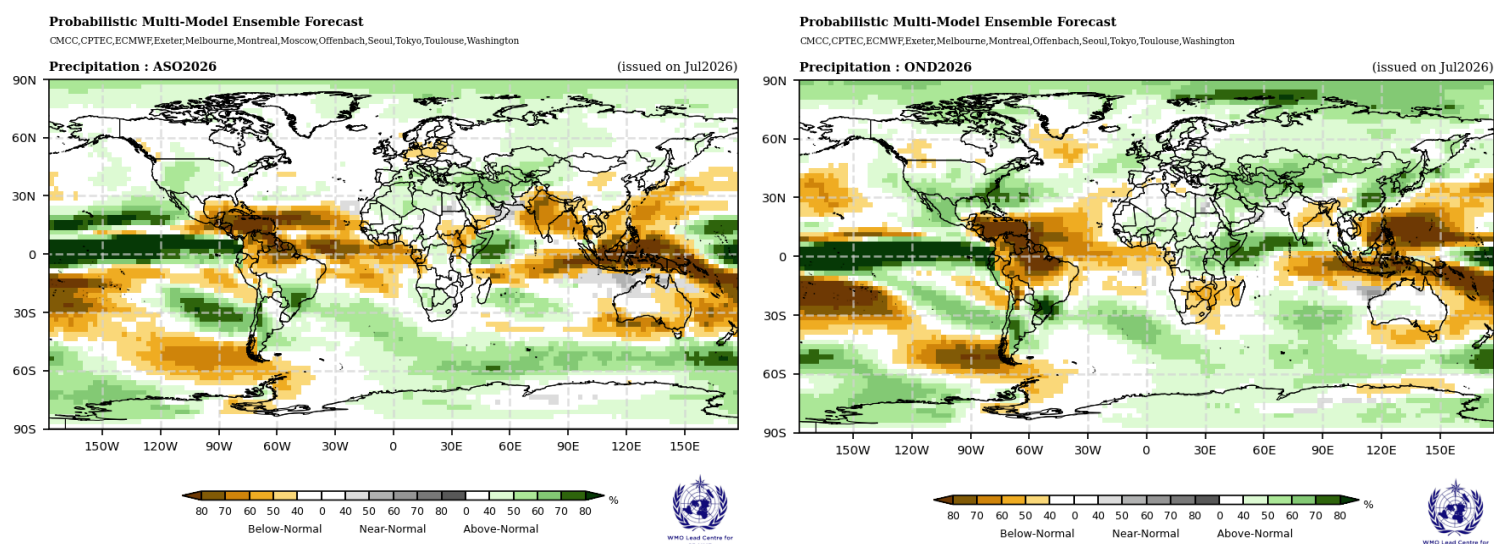


Figure 1. Forecast models for precipitation for August–October 2026 (left) and October–December 2026 (right), as provided by WMO: WMO Lead Centre for Seasonal Prediction Multi-Model Ensemble (LC-SPMME) and WMO Global Seasonal Climate Update (GSCU). Note from WMO: The tercile probabilities are the forecast probabilities that the temperature or precipitation will be in the lower 33.3% of the climatological distribution (below-normal), the middle 33.3% (near-normal), or the upper 33.3% (above-normal). The probability of the dominant tercile is the probability of the tercile that has the highest forecast probability. Day-to-day and week-to-week variations, including opposite signal of the most likely tercile, may occur during the forecast period. **Above-normal:** Western coastal and southern South America, western North America, eastern East Africa, parts of Central Asia and the Middle East, central and eastern equatorial Pacific islands, parts of southern Europe. **Below-normal:** Central America and the Caribbean, northern South America, western East Africa, parts of northern Europe, most of South Asia, Maritime Continent (**), southern equatorial Pacific islands, southern and eastern Australia.

The WMO Coordination Mechanism for humanitarians ([WCM](#)) ‘Global Seasonal Climate Outlook Briefing to UN and Humanitarian Agencies’ on 29 July 2026 highlighted that:

The seasonal precipitation outlook for August–October 2026 reflects a strong influence of El Niño in several regions (**Figure 1**). El Niño is expected to continue strongly influencing precipitation patterns in October–December 2026, especially in tropical regions. Globally, there is a high likelihood of above-normal temperatures (**Figure 2**). WMO has noted that this event additionally occurs against the backdrop of long-term climate change and other climate patterns, meaning that past events may no longer be predictive of the current event, and assumptions and forecasts should be continuously reviewed to provide a sound basis for anticipatory action. While precipitation anomalies associated with El Niño vary geographically and may result in wetter- or drier-than-normal conditions, the latest WMO outlook indicates that widespread above-normal temperatures are very likely globally. Temperature anomalies should therefore be assessed as an additional consideration to wet

and dry precipitation patterns.

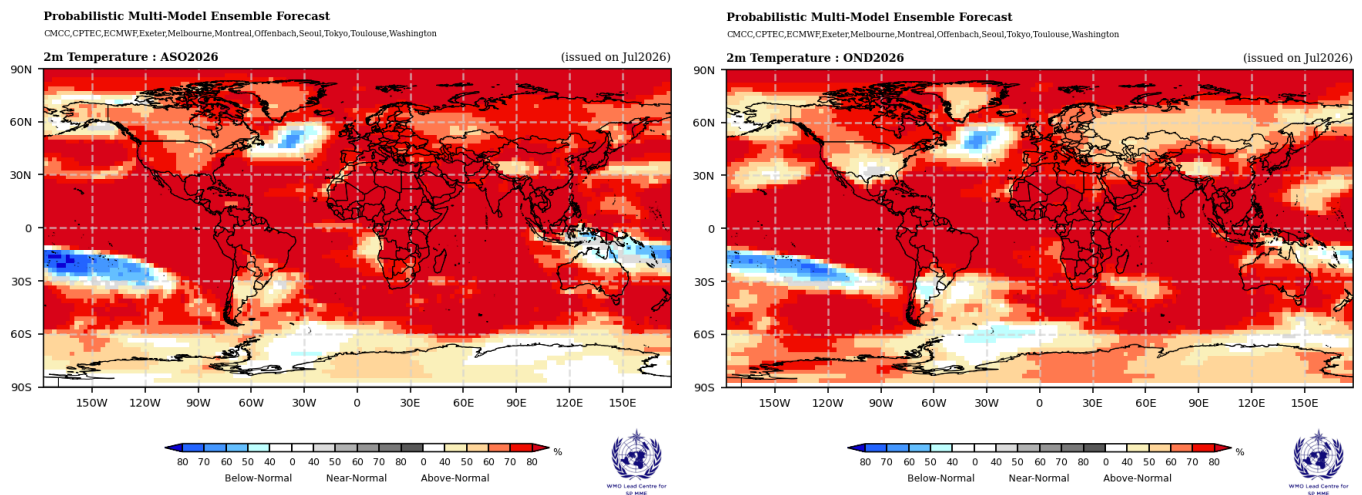
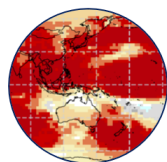


Figure 2. Forecast models for temperature for August–October 2026 and October–December 2026, as provided by WMO: WMO Lead Centre for Seasonal Prediction Multi-Model Ensemble (LC-SPMME) and WMO Global Seasonal Climate Update (GSCU). Note from WMO: The tercile probabilities are the forecast probabilities that the temperature or precipitation will be in the lower 33.3% of the climatological distribution (below-normal), the middle 33.3% (near-normal), or the upper 33.3% (above-normal). The probability of the dominant tercile is the probability of the tercile that has the highest forecast probability. Day-to-day and week-to-week variations, including opposite signal of the most likely tercile, may occur during the forecast period. **Above-normal:** Widespread, with very high probability in Africa, most of Asia, northern Maritime Continent (**), Central America and the Caribbean, northern and central South America, parts North America, Europe. **Below-normal:** South Pacific subtropical region.

Public Health Risks

El Niño-driven changes impact health

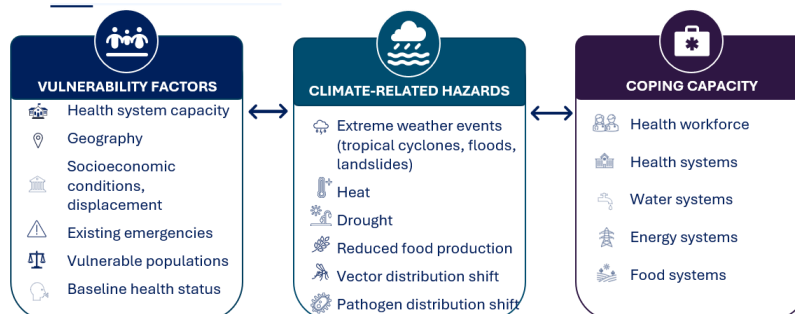
1. CLIMATE DRIVER



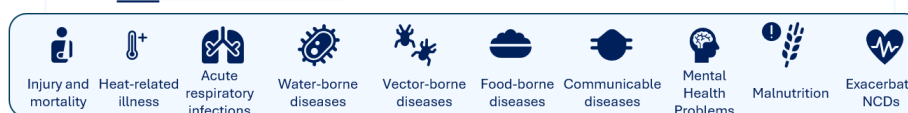
El Niño

Warming of sea surface temperatures in the central and eastern Pacific alters weather patterns globally.

2. RISK PATHWAYS



3. ELEVATED PUBLIC HEALTH RISKS



RISK IS UNEVENLY DISTRIBUTED: Impacts are greatest for vulnerable populations and settings with low adaptive capacity.

4. IMPACTS ON HEALTH SYSTEM & FACILITIES



- Damage to health facilities
- Reduced access to health care.
- Increased demand for health services.
- Disruption of health services.

Figure 3. Heightened El Niño-Related Health Risks. El Niño conditions increase the probability of extreme weather in certain regions in certain seasons that exacerbate and trigger a range of health risks^{vi}. Figure adapted from: Quality criteria for integrating health into Nationally Determined Contributions (NDCs). Geneva: World Health Organization; 2024. Licence: CC BY-NC-SA 3.0 IGO.

Summary of Public Health Risks

This section and its corresponding Annexes were adapted from WHO: El Niño and Health – Global Overview (January 2016)^{vii} and the WHO/WMO Public Health Situation Analysis: El Niño – Global Climate Event – (October–December 2023)^{viii} and further informed by a scoping review^{ix}.

El Niño does not directly cause disease. It can instead be considered as a risk modifier (**Figure 3**), **with the greatest risks expected where El Niño-related climate anomalies coincide with weak health systems, low population immunity, poor access to care and environmental conditions favorable to disease transmission**. El Niño may also disrupt critical public health functions such as surveillance systems, laboratory networks, emergency coordination, supply chains and continuity of essential health services.

The magnitude of public health impacts associated with El Niño varies depending on how strongly El Niño influences local climate, as well as local coping capacities and vulnerabilities. The likelihood of risks thus may differ from country to country, and even within country. The public health consequences and level of risk are highly dependent on the vulnerability and coping capacity of the area. Additionally, while El Niño can contribute to increased extreme weather conditions, it can also alter risk for various diseases simply by contributing towards

changing weather conditions. Public health consequences associated with extreme weather or changing conditions are interrelated and can occur due to a range of factors:

1. Impacts on physiology

- Elevated temperatures can affect populations in both wet and dry conditions, with the magnitude of health impacts influenced by the intensity and duration of heat, humidity and night-time temperatures, population exposure and vulnerability, and the capacity of health and social systems to protect at-risk populations.
- Heat exposure can directly result in heat exhaustion and heatstroke and can also contribute to death and severe illness by exacerbating cardiovascular, respiratory, renal, metabolic and mental health conditions (**Figure 4**).
- Extreme heat is an important environmental and occupational health hazard and a leading cause of weather-related mortality and morbidity and can exacerbate underlying NCDs.
- Recent studies show the impact of heat on maternal and perinatal outcomes including preterm birth, stillbirth, congenital anomalies, small-for-gestational-age newborns, and cardiovascular events during labour^x.

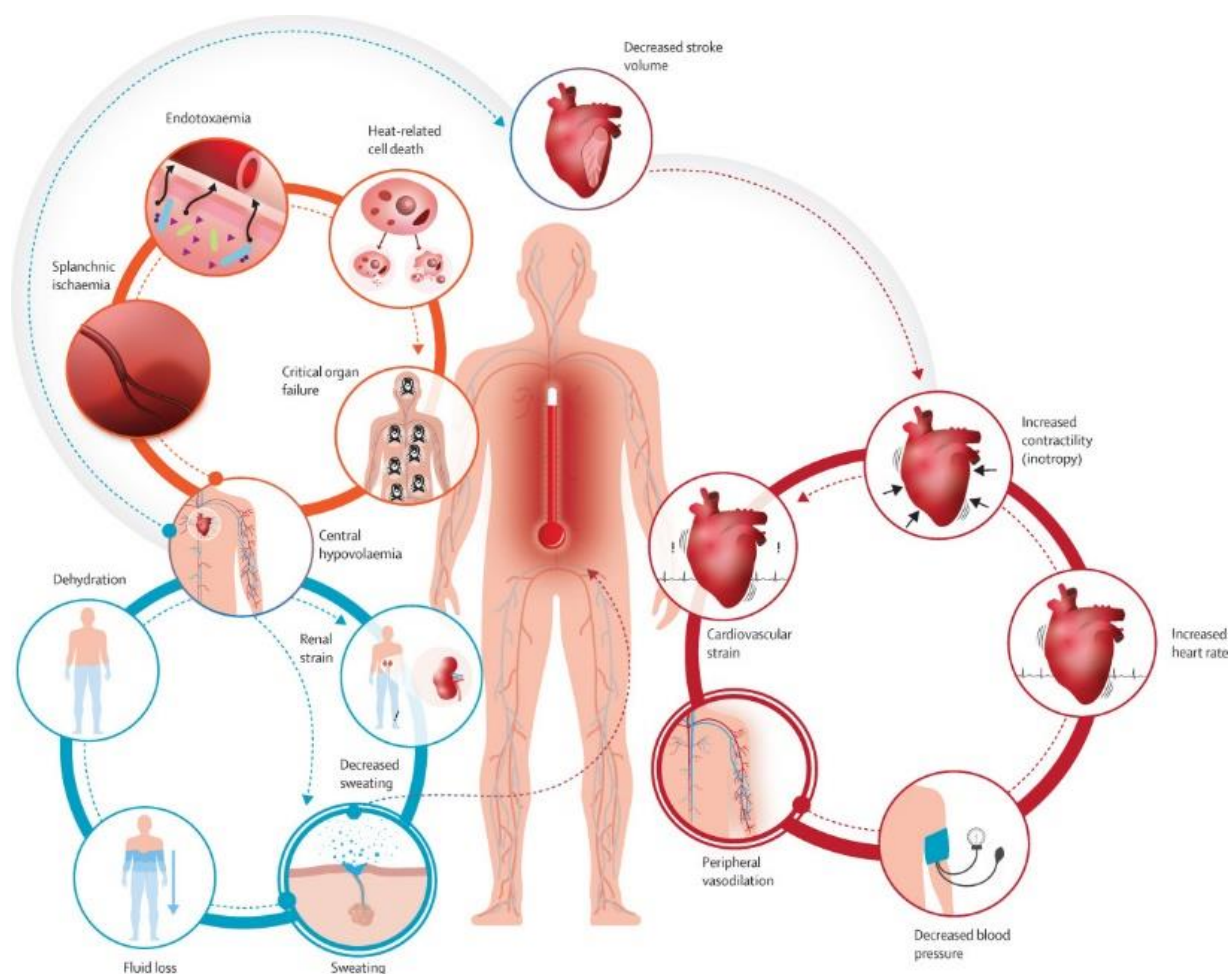


Figure 4. Illustration of the physiological pathways of human heat strain. Figure from: Ebi K, Capon A, Berry P et al. Hot weather and heat extremes: health risks. *The Lancet*, 398, 698-708

2. Impacts on mobility, livelihoods and displacement

- Droughts and flooding may disrupt food production, livelihoods and access to safe water and increase the risk of food insecurity and malnutrition.
- Flooding, tropical cyclones, landslides and intense rainfall may cause loss of life, injuries and significant population displacement.
- Climate-related mobility increases in both wet and dry conditions (for example, due to flooding or wildfires), with potential consequences for access to health care, continuity of treatment, protection and mental health and psychosocial well-being;
- Displacement, loss of livelihoods, food and water insecurity, overcrowding and disruption of community and protection systems may increase exposure to gender-based violence (GBV), including sexual violence, intimate partner violence, exploitation and abuse, with associated physical, sexual and reproductive and mental health consequences.

3. Impacts access to care

- Flooding, tropical cyclones, landslides and intense rainfall may damage or close health facilities and critical infrastructure, reducing regular health service delivery and restricting access to healthcare during the emergency and well beyond the event.
- Climate-related mobility may have consequences for access to health care and continuity of treatment.
- Disruptions to surveillance systems, laboratory capacity, service provision emergency coordination and medical supply chains may delay outbreak detection and response, particularly in fragile and humanitarian settings.
- The capacity of health and social systems to protect at-risk populations influences the magnitude of health impacts associated with elevated temperatures.

4. Impacts on disease patterns

- Droughts and flooding may heighten the risk of water-borne, vector-borne and food-borne infectious diseases.
- Extremely hot and dry conditions may lead to heat waves, wildfires, increased smoke and deteriorating air quality, causing or exacerbating heat-related illness, acute respiratory diseases, and other noncommunicable diseases (NCDs).
- El Niño-related warmer temperatures may lead to vector-borne disease epidemics in high altitude areas where vectors are present but cooler temperatures normally limit transmission.
- Overcrowding and disrupting living conditions may increase the risk of acute respiratory infections and other communicable diseases and exacerbate pre-existing NCDs.
- Damaged or flooded sanitation infrastructure may lead to water-borne diseases.

5. Impacts are greatest for those facing humanitarian emergencies

- Disruptions to surveillance systems, laboratory capacity, emergency coordination and medical supply chains may delay outbreak detection and response, particularly in fragile and humanitarian settings.
- Climate-related mobility increases in both wet and dry conditions (for example, due to flooding or wildfires), with potential consequences for access to health care, continuity of treatment, protection and mental health and psychosocial well-being.
- Populations already affected by humanitarian crises, including internally displaced persons, refugees and people living in camp or camp-like settings, face heightened public health risks under both wet and dry conditions, including infectious diseases, malnutrition, injuries, protection risks and mental health problems.
- Vulnerable populations within countries, including children under five, pregnant and lactating women, older people, persons with disabilities, people with chronic diseases (NCDs), migrants, refugees, internally displaced people, urban slum populations, remote mountain communities, small-island and coastal communities all face heightened public health risks under both wet and dry conditions.

In addition to the impact of heat, potential public health impacts can be grouped into those linked with increased dry conditions (**Table 1**) and those linked with increased wet conditions (**Table 2**). The risk table below presents a broad risk analysis of these expected risks. More nuanced discussions on these by region countries identified as high risk for potential humanitarian challenges are then identified (**Table 3**). Links to risk-specific guidance documents are provided in **Annex 1**. A more detailed rationale for each specific health risk is presented in the **Annex 2**.

The level of risk can be interpreted as follows:

Level of Risk
Red: Very high risk. Could result in high levels of excess mortality/morbidity.
Orange: High risk. Could result in considerable levels of excess mortality/morbidity.
Yellow: Moderate risk. Could make a minor contribution to excess mortality/morbidity.
Green: Low risk. Unlikely to make a significant contribution to excess mortality/morbidity.

Table 1. Public health risks associated with **warmer- and drier-than-normal conditions** in the context of El Niño

Public health risk	Likelihood	Public health consequences	Level of overall risk*	Rationale
Malnutrition	Almost certain	Severe	Very high risk	Increased food insecurity and diarrhoea likely to negatively affect the nutritional status of vulnerable population, especially in drought-affected regions. This may further contribute to population displacement, compromise access to essential services and health diets and increase the risk of acute malnutrition, particularly among children under five and pregnant and breastfeeding women. Drought-stressed crops may also become more vulnerable to some insect pests and disease.
Cholera and other waterborne diseases	Highly likely	Severe	Very high risk	Water contamination and worsening hygiene often occur due to water scarcity in event of droughts.
Heat Stress	Almost Certain	Major	Very high risk	Heat stress is a leading cause of weather-related death and can exacerbate underlying illnesses. Heat stress, heat exhaustion and heatstroke are all at heightened risk, with risk further increased among vulnerable populations and outdoor workers.
Respiratory Illness	Almost certain	Major	High risk	Air pollution and its impacts on respiratory function results from multiple mechanisms, including smoke from wildfires, haze events and dust from droughts. These can contribute to increased respiratory morbidity in affected populations. Heat can further exacerbate respiratory illnesses.
Conditions requiring mental health and psychosocial support	Highly likely	Moderate	High risk	Reduced livelihoods, food insecurity, and displacement may increase psychological distress and exacerbate existing mental health conditions.
Gender-based violence	Highly likely	Moderate	High risk	Reduced livelihoods, food insecurity, and displacement, may increase protection risks in some contexts, including gender-based violence, sexual exploitation and abuse. Increased distances travelled to access water, food and other essential resources, economic stress and disruption of community and protection systems may further increase exposure to violence.
Arboviral diseases (Dengue, Zika,	Likely	Moderate	High risk	Drought and water shortages can lead to storage of water in containers favorable for the breeding of mosquitoes that transmit arboviral diseases. In

Chikungunya, Yellow fever, RVF etc)				some settings, drying rivers and water bodies can also leave isolated pools suitable for mosquito breeding. High temperatures associated with El Niño can further increase transmission potential where temperatures remain within ranges favourable to the vector and virus.
Direct injuries	Likely	Moderate	High risk	Direct injuries attributable to fires, injuries associated with displacement, and occupational injuries experienced by outdoor workers.
Exacerbated NCDs	Likely	Moderate	High risk	Exacerbation of NCDs linked to decreased access to health services and disruption of essential NCD treatments and medication access. Strain on cardiovascular and respiratory related diseases and increased risks of kidney complications in pre-existing conditions due to higher temperatures and likelihood of heat waves. Malnutrition can further exacerbate resilience to NCDs.
Malaria	Likely	Moderate	High risk	El Niño-associated changes in rainfall and temperature may increase malaria transmission risk, particularly in epidemic-prone areas, high-altitude/transmission-fringe settings, and humanitarian contexts. Displacement and health-system disruption may further increase risk by impacting surveillance, vector control, diagnosis and treatment.
Other zoonotic diseases	Likely	Moderate	High risk	Increased vector breeding sites, exposure to vectors and movement of animals.
Vaccine-preventable diseases	Likely	Moderate	High risk	Decreased access to health services due to displacement, or disruption of routine immunization services from they hazardous event. Overcrowding in displacement settings may further increase the risk of transmission of vaccine-preventable diseases, particularly those spread through the air, including meningococcal infections, diphtheria and measles.
Worsening maternal and child health	Likely	Moderate	High risk	Decreased access to health services, displacement, others.
Biotoxins: fish and shellfish poisoning	Likely	Minor	Moderate risk	Increased sea surface temperatures resulting in algal proliferation. Some associations between biotoxins and El Niño have been observed in both marine and freshwater settings.
Rodent-borne diseases	Likely	Minor	Moderate risk	Dry conditions and reduced availability of food and water may alter rodent populations and behavior, potentially increasing exposure to rodent-borne diseases.

Table 2. Key health risks associated with **warmer-** and **wetter-than-normal conditions** in the context of El Niño

Public health risk	Likelihood	Public health consequences	Level of overall risk*	Rationale
Cholera and other waterborne diseases	Highly likely	Severe	Very high risk	Water contamination due to flooding; deteriorations in hygiene and sanitation conditions.
Malnutrition	Highly likely	Severe	Very high risk	Increased food insecurity due to crop inundation, livestock losses and diarrhoea may result in malnutrition. This may further contribute to population displacement, resulting in lower access to nutrition services and healthy diets. Wetter conditions may also produce favorable conditions for certain crop pests and fungal diseases, which may compromise food availability and heighten the risk of malnutrition.
Arboviral diseases (Dengue, Zika, Chikungunya, Yellow fever, etc)	Highly likely	Moderate	High risk	Increased rainfall may create or expand vector breeding through the accumulation of standing water, potentially increasing vector abundance and the risk of arboviral disease transmission.
Conditions requiring mental health and psychosocial support	Highly likely	Moderate	High risk	Reduced livelihoods, food insecurity, displacement, others.
Direct injuries	Highly likely	Moderate	High risk	Direct injuries mostly attributable to flooding and storms.
Gender-based violence	Highly likely	Moderate	High risk	Reduced livelihoods, food insecurity, displacement, others.
Heat Stress	Highly likely	Moderate	High risk	High temperatures combined with increase humidity may increase the risk of heat stress, heat exhaustion and heatstroke, with risk further increased among vulnerable populations and outdoor workers. Heat stress is a leading cause of weather-related deaths and can exacerbate underlying illness.
Malaria	Highly likely	Moderate	High risk	Increased rainfall may create or expand mosquito breeding sites and increase malaria transmission, particularly in epidemic-prone and transmission-fringe settings. Flooding, displacement and disruption to surveillance, vector control, diagnosis and treatment may further increase risk. Impacts may emerge in the weeks to months following increased rainfall.

Exacerbated noncommunicable diseases (NCDs)	Likely	Moderate	High risk	Exacerbation of NCDs linked to decreased access to health services and disruption of essential NCD treatments and medication access. Malnutrition can further exacerbate resilience to NCDs.
Other zoonotic diseases	Likely	Moderate	High risk	Increased vector breeding, exposure to vectors and movement of animals.
Vaccine-preventable diseases	Likely	Moderate	High risk	Reduced access to health services due to displacement, or disruption of routine immunization services following hazardous events, may increase the risk of vaccine-preventable disease outbreaks. Overcrowding, poorly ventilated living conditions and inadequate access to safe water and sanitation in displacement settings may further increase transmission risk, particularly for highly transmissible diseases such as measles.
Worsening maternal and child health	Likely	Moderate	High risk	Decreased access to health services, displacement, others.
Neglected Tropical Diseases (NTDs): Schistosomiasis and snakebite envenoming	Likely	Minor – Moderate (Schistosomiasis) Moderate (Snakebite)	Moderate risk	Increased rainfall and flooding may alter freshwater ecosystems and increase human contact with infested water, potentially increasing the risk of schistosomiasis transmission in endemic areas. Flooding and population displacement may also increase human-snake encounters, while disruption of access to health services and antivenom may increase the risk of severe outcomes from snakebite envenoming. The magnitude of these risks is context-specific and will depend on local endemicity, the extent and duration of flooding, population exposure and access to timely and appropriate health services.
Rodent-borne diseases	Highly likely	Minor	Moderate risk	Increased breeding and movement of rodents.
Biotoxins: fish and shellfish poisoning	Likely	Minor	Moderate risk	Increased sea surface temperatures resulting in algal proliferation. Some associations between biotoxins and El Niño have been observed in both marine and freshwater settings.

Public Health Risks by Region: Where and When to Respond

Potential high and very high risks by region or sub-region are presented in the table below. Regional risk profiles aim to provide more context of the global wet-dry risk assessment. The level of risk and the risks that can be anticipated will still differ considerably between countries as well as within a country. Additionally, the Indian Ocean Dipole (IOD) is also forecast to experience development of the **positive IOD phase**^{xi}. A positive IOD would

reinforce El Niño dryness across the Maritime Continent and South and Southeast Asia, while amplifying above-normal rainfall and flood risk in equatorial East Africa during October–December 2026^{xii}.

As mentioned in the section above, **vulnerable populations** are at an elevated risk, and their needs should be central to emergency risk management activities.

Outside of the country-specific risks, **health facility vulnerability** is an important area of consideration for any country expecting to experience elevated El Niño-related risks. Floods, cyclones, storm surges, landslides, forest fires and road disruption can damage facilities or cut off access. Heat and power/water stress can place additional risks to health facility functionality, health workers and patients.

Any risks and climate signals should be taken as possibilities but not guarantees: each El Niño event is unique. The latest weather forecasts should be consulted.

Table 3. Table outlining, by WHO region, the climate signal related to El Niño, countries with high or very high risks, the risks common to most countries in that region, and risks that are more specific to particular countries. Note that likelihood and impact of a public health risk will differ within a country. The risks presented in Table 3 are intended to raise awareness of heightened risk and should be used in complement to existing risk reports and with awareness that the risks will change over time. Do not use this table as the sole source of information.

African Region	
El Niño-related climate signal	Countries with high or very high risks
Eastern Africa: Drier-than-normal conditions in Western East Africa, and wetter-than-normal in Eastern East Africa expected August–October 2026. Wetter-than-normal conditions expected in Equatorial East Africa in October–December 2026. Central Africa: Above-normal rainfall and river flooding possible. West Africa: Below-normal rainfall in eastern Sahel; above-normal rains in Central Sahel; below-normal rainfall in coastal areas possible, August–October 2026. Southern Africa: Drought risk October 2026–March 2027, northern areas may see wetter-than-normal conditions August–October 2026.	Burkina Faso, Burundi, CAR, Chad, DRC, Eritrea, Ethiopia, Kenya, Madagascar, Malawi, Mali, Mozambique, Niger, Nigeria (north), South Sudan, Uganda, Zambia, Zimbabwe.
Risks (high / very high) common across most countries	
Malaria, vaccine-preventable diseases, exacerbated NCDs In the WHO African Region, El Niño is expected to compound existing humanitarian crises, including armed conflicts, population displacement, recurrent epidemics (Cholera, Ebola disease, Mpox, Yellow fever and Dengue).	
Country-specific risks (high / very high)	
Food insecurity/malnutrition: Ethiopia, Kenya, Madagascar, Malawi, Mozambique, Sahel region, South Sudan, Zambia and Zimbabwe. Cholera: Ethiopia, Kenya, Mozambique, South Sudan, Tanzania and Uganda. Rift Valley fever: Ethiopia, Kenya.	

Meningococcal disease: Burkina Faso, Chad, Mali, Niger and Nigeria.

Yellow fever: Burkina Faso, CAR, Chad, DRC, Ethiopia, Kenya, Mali, Niger, Nigeria, South Sudan and Uganda.

Heat stress: Burkina Faso, Chad, Mali and South Sudan.

Dengue: Burkina Faso, Kenya, Madagascar; however, any areas where dengue is endemic are at risk.

Zika: Burkina Faso.

Crimean-Congo haemorrhagic fever (CCHF): Mali, Namibia.

Chikungunya: Kenya and Madagascar.

Region of the Americas

El Niño-related climate signal	Countries with high or very high risks
Central America and the Caribbean: Generally hotter and drier conditions, particularly in the Central American Dry Corridor and parts of the Caribbean. Pacific coast and parts of southern South America: Above-normal rainfall, flooding and landslides, especially in coastal Ecuador, northern Peru, western Colombia and parts of southern Brazil and the Southern Cone. Northern South America and the Amazon: Increased risk of heat, drought, low river levels and wildfires in parts of Colombia, Venezuela, Guyana, northern Brazil and the Amazon Basin.	Bolivia, Brazil, Colombia, Cuba, Ecuador, El Salvador, Guatemala, Guyana, Haiti, Honduras, Nicaragua, Peru, Suriname, Venezuela.

Risks (high / very high) common across most countries

Malnutrition/food insecurity, cholera/waterborne diseases, Dengue, exacerbated NCDs, heat stress

Country-specific risks (high / very high)

Heat + CKDu: Central American Dry Corridor, particularly Guatemala and Honduras.

Leptospirosis/flooding-related diseases: Brazil, Ecuador and Peru.

Yellow fever: Bolivia, Brazil, Colombia, Ecuador, Peru and Venezuela.

Malaria: Amazon Basin, Colombia, Guyana, Peru and Venezuela.

Oropouche: Brazil, Colombia, Cuba, Guyana, Panama, Peru and Venezuela.

Vaccine-preventable diseases: Haiti.

Measles: Guatemala, Peru, as well as other countries with active transmission or significant immunity gaps.

Chikungunya/Zika: Honduras/Guatemala, Venezuela.

Eastern Mediterranean Region

El Niño-related climate signal	Countries with high or very high risks
Western eastern Africa: Drier conditions (June–September 2026), followed by above-normal rainfall and flooding (October–December 2026; conditional on the state of the IOD). Yemen: Below-normal rainfall, above-normal temperatures. Syria, Iraq, Iran, the Levant: Potential for above-average winter rains with possible flash-flood risk on dry ground; outcomes influenced by IOD. Pakistan: Below-average monsoon possible; outcomes influenced by IOD; December 2026–February 2027 precipitation deficit.	Afghanistan, Djibouti, Pakistan, Somalia, Sudan, Syria, Yemen.

Afghanistan: Drought with possible flooding from above-average winter rains. Gulf Countries: Potential for heat waves.	
Risks (high / very high) common across most countries Heat stress*, malnutrition/food insecurity, vaccine-preventable diseases, vector-borne diseases, water-borne diseases, exacerbated NCDs.	
Country-specific risks (high / very high) Malnutrition/food insecurity: Djibouti, Somalia, Sudan. Cholera/waterborne disease: Somalia, Sudan, Yemen. Dengue: Somalia, Yemen, with any areas where dengue is endemic at risk. Rift Valley fever: Somalia, Sudan, Yemen. Yellow fever: Sudan. Malaria: Djibouti, Somalia, Sudan, Yemen. *Heat Stress: In addition to the countries listed above, Gulf Countries are also at high risk.	
South-East Asia Region	
El Niño-related climate signal South Asia: Drier-than-normal and above-normal heat conditions expected across most of South Asia (August–October 2026). Mainland SE Asia: Drought, heat and water stress; positive IOD may reinforce dryness (August–October 2026).	Countries with high or very high risks Bangladesh, Bangladesh (Cox's Bazar), Bhutan, DPR-Korea, India, Maldives, Myanmar, Nepal, Sri Lanka, Thailand, Timor-Leste. Border areas should also be considered in risk analyses where displacement and cross-border disease transmission may occur, for example: India/Nepal border; India-Bhutan border; borders related to Greater Mekong movements.
Risks (high / very high) common across most countries Heat stress, malnutrition/food insecurity, exacerbated NCDs	
Country-specific risks (high / very high) Cholera/AWD: Bangladesh, Bangladesh (Cox's Bazar) and Myanmar. Leptospirosis: Bangladesh, Bangladesh (Cox's Bazar), Bhutan, India, Nepal, Sri Lanka and Thailand. Malaria: Bangladesh, parts of northeast India and Myanmar. Dengue: Bangladesh, India, Maldives, Myanmar, Nepal, Sri Lanka, Thailand, Timor-Leste. Vaccine-preventable and communicable diseases (linked to potential increases in displacement or decreased access to care): Bangladesh, Bangladesh (Cox's Bazar), India, Myanmar, Nepal and Sri Lanka. Direct injuries: Bangladesh, Bhutan, Maldives, Myanmar, Nepal, Sri Lanka, Thailand (from flood, cyclone, landslides). Some SEARO countries may also experience other climate-sensitive vector-borne diseases (such as Japanese encephalitis, Chandipura virus disease, Kyasanur Forest Disease and scrub typhus) which may be higher risk in specific areas.	
Western-Pacific Region	
El Niño-related climate signal Maritime Continent: Drier-than-normal conditions: drought, heat and water stress possible (August–December 2026). Southern equatorial Pacific Islands: Drier-than-normal conditions: drought and water insecurity	Countries with high or very high risks Cambodia, Fiji, FSM, Indonesia, Kiribati, Lao PDR, Marshall Islands, Palau, Papua New Guinea, Philippines, Solomon Islands, Tuvalu, Vanuatu, Viet Nam.

possible; altered tropical cyclone patterns (August–December 2026).	
Equatorial central and eastern Pacific Islands: Wetter-than-normal conditions possible (August–December 2026).	
Papua New Guinea: In addition to drought concerns, risk of frost in highland areas.	
Risks (high / very high) common across most countries	
Dengue, heat stress, malnutrition/food insecurity, exacerbated NCDs	
Country-specific risks (high / very high)	
Wildfire smoke/air pollution/respiratory illness: Indonesia and surrounding areas.	
Malaria: Papua New Guinea, Solomon Islands.	
Drought and water insecurity: Southern equatorial Pacific Island countries.	
European Region¹	
El Niño-related climate signal	Countries with high or very high risks
Well-above-average temperatures across whole region.	Albania, Bosnia and Herzegovina, central Asian countries, Croatia, Greece, Italy, Kosovo, Moldova, Montenegro, North Macedonia, Portugal, Serbia, Spain, Türkiye, Ukraine.
Southern Europe: Wetter-than-average conditions in southern Europe during early autumn. Extreme heat, drought, water scarcity, major wildfires, increase in arbovirus outbreaks, particularly West Nile and Dengue.	
Western Balkans: drought, wildfires, smoke, reduced hydropower generation and possible interruption of essential health services.	
Central Asia: A strong El Niño would increase the likelihood of above-normal precipitation in parts of Central Asia from autumn 2026 through winter 2026–27 and potentially into spring 2027. Historical evidence indicates that the wet signal is generally stronger and more persistent during strong El Niño events.	
Ukraine and Moldova: Conflict-related vulnerabilities exacerbated by extreme weather could further disrupt energy and water availability at household and health care facilities.	
Northern Europe (Scandinavia, Baltic region): Slightly increased chance of drier-than-average conditions.	
Risks (high / very high) common across most countries	
Extreme heat, drought, flooding	
Country-specific risks (high / very high)	
Portugal and Spain: Extreme heat, water shortage, flooding.	
Ukraine: Power and energy shortage disrupting essential health services, infectious disease outbreaks, respiratory diseases, NCDs and cold related risks in front line areas.	
Central Asian countries: Flooding including flash floods and mudflows.	

¹ Forecast confidence for Europe remains relatively low compared with tropical regions. Other factors – especially the North Atlantic Oscillation (NAO), Arctic circulation, and regional sea-surface temperatures – often have a larger influence.

Urgent Actions to Minimize Health Impacts

The forecast creates a genuine opportunity to act before impacts peak^{xiii}.

Broadly speaking, three windows have been identified by the IASC ENSO Cell that can be used to take action to protect lives and livelihoods^{xiv}. The timing on when impacts are expected to peak will differ by each region (see **Figure 5**. A more detailed calendar for the three windows in different geographic areas is available in the IASC ENSO Cell Report)^{xv}.

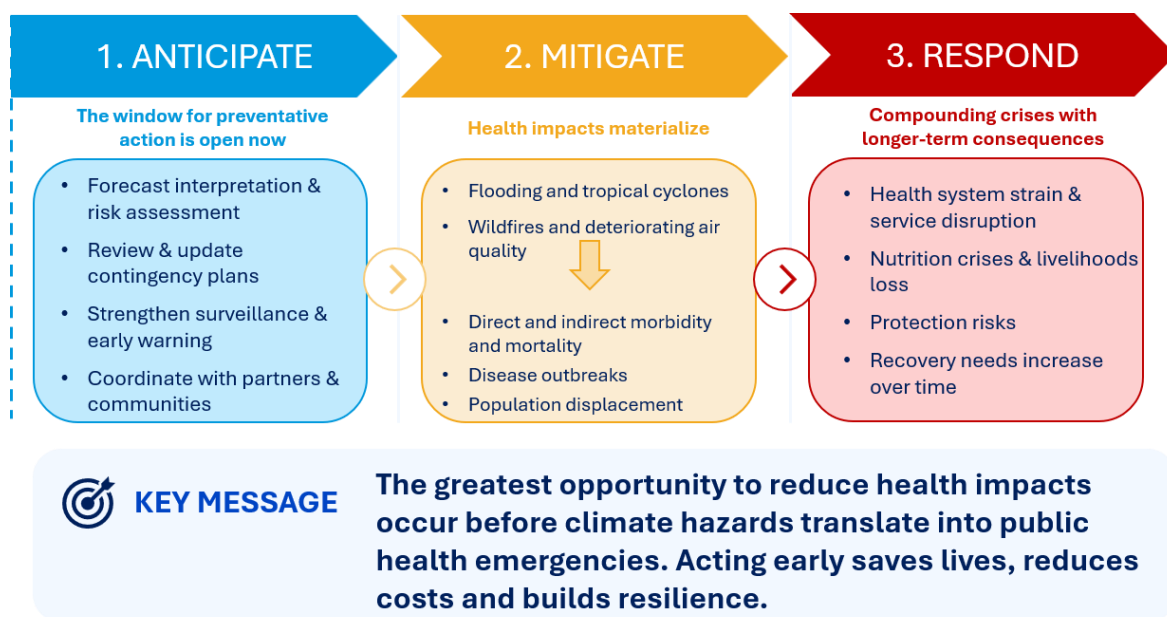


Figure 5. The three windows of opportunity as identified by the IASC ENSO Cell Report.

In each of the broad windows of opportunity, specific actions can be taken to reduce potential impacts of a risk. While ENSO forecasts are available with high confidence, there is greater uncertainty in predicting the resulting health risks and impacts, as many other contextual and environmental factors influence outcomes. Additionally, as the risk will differ across and even within countries, actions should be tailored to contexts. Below outlines health-related actions within each window, followed by a description of areas where WHO can provide support Member States and partners:

1. **Anticipate** - *Anticipatory Action to protect health and health infrastructure*

In the anticipate stage, there is the opportunity to act ahead of the peak of the season to identify where risks might substantially heighten, communicate risks, verify health emergency operational readiness, flag high-risk areas and confirm that surveillance and essential health service continuity arrangements are functioning well. Actions may include:

- Establishing and maintaining regular coordination with national meteorological and hydrological services (NMHSs), national disaster management authorities and other relevant actors to interpret seasonal forecasts, real-time conditions, and local rainfall and temperature outlooks.

- Strengthening knowledge and information management mechanisms to capture and analyse El Niño-related health consequences and support timely operational decision-making.
- Strengthening surveillance and early warning systems for climate-sensitive diseases and other public health risks using a One Health approach, including routine monitoring of infectious disease incidence and other potential climate-related health effects.
- Collecting information on baseline health indicators to identify early warning signs of system stress and potential risks.
- Strengthening cross-border collaboration and information sharing, including joint risk assessment and coordinating preparedness actions, particularly in high-risk areas where climate-related displacement and population mobility may increase public health risks.
- Verifying and testing of scenario-based health emergency contingency and trigger-based response plans, including referral pathways and coordination mechanisms and arrangements for continuity of essential health services. Plans should account for the direct health consequences of climate-related hazards and concurrent emergencies, including displacement and refugee situations.
- Aligning anticipatory action frameworks with national contingency plans.
- Identifying and strengthen essential health services that must be maintained during El Niño-related shocks, including maternal, newborn and child health, immunization, nutrition services, NCD care, mental health and psychosocial support, and management of common communicable diseases. Ensure that relevant protocols, Standard operating procedures and guidelines for these measures are validated and disseminated.
- Mapping health facilities vulnerabilities and operational continuity in high-risk areas, including primary health care (PHC) facilities, and identify areas where preparedness measures can mitigate the potential consequences of hazards.
- Supporting countries to undertake rapid readiness assessments at national and subnational level, identifying critical gaps and implementing corrective actions before forecast impact peak.
- Supporting countries prior to mobilizing funds to assess whether they are able to absorb and act on elevated risks, or if additional resources are needed outside of what may currently be mobilized/planned for.
- Conducting risk communication and community engagement to support operational readiness, using clear and consistent messages to keep the public and health-sector response agencies informed about climate hazards and associated health risks.
- Finalizing anticipatory action-related resource mobilization measures and frameworks.
- Increasing forecast-based financial resources.

- Strengthening interagency collaboration and coordination mechanism at national and subnational level specially in at high-risk areas.
- Verifying readiness of health workers for priority risks through refresher trainings, including PHC teams and community health workers.
- Ensuring local risk assessments contain exposure of vulnerable groups, health system vulnerability and coping capacity.
- Ensuring risk-informed strategic stockpiling of medical countermeasures, including, where relevant, pre-positioning of essential medicines, vector-control commodities and communications equipment.
- Work with specific health or disease-specific programmes to raise awareness of the heightened risks.

2. **Mitigate** - *Mitigate immediate consequences*

As impacts begin to be seen, key risk mitigation measures may help to protect health systems and population health before health services become overwhelmed:

- Planning for a potential surge in health workforce capacity.
- Scaling up nutrition screening in communities and facilities; scale up community-based management of malnutrition where risks are increasing (outpatient and inpatient), in coordination with partners. Monitor trends and regularly disseminate trend analysis.
- Verifying stockpile levels and supply chain continuity for essential medicines and outbreak response supplies and confirming availability of critical operational and communications equipment.
- Conducting just-in-time or refresher training for health workers.
- Implementing risk mitigation measures, particularly for vulnerable populations such as women, children, older people, people with chronic diseases, people with disabilities and displaced populations including refugees and migrants.
- Enhancing operational readiness for outbreaks for climate-sensitive diseases.
- Ensuring and maintaining continuity of essential health services, including maternal, newborn and child health, immunization, nutrition, NCD care, mental health and psychosocial support, and referral services, particularly in high-risk and hard-to-reach populations, with adequate age-appropriate medicines, commodities and supplies and functioning referral pathways.
- Analyzing where health risks may deteriorate based on baseline status, and quantify the population exposed per type of hazard to estimate health needs.
- Identify high-risk cross-border areas where climate-related displacement and population mobility may increase public health risks, and plan accordingly.
- Identifying which hospitals and PHC facilities are likely to be impacted first based on risk profiles. For health facilities deemed most vulnerable, identify options to maintain

flexible service delivery, including advance notification, referral arrangements, mobile clinics, outreach services and support from partners.

3. **Respond** - *Operational readiness for impact*

When impacts materialize and operations need to scale, priority actions can include:

- Activating emergency response mechanisms and surge capacity.
- Activating health sector/cluster coordination mechanisms and partner engagement.
- Scaling delivery of life-saving health, nutrition, and WASH services.
- Supporting continuity of essential health services while responding to outbreaks or climate-related emergencies.
- Where routine services are disrupted, planning and implementing appropriate catch-up or recovery activities, including vaccine campaigns and other priority services, based on identified gaps and population needs.
- Expanding disease surveillance, outbreak investigation and rapid response capacities.
- Deploying or scaling mobile clinics, outreach teams and community-based health services where fixed facilities are damaged, inaccessible or overwhelmed.
- Ensuring essential medicines, vaccines, diagnostics and supplies are available for priority services and climate-sensitive health risks.
- Maintaining clear and consistent public and health-sector communications on evolving climate hazards, health risks and recommended protective actions.
- Consolidating climate, health and operational information through strengthened knowledge and information management mechanisms to support situation awareness and response decisions.
- Where response involves cross-border health risks, coordinate with relevant authorities to strengthen response and knowledge sharing.
- Ensuring public health measures in displacement sites, including access to PHC including vaccination, nutrition screening, WASH, IPC, referral pathways, mental health and psychosocial support services and protection-sensitive services.

Areas Where WHO can Support Member States and Partners

WHO can provide technical assistance in the following areas:

- Supporting Ministries of Health to review and update hazard-specific health contingency plans, health-facility readiness plans, referral arrangements and continuity of essential service plans;
- Supporting relevant countries to integrate El Niño considerations and anticipated health impacts and potential for outbreaks into their Humanitarian Needs and Response Plan (HNRP) planning and contingency planning. For HNRP planning, supporting in assessing the severity of health needs (Joint Intersectoral Analysis Framework, JIAF);
- Supporting the development and implementation of heat-health action plans, including heat alerts, public communication, cooling arrangements in health facilities,

community health worker outreach, hospital surge planning and heat–health surveillance. WHO’s 2026 heat–health action plan guidance identifies governance, warning systems, identification of at-risk populations, communication, health-system resilience, heat-exposure reduction, surveillance and monitoring as core components. It provides ready-to-use user action briefs for priority sectors (including health and social care, occupational, educational and childcare, and the urban and built environment) to help translate HHAP priorities into operational actions;

- Supporting wasting protocol validation, strengthening workforce capacity on the treatment of acute malnutrition at the facility level and improve health workers capacity on promotion, protection and support of breastfeeding and timely and safe introduction of complementary feeding. Provide technical support on the monitoring and analysis of acute malnutrition;
- Supporting facility-level assessments and monitoring for the risk mitigation of water, power, cold chain, oxygen, referral routes, safe evacuation, infection prevention and control and continuity of essential services, recognizing that extreme weather can damage health facilities, disrupt energy and water supplies, block transport and supply routes, and restrict patient access;
- Strengthening alternative service delivery platforms, including emergency referral plans, mobile medical teams, Emergency Medical Team deployment, planning for task shifting, health-worker safety and rapid post-disaster health assessments. WHO’s Emergency Medical Teams initiative supports the timely delivery and quality of emergency health services and strengthens national capacity to activate and coordinate rapid response following disasters, outbreaks and other emergencies;
- Supporting water-quality surveillance, preparedness for acute watery diarrhoea and cholera, public health messaging on safe water, readiness of oral rehydration solution and intravenous fluid supplies, and coordination with WASH partners. Decisions on water allocation, irrigation and reservoir management remain the responsibility of government water authorities, WASH agencies, and hydrometeorological and disaster-management systems. In the South-East Asia Region, for example, SEARHEF-supported health emergency activities have included safe water access, vector-borne disease prevention, disease surveillance and health education;
- Strengthening rapid risk assessment, event-based surveillance, and early warning, alert and response systems. WHO’s EWARS is designed to improve outbreak detection in emergencies, including conflict settings and disasters, while WHO epidemiological bulletins can support situational awareness, risk assessment and response planning; and
- Tailoring risk communication, referral and outreach plans, and advocacy plans to other health programmes to the needs of vulnerable populations at increased risk.

Annex 1: Hazard-Specific Guidance

The below table provides links to helpful guidance documents or tools for the hazards highlighted in this report. The UNDRR's [Hazard Information Profiles \(HIPs\)](#) can also be consulted for an overview of hazard drivers, impacts and risk management^{xvi}.

Table A1.1. Key guidance documents and tools relevant to El Niño-related public health risks and technical areas

Public Health Risk/ Technical Area	Key Available Guidance Documents/Tools
Humanitarian response	Preliminary guidance for a package of high-priority health services for humanitarian response (H3 package) . Geneva: World Health Organization; 2024. Licence: CC BY-NC-SA 3.0 IGO.
Malnutrition	1. WHO guideline on the prevention and management of wasting and nutritional oedema (acute malnutrition) in infants and children under 5 years. Geneva: World Health Organization; 2023. Licence: CC BY-NC-SA 3.0 IGO. 2. Addressing nutrition in emergencies 3. Strategic framework to guide health and nutrition actions in response to increased malnutrition and health risks during food crises. Geneva: World Health Organization; 2026. Licence: CC BY-NC-SA 3.0 IGO.
Cholera and other waterborne diseases	1. Guidelines for drinking-water quality: small water supplies. Geneva: World Health Organization; 2024. Licence: CC BY-NC-SA 3.0 IGO. 2. Sanitary Inspections for drinking-water supplies 3. Water safety planning 4. Global Task Force on Cholera Control: Tools and Technical Guidance 5. Cholera outbreak toolbox
Heat stress and air pollution	1. Health advice for hot weather. Geneva: World Health Organization; 2026. 2. Climate change and workplace heat stress: technical report and guidance. Geneva: World Health Organization and World Meteorological Organization; 2025. Licence: CC BY-NC-SA 3.0 IGO. 3. Global Heat Health Information Network 4. WHO-WMO joint climate and health programme 5. Compendium of WHO and other UN guidance in health and environment, 2024 update. Geneva: World Health Organization; 2024. Licence: CC BY-NC-SA 3.0 IGO. 6. Air Quality Indexes: key considerations and roadmaps for best practices. Geneva: World Health Organization; 2026. Licence: CC BY-NC-SA 3.0 IGO. 7. Heat-health action plans: guidance, second edition. Geneva: World Health Organization; 2026. Licence: CC BY-NC-SA 3.0 IGO. 8. Heat, air pollution and solar ultraviolet radiation: mass gathering-specific considerations and research gaps. Geneva: World Health Organization; 2025. Licence: CC BY-NC-SA 3.0 IGO. 9. Prevention and management of heat-related illness at mass gatherings: systematic reviews. Geneva: World Health Organization; 2026. Licence: CC BY-NC-SA 3.0 IGO.

	10. Prevention and management of heat-related illness at mass gatherings: considerations for implementation. Geneva: World Health Organization; 2026. Licence: CC BY-NC-SA 3.0 IGO 11. Prevention and management of heat-related illness at mass gathering: developing evidence-based communication messages. Geneva: World Health Organization; 2026. Licence: CC BY-NC-SA 3.0 IGO. 12. Prevention and management of heat-related illness at mass gatherings: risk assessment tool. Geneva: World Health Organization; 2026. 13. (Spanish) Risk management for health emergencies and disasters caused by heatwaves: guidelines for urban contexts. Washington, D.C.: Pan American Health Organization; 2024. 14. (Spanish) Health sector operational readiness checklist for wildfires. Washington, D.C.: Pan American Health Organization; 2025.
Malaria	1. WHO guidelines for malaria, 13 August 2025. Geneva: World Health Organization; 2025. Licence: CC BY-NC-SA 3.0 IGO. 2. Malaria control in emergencies: field manual. Geneva: World Health Organization; 2025. Licence: CC BY-NC-SA 3.0 IGO. 3. Operational manual on indoor residual spraying: Control of vectors of malaria, Aedes-borne diseases, Chagas disease, leishmaniasis and lymphatic filariasis. Geneva: World Health Organization; 2024. 4. Operational manual on larval source management: control of Anopheles and Aedes mosquito vectors. Geneva: World Health Organization; 2026.
Arboviral diseases: Dengue, Zika, Chikungunya, Yellow fever, etc.	1. WHO guidelines for clinical management of arboviral diseases: dengue, chikungunya, Zika and yellow fever. Geneva: World Health Organization; 2025. Licence: CC BY-NC-SA 3.0 IGO. 2. Global arbovirus initiative 3. Dengue outbreak toolbox 4. Chikungunya outbreak toolbox 5. Zika outbreak toolbox 6. Rift Valley Fever outbreak toolbox 7. Yellow Fever outbreak toolbox 8. WHO guidance for controlling vector borne diseases through indoor residual spraying. Geneva: World Health Organization; 2024. Licence: CC BY-NC-SA 3.0 IGO. 9. Operational manual on larval source management: control of Anopheles and Aedes mosquito vectors. Geneva: World Health Organization; 2026. Licence: CC BY-NC-SA 3.0 IGO. 10. Urban yellow fever risk management: Handbook for national preparedness and response planning. Geneva: World Health Organization; 2026. Licence: CC BY-NC-SA 3.0 IGO.
Rodent-borne diseases	1. Hantavirus outbreak toolbox 2. Leptospirosis outbreak toolbox 3. Manual for plague surveillance, diagnosis, prevention and control. Geneva: World Health Organization; 2024. 4. WHO guidelines for plague management: revised recommendations for the use of rapid diagnostic tests, fluoroquinolones for case management and personal protective equipment for prevention of post-mortem transmission. Geneva: World Health Organization; 2021.

Other zoonotic diseases	1. WHO fact sheet on vector-borne diseases 2. Crimean-Congo Hemorrhagic Fever outbreak toolbox 3. Operational manual on leishmaniasis vector control, surveillance, monitoring and evaluation. Geneva: World Health Organization; 2022. Licence: CC BY-NC-SA 3.0 IGO. 4. Plague outbreak toolbox 5. Operational manual on indoor residual spraying: Control of vectors of malaria, Aedes-borne diseases, Chagas disease, leishmaniases and lymphatic filariasis. Geneva: World Health Organization; 2024. Licence: CC BY-NC-SA 3.0 IGO.
Vaccine-preventable diseases	1. Vaccination in acute humanitarian emergencies 2. Global immunization policy and guidance 3. Measles outbreak toolbox 4. Outbreaks – Measles and Rubella Partnership 5. Vaccination in acute humanitarian emergencies. Geneva: World Health Organization; 2017. Licence: CC BY-NC-SA 3.0 IGO. 6. Vaccination in acute humanitarian emergencies: implementation guide. Geneva: World Health Organization; 2017. Licence: CC BY-NC-SA 3.0 IGO. 7. The WUENIC data: Progress and challenges with Achieving Universal Vaccine Access and Immunization Coverage 8. Global Evidence review on Health and Migration (GEHM) series: Ensuring the integration of refugees and migrants in immunization policies, planning and service delivery globally 6. WHO guidelines on meningitis diagnosis, treatment and care. Geneva: World Health Organization; 2025. Licence: CC BY-NC-SA 3.0 IGO. 9. Preparedness and response to bacterial meningitis outbreaks: toolkit for frontline healthcare workers. Geneva: World Health Organization; 2026. Licence: CC BY-NC-SA 3.0 IGO. 10. Standard case definitions of acute bacterial meningitis and invasive meningococcal disease for routine and outbreak surveillance. Geneva: World Health Organization; 2025. Licence: CC BY-NC-SA 3.0 IGO. 11. WHO practical manual on meningitis diagnosis, treatment and care. Geneva: World Health Organization; 2026. Licence: CC BY-NC-SA 3.0 IGO.
Health care facilities	1. WHO guidance for climate-resilient and environmentally sustainable health care facilities. Geneva: World Health Organization; 2020. Licence: CC BY-NC-SA 3.0 IGO. 2. (Spanish) Recommendations for strengthening the non-structural safety of healthcare facilities in the face of extreme hydrometeorological events. Washington, D.C.: Pan American Health Organization; 2024.
Primary health care	1. Emergency ready primary health care framework. Geneva: World Health Organization; 2026. Licence: CC BY-NC-SA 3.0 IGO. 2. Emergency ready primary health care operational guide. Geneva: World Health Organization; 2026. Licence: CC BY-NC-SA 3.0 IGO. 3. Primary health care and health emergencies. Geneva: World Health Organization; 2018. Licence: CC BY-NC-SA 3.0 IGO.
Gender-based violence	Strengthening health sector response to gender-based violence in humanitarian emergencies
Mental health	1. Mental health and climate change: policy brief. Geneva: World Health Organization; 2022. Licence: CC BY-NC-SA 3.0 IGO.

	2. Technical Note: Linking Disaster Risk Reduction (DRR) and Mental Health and Psychosocial Support (MHPSS) – Practical Tools, Approaches and Case Studies. Inter-Agency Standing Committee, Reference Group on MHPSS in Emergency Settings; 2021. 3. Why mental health is a priority for action on climate change. Pan American Health Organization / World Health Organization; 2022. 4. The Mental Health and Psychosocial Support Minimum Service Package 5. Advocacy Briefs: Climate Change, Environment, Mental Health and Wellbeing - Impacts and Practical Solutions
Biotoxins: fish and shellfish poisoning	1. WHO natural toxins in food fact sheet 2. WHO food safety fact sheet
NCDs	1. Strengthening noncommunicable disease integration in all-hazards emergency preparedness and response. Geneva: World Health Organization; 2025. Licence: CC BY-NC-SA 3.0 IGO. 2. Operational manual on noncommunicable diseases in all-hazards emergency preparedness and response. Geneva: World Health Organization; 2024. Licence: CC BY-NC-SA 3.0 IGO. 3. Integration of NCD care in emergency response and preparedness. World Health Organization, Regional Office for South-East Asia; 2018. Licence: CC BY-NC-SA 3.0 IGO. 4. Addressing noncommunicable diseases in emergencies: a regional framework for action. World Health Organization, Regional Office for the Eastern Mediterranean; 2024. Licence: CC BY-NC-SA 3.0 IGO.
Maternal, newborn and child health	1. Protecting maternal, newborn and child health from the impacts of climate change: A call for action. Geneva: World Health Organization; 2023. Licence: CC BY-NC-SA 3.0 IGO. 2. Priority indicators to monitor the impact of heat exposure on maternal, newborn and child health. Geneva: World Health Organization; 2026. Licence: CC BY-NC-SA 3.0 IGO. (<i>Unpublished; Anticipated in September 2026</i>)
NTDs: Schistosomiasis and snakebite envenoming	1. WHO Schistosomiasis fact sheet 2. WHO Schistosomiasis programme pages 3. WHO snakebite envenoming fact sheet 4. Snakebite envenoming: a strategy for prevention and control. Geneva: World Health Organization; 2019. Licence: CC BY-NC-SA 3.0 IGO.
Migrant health	Health system strengthening interventions to improve the health of displaced and migrant populations in the context of climate change. Geneva: World Health Organization; 2025. Licence: CC BY-NC-SA 3.0 IGO.

Annex 2: Detailed Information on Public Health Risks

This section has been adapted from WHO's previous El Niño reports ^{xvii,xviii}.

Note: The risk of different hazards differs across countries, and thus anticipatory/emergency preparedness actions should be tailored to contexts.

Table A2.1. Public health risks and technical areas associated with El Niño and possible preparedness and response actions.

Public Health Risk/Technical Area	Heat stress
Linkage with El Niño	El Niño conditions can increase global and regional temperatures, and when superimposed on long-term climate change, can contribute to record-breaking heat. 2024 was the warmest year on record, with global temperatures boosted by a strong El Niño that peaked in early 2024, although WMO notes that underlying human-caused warming was already driving record temperatures^{xix}. Heat exposure is a leading cause of weather-related deaths and can exacerbate underlying illnesses including cardiovascular disease, diabetes, mental health, asthma and can increase the risk of accidents and transmission of some infectious diseases^{xx}. Older people, infants, outdoor workers, people with chronic illnesses and socially vulnerable populations are particularly at risk. <u>In the context of mass gatherings</u>, visitors, particularly those travelling from cooler climates, with limited acclimatization represent a distinct at-risk group. International travellers, migrants and seasonal workers may be especially vulnerable. High crowd density, prolonged exposure to heat, limited access to safe water or cooling areas; unfamiliarity with local climatic conditions; language barriers and reduced access to local health and social services can increase vulnerability even among otherwise healthy attendees and workers.
Possible Actions	<u>Mass gatherings</u> are planned events, often scheduled during periods of predictable heat risk. Where feasible, event timing and scheduling should consider seasonal forecasts of heat and air pollution, with activities adjusted to avoid the hottest periods of the day and episodes of poor air quality. Key public health interventions include risk assessments to identify vulnerable populations; heat-health action plans, incorporating safe water points and cooling areas; multi-sectoral coordination between health, meteorological and emergency management authorities, multi-language and culturally appropriate risk communication with real-time on-site heat alerts; heat-health surveillance covering attendees, workers and volunteers; and readily accessible on-site medical services or mobile response teams.

Public Health Risk/Technical Area	Malnutrition
Linkage with El Niño	Malnutrition due to El Niño is a consequence of its effects on food security – through crop losses, livestock impacts, food-price shocks, reduced livelihoods and displacement, which disrupts access to nutrition, maternal and child health services– as well as increases in diarrheal diseases (see section on waterborne diseases). Existing malnutrition hotspots, conflict-affected populations, rain-fed agricultural communities, displaced persons, pregnant and lactating women and young children remain particularly vulnerable to El Niño-related food and nutrition shocks. The magnitude and timing of malnutrition impacts depend on numerous factors, such as rainfall anomaly, baseline food insecurity, disease burden, market access, humanitarian assistance and health-system capacity. • In northern Peru, children born during and after the 1997–1998 El Niño were, while controlling for other factors, on average shorter and had less lean mass for their age and sex than expected had El Niño not occurred^{xxi}. • Multi-country research across the global tropics found that “warmer El Niño conditions predict worse child undernutrition in most of the developing world” and estimated that the 2015 El Niño was associated with almost six million additional underweight children^{xxii}. • In Southern Africa, El Niño-associated drought conditions in 2023-2024 were associated with reduced food availability, water scarcity and disease outbreaks, rising food prices and diminished agricultural labor opportunities, hindering access to a nutritious diet, disruption of supply chains, and humanitarian crises, displacement and migration^{xxiii}. In addition to crop losses attributable to drought or flooding conditions, temperature and rainfall anomalies can alter pest development, survival and distribution as well as crop diseases. • The spatial prevalence of desert locusts in parts of the Middle East and North Africa (MENA) area has been suggested to be influenced by ENSO, which can increase the likelihood of climatic conditions that favour breeding and outbreaks^{xxiv}. • Wet El Niño conditions may increase the risk of fungal crop diseases. Botrytis fruit rot in Florida strawberries had an above-average fungal infection risk during approximately 70% of El Niño seasons^{xxv}.
Possible Actions	FAO-WFP Anticipatory Action Strategy on scaling up anticipator actions to prevent food crises and FAO’s Anticipatory Action Portal both contain useful resources. Specific actions should prioritize a continuous monitoring of the situation through enhanced nutrition surveillance and early detection/referral of wasting; ensuring the continuity of nutrition services and treatment for children with wasting, prevention of wasting through the promotion and protection of optimal breastfeeding and infant feeding practices; and

	availability of nutrition interventions for high-risk groups, in close coordination with partners
Public Health Risk/Technical Area	Cholera and other waterborne diseases
Linkage with El Niño	Outbreaks of cholera and waterborne diseases may occur after flooding when floodwaters are contaminated with human or animal waste, or when drinking-water systems and sanitation infrastructure are damaged^{xxvi}. Drought conditions may reduce the water available for hygiene and sanitation purposes, and thus also increase the risk of infection^{xxvii, xxviii}. Drought also leads to increased concentration of pathogens in surface water. Higher temperatures are also associated with an increase in diarrheal diseases^{xxix, xxx, xxxi, xxxii, xxxiii}. Rising water temperatures can boost the proliferation of <i>Vibrio cholerae</i> in environmental reservoirs where the bacteria is known to be present (estuaries, sea coasts)^{xxxiv, xxxv}. In existing reservoirs, increased temperature can have two effects: increasing the proliferation of algae, mollusks and other substrates where <i>V. cholerae</i> is found; and extending the season during which <i>V. cholerae</i> is a risk^{xxxvi}. In environments not previously favorable for the presence of <i>V. cholerae</i>, increased water temperatures can make them favorable for its proliferation, if introduced anthropogenically^{xxxvii}. • Evidence linking El Niño specifically to cholera is strongest in parts of Africa and Latin America, although effects vary geographically. During the 2015-2016 El Niño, shifts in incidence of cholera in sub-Saharan Africa were reported, with increases in several East Africa countries and reductions in some drier southern African settings^{xxxviii}. • Increased incidences have been reported in Peru, Colombia and Ecuador during the El Niño in 1982-3^{xxxix}. • Further analyses of cholera epidemics in Peru suggest that El Niño contributed to where and how severely cholera spread through amplifying existing vulnerabilities, particularly in northern coastal areas, by interacting with underlying poverty and sanitation conditions that facilitated transmission^{xl}. • The current global cholera context increases concern. The global cholera upsurge that began in 2021 has been continuing, with outbreaks affecting multiple regions and the burden of the disease remaining concentrated in Africa, the Middle East and Asia. WHO has evaluated the current global risk from cholera as very high^{xli}. In Eastern and Southern Africa, the 2023–2024 El Niño period to overlapped with drought, floods, malnutrition and cholera risks, with children particularly exposed where safe water access and sanitation are compromised^{xlii}. Leptospirosis is a waterborne disease associated with flooding. During the Coastal El Niño phenomenon of 2017 in northern Peru, outbreaks of dengue and leptospirosis occurred. The coexistence of leptospirosis with other infectious diseases has been described, depending on the season, age group, geographical distribution, and social condition, even sharing a similar clinical picture^{xliii}.

Possible Actions	Interventions have been recommended to focus on causal pathways by which climate impacts pathogen exposure and disease outcomes, including how meteorological variables might affect the success of these programs^{xliv, xlv}. The Global Task Force on Cholera Control has extensive guidelines and technical documents for readiness and response which should be consulted^{xlvi}. Water and sanitation services can be adapted or managed, through increased investment in water resources assessment and accounting, use of climate-resilient water safety plans to manage risk, and develop public-private partnerships to increase resilience of systems^{xlvii}. Preparing for rainfall variability and water scarcity through supply-side investments and expansion of water storage buffers may also reduce the risk of waterborne diseases^{xlviii}. Development of a water safety plan outlined in the WHO Climate-resilient Water Safety Plans Guideline^{xlix}. Integration of meteorological conditions in Early Warning Systems, to monitor atmospheric forecasts of heavy rain events or sea surface temperatures in coastal waters Computing the risk on the basis of meteorological conditions, to perform active surveillance^l.
Public Health Risk/Technical Area	Malaria
Linkage with El Niño	Malaria impacts associated with El Niño will vary according to local climate conditions, local health vulnerability and health system capacities, population immunity and the effectiveness of malaria control programmes^{li}. Impacts of El Niño on temperature and rainfall patterns influence the breeding and survival of both <i>Anopheles</i> mosquitoes and <i>Plasmodium</i> parasites^{lii, liii}. The effects of El Niño on malaria are particularly pronounced in epidemic-prone areas where climate conditions are generally not suitable for year-round vector reproduction^{liv, lv, lvi}. Small changes in climate conditions in these areas have the potential to change normally unsuitable habitats into viable habitats for mosquitoes that transmit malaria, or to temporarily extend the period of malaria susceptibility. Such areas often include regions in higher altitude, desert fringes and areas of unstable malaria transmission and are therefore more susceptible to outbreaks when transmission conditions become favorable^{lvii, lviii, lix}. Temperature is a particularly significant driver of the development rates of both the mosquito vector and the <i>Plasmodium</i> parasite^{lx}. In addition, rainfall

	and humidity provide essential environmental characteristics for larval habitat formation and adult mosquito survival^{lxi}. Excess rainfall may create additional breeding sites through standing water accumulation, whereas drought may increase transmission in some settings by concentrating human and vector activity around limited water sources^{lxii}. The direction and magnitude of effects strongly depend on local ecological conditions^{lxiii}. Associations between El Niño events, malaria, and other vector borne diseases have been documented in Africa and parts of Latin America and Asia^{lxiv, lxv, lxvi}. In East African highlands and other epidemic-prone settings, warmer conditions associated with ENSO events have been linked to increased epidemic risk^{lxvii, lxviii}. Studies from South Asia also suggest that higher temperatures associated with El Niño may increase transmission potential in high-altitude areas where lower temperatures typically constrain vector development^{lxix, lxx}. However, climatic variability alone does not explain malaria trends - an examination of East African highland areas has found that changes in land use, population growth, deforestation, reduced malaria control efforts, drug resistance, and other social and environmental factors were also contributed to the increase in malaria^{lxxi}. Climate change has reduced the importance of climatic limits as a method of effective malaria control, where public health interventions are playing a role of increasing importance. Epidemics may occur at these “control” fringes when public health infrastructure deteriorates^{lxxii}. In areas of unstable malaria transmission, when climatic conditions become favorable and public health systems are unable to rapidly detect and respond, the risk of a malaria epidemic may grow. Many such areas across the globe experience drought or excessive rainfall due to El Niño.
Possible Actions	Possible preventative measures include actions around the availability and use of malaria chemoprevention for high-risk populations^{lxxiii}, actions for high coverage of nets, and enhanced surveillance detection^{lxxiv}, strengthening malaria surveillance and epidemic preparedness, pre-positioning diagnostics and antimalarial commodities, maintaining vector control interventions, and using seasonal climate forecasts to guide preparedness and response activities.
Public Health Risk/Technical Area	Arboviral diseases: Aedes aegypti-borne (Dengue, Chikungunya, Yellow Fever, Zika)
Linkage with El Niño	Unusual increases in temperature or rainfall can increase mosquito densities and viral transmission, thereby increasing the potential for Aedes-borne disease outbreaks. Changes in temperature, rainfall and humidity, as well as associated changes in water-storage practices, may influence chikungunya transmission by altering <i>Aedes</i> mosquito abundance, survival and human exposure^{lxxv, lxxvi}. It is also important for non-endemic areas such as Europe and North America to be aware of the risk, given the recent and increasing presence of Aedes mosquitoes which can generate local outbreaks of these diseases during the summer months. El Niño-related warmer temperatures

	may result in vector-borne disease epidemics in highland areas, which are too cold for vector survival and disease transmission at other times. Evidence is particularly strong for dengue: a recent global model found El Niño to be positively correlated with global dengue outbreak risk, with strong El Niño events associated with increased outbreak risk worldwide, although effects varied geographically^{lxxvii}. A multi-country modelling study using dengue data from 57 tropical countries across the Americas and Asia found that dengue outbreaks frequently occurred in El Niño years, with 63% of variation in dengue cases being attributable to El Niño (and higher values in endemic regions)^{lxxviii}. Heavy rainfall events can facilitate the emergence or expansion of yellow fever outbreaks in areas with suitable vectors and susceptible populations. Recent evidence from the outbreak in Tolima, Colombia, suggests that unusually high seasonal rainfall contributed to favorable mosquito breeding conditions and increased transmission risk^{lxxix}. The 2015-2016 El Niño coincided with unusually high temperatures and severe droughts in parts of Latin America and the Caribbean. While the initial introduction of Zika virus in the South and Central America may be unrelated to the weather conditions, the persistence of above-normal temperatures and drought conditions over this region were thought to have contributed to the epidemic^{lxxx}. Epidemiological modelling of the outbreak has found that temperature conditions were exceptionally conducive for mosquito-borne transmission of Zika virus^{lxxxi}. The same modelling study found that other areas in the world, such as Southeast Asia and tropical Africa, also had elevated environmental suitability for Zika transmission, however population immunity may have reduced the potential for large outbreaks despite the favorable climatic conditions. A subsequent study in Brazil has found that moderate-to-strong El Niño phases, alongside other impacts such as social inequality, have coincided with higher <i>Aedes aegypti</i> larval indices^{lxxxii}. Chikungunya transmission may be influenced by El Niño through climatic effects on <i>Aedes</i> mosquito vectors, including changes in temperature, rainfall, humidity and water storage practices that alter vector abundance and human exposure^{lxxxiii, lxxxiv}.
Possible Actions	The risk of yellow fever epidemics differs across countries, and thus actions should be tailored to contexts. WHO's Urban yellow fever risk management handbook contains suggestions on a general approach for managing urban yellow fever risk^{lxxxv}. More broadly, countries can align vector-control activities with WHO's Global vector control response 2017–2030 (GVCR), which promotes strengthened vector-control capacity, inter- and intra-sectoral collaboration, community engagement, enhanced vector surveillance and monitoring, and the scaling-up and integration of appropriate vector-control tools and approaches.^{lxxxvi} WHO's Global Arbovirus Initiative (GLAI) provides an overarching framework for arboviruses with epidemic and pandemic potential, including dengue,

	chikungunya, Zika and yellow fever. Its priority areas include monitoring and anticipating risk, reducing local epidemic risk, strengthening vector control, improving preparedness for epidemics and pandemics, supporting innovation, and strengthening coordination among partners ^{lxxxvii} .
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Public Health Risk/Technical Area	Rift Valley Fever
Linkage with El Niño	Since the 1950s, major RVF outbreaks in East Africa have been associated with El Niño-related patterns of above-normal and widespread rainfall^{lxxxviii, lxxxix, xc}. Transmission occurs primarily through mosquito vectors, including <i>Aedes</i> and <i>Culex</i> species, although humans may also become infected through direct contact with blood, tissues or bodily fluids of infected animals. Heavy rainfall and flooding create temporary water bodies that support rapid mosquito breeding and increase opportunities for transmission among livestock, which can subsequently amplify human risk. However, outbreak occurrence also depends on livestock density, animal movement, veterinary surveillance systems, vaccination coverage and human exposure patterns^{xc, xcii}.
Possible Actions	Preventive vaccination in livestock can significantly reduce RVF transmission in both animals and humans, while safeguarding the livelihoods and food security of communities that depend on these herds and flocks^{xciii}. Risk mapping and modelling are essential for preventing RVF outbreaks and understanding disease dynamics across ecosystems^{xciv}. FAO launched the RVF Early Warning Decision Support Tool (RVF DST) in 2019, a web-based platform for near real-time monitoring and forecasting, and a public version has been made freely available since November 2025, alongside tailored national versions for authorized users^{xcv}.

Public Health Risk/Technical Area	Japanese Encephalitis
Linkage with El Niño	Japanese encephalitis virus is transmitted primarily by <i>Culex</i> mosquitoes, particularly <i>Culex tritaeniorhynchus</i>, which breed in irrigated rice fields, wetlands and other standing-water environments^{xcvi}. In most temperate areas of Asia, JEV is transmitted mainly during the warm season, when large epidemics can occur. In the tropics and subtropics, transmission can occur year-round but often intensifies during the rainy season and pre-harvest period in rice-cultivating regions^{xcvii}. The relationship between ENSO and Japanese encephalitis is less well-established, and observed associations vary geographically^{xcviii}.
Possible Actions	Strengthen risk-based vaccination in endemic areas in line with national recommendations, particularly for populations living in or moving into high-risk areas.

	Maintain PHC capacity for early recognition and management of mild cases, with timely referral of suspected severe cases. Strengthen vector-control and community-based measures to reduce mosquito exposure.
Public Health Risk/Technical Area	Murray Valley Encephalitis and Ross River Virus Disease
Linkage with El Niño	Studies have supported the use of ENSO indicators and seasonal climate forecasts as components of early warning systems for mosquito-borne diseases in Australia for Ross River virus and Murray Valley encephalitis^{xcix, c}.
Possible Actions	Use seasonal climate information and vector surveillance to identify periods and locations of increased risk. Strengthen community messaging on mosquito-bite prevention and vector-control measures. Ensure PHC services are able to recognize suspected cases, provide appropriate clinical management and refer patients with severe neurological manifestations.
Public Health Risk/Technical Area	Zoonotic diseases: plague^{ci}
Linkage with El Niño	Climatic variability associated with ENSO may influence plague dynamics across endemic and enzootic foci by altering the environmental conditions that affect rodent reservoir hosts and flea vectors. ENSO-related changes in temperature, rainfall and vegetation can modify rodent abundance, flea survival and transmission dynamics, although the direction and magnitude of these effects vary by ecological setting. For example, intensity of plague activity in parts of the southwestern United States of America have been significantly associated with above normal rainfall, attributed to shifts in rainfall, temperature and vegetation in ENSO-impacted regions^{cii}. Evidence from Madagascar also suggests that periods of high ENSO intensity may increase plague incidence through ENSO-related effects on temperature and rainfall^{ciii}. More generally, zoonotic diseases are widely sensitive to climatic factors, with temperature and precipitation influencing rodent and flea populations and, consequently, the risk of transmission^{civ}.
Possible Actions	Strengthen surveillance in known endemic foci, including monitoring unusual rodent die-offs and other signals of increased transmission risk. Ensure PHC facilities can rapidly recognize and manage suspected cases, initiate appropriate treatment and infection prevention and control measures. Activate referral and outbreak investigation mechanisms when needed.

Public Health Risk/Technical Area	Zoonotic diseases: Leishmaniasis
Linkage with El Niño	There is some evidence that leishmaniasis transmission may be influenced forms of climate variability through impacts on temperature and rainfall that alter the ecology of phlebotomine sand fly vectors and animal reservoirs^{cv}. A study examining the impact of El Niño on visceral leishmaniasis in Brazil reported associations between ENSO variability and changes in both visceral and cutaneous leishmaniasis transmission between 1980 and 1998, with drought conditions potentially contributing to increased transmission in subsequent periods^{cv}. In the western Amazon, ENSO oscillations have been found to significantly affect local weather patterns and contribute to changes in seasonal patterns of leishmaniasis transmission^{cvii}. However, the relationship between ENSO oscillations and leishmaniasis may vary across ecological settings and be influenced by non-climatic factors such as changes in land use, migration, socioeconomic conditions and malnutrition^{cviii}.
Possible Actions	Maintain surveillance and vector-control activities in endemic and newly at-risk areas, with particular attention to displaced and otherwise vulnerable populations. Strengthen PHC capacity for early detection, diagnosis, treatment and referral, and ensure availability of essential diagnostics and medicines where transmission risk is elevated.

Public Health Risk/Technical Area	Zoonotic diseases: tick-borne diseases
Linkage with El Niño	Climate variability and climate change can influence the geographic distribution of tick-borne diseases through effects on temperature and rainfall. However, compared with mosquito-borne diseases, evidence directly linking El Niño events to tick-borne disease outbreaks remains limited and inconsistent across regions. Tick-borne diseases potentially impacted by climatic variability include Crimean-Congo haemorrhagic fever (CCHF), Lyme disease and Kyasanur Forest disease (KFD)^{cix, cx, cxi}. Climatic factors have been used to explain the upsurge of CCHF cases in areas in Europe and the Middle East, while the relationship between upsurges in CCHF cases and precipitation are unclear^{cxii}. Conversely, increases in temperature in areas in the south of India have been found to decrease the intensity of KFD transmission, whereas high precipitation from June to October is thought to provide suitable ecology to tick vector and be related to an increased transmission season during the dry months, November through May^{cxiii}. Notably, additional factors outside of changes in weather patterns have been found to impact tick spread, including environmental factors related to land cover, increased densities of wild and domestic ungulates and human risk factors such as occupations that increase human interaction with potentially infectious animals^{cxiv}.

Possible Actions	Strengthen risk communication for populations with occupational or environmental exposure to ticks and promote appropriate personal protective measures. Maintain PHC capacity for early recognition and clinical management of locally relevant tick-borne diseases, supported by appropriate diagnostic, referral and infection prevention arrangements.
Public Health Risk/Technical Area	Zoonotic diseases: Hantavirus
Linkage with El Niño	Hantaviruses are zoonotic viruses that naturally infect rodents and are occasionally transmitted to humans^{cxv}. Although many hantavirus species have been identified worldwide, a limited number are known to cause human disease: hantaviruses present in North, Central and South America (known to lead to hantavirus cardiopulmonary syndrome); and Hantaviruses found in Europe and Asia (known to lead to haemorrhagic fever with renal syndrome)^{cxvi}. Transmission of hantaviruses to humans occurs from contact with contaminated urine, droppings or saliva of infected rodents. Infection may also occur, although less commonly, through rodent bites. Activities that involve contact with rodents such as cleaning enclosed or poorly ventilated spaces, farming, forestry work and sleeping in rodent-infested dwellings increase exposure risk^{cxvii}. The epidemiology of hantavirus disease is thus closely linked to rodent population dynamics. Increased rainfall leading to vegetation growth and wider food availability attributed to El Niño in the American Southwest has suggested that it led to rodent abundance and greater opportunities for human exposure to rodents^{cxviii, cxix}.
Possible Actions	Strengthen community awareness on reducing exposure to rodents and safely cleaning rodent-contaminated environments, particularly following climatic conditions associated with increases in rodent populations. Ensure PHC and secondary care level services are prepared to recognize suspected cases early, provide supportive management and rapidly refer patients with severe respiratory or renal manifestations.

Public Health Risk/Technical Area	Zoonotic diseases: Leptospirosis
Linkage with El Niño	Leptospirosis is a widespread zoonotic bacterial disease caused by pathogenic <i>Leptospira</i> spp., with rodents serving as the principal reservoir, although livestock, dogs and other mammals can also carry and shed the bacteria. Humans become infected primarily through direct contact with the urine of infected animals or, more commonly, through exposure to water, soil or mud contaminated with infected urine. The bacteria enter the body through cuts or abrasions in the skin or via the mucous membranes of the eyes, nose or mouth. Human-to-human transmission is extremely rare. The disease occurs worldwide but is most common in tropical and subtropical regions with warm, humid climates, where environmental conditions favour bacterial survival. Occupations and activities involving contact with contaminated water or animals, including farming, livestock handling, sewer work, waste management, and recreational exposure to freshwater, are associated with increased risk^{CXX, CXXI}. The epidemiology of leptospirosis is strongly influenced by environmental and climatic conditions. Heavy rainfall and flooding, which are common consequences of El Niño in many regions, facilitate the spread of <i>Leptospira</i> by washing contaminated urine into surface waters, saturating soils, overwhelming sanitation systems, and increasing human contact with contaminated floodwaters. Flooding may also displace rodent populations and increase contamination of urban and peri-urban environments. Consequently, outbreaks of leptospirosis frequently occur following periods of intense rainfall and flooding, particularly in settings with inadequate drainage, poor sanitation, high rodent densities and limited access to safe water. These conditions may be further exacerbated by El Niño-related extreme weather events, increasing the risk of transmission and large outbreaks in vulnerable populations^{CXXII}.
Possible Actions	Following flooding or heavy rainfall, strengthen risk communication to minimize contact with potentially contaminated water and promote appropriate protective measures among high-risk populations. Enhance early case detection through PHC and emergency services, ensure access to appropriate diagnostics and treatment, and establish clear referral pathways for severe cases.
Public Health Risk/Technical Area	Vaccine-preventable diseases
Linkage with El Niño	In many settings globally, the accumulation of immunity gaps is often an important driver of outbreaks of VPDs. Immunity gaps may arise from persistently low routine immunisation coverage, missed vaccination campaigns, inequities in access to vaccination, or the progressive accumulation of susceptible individuals in populations that have not experienced recent transmission. Climate-related events can further increase risk of outbreaks of VPDs. Displacement, crowding, disruption of

	health services and interruptions to routine immunization following El Niño-related floods, droughts and other climate events may increase the risk of outbreaks of VPDs such as measles and meningococcal infections, particularly among vulnerable population^{cxxiii, cxxiv}. Interruptions in routine immunisation and infrastructural damage to health facilities and vaccine storage can all increase the risk of infectious diseases and related mortality^{cxxv}. Meningococcal infections in parts of the sub-Saharan region of Africa have been associated with dry, dusty conditions that favour transmission^{cxxvi, cxxvii}. ENSO-related climate anomalies may modify risk of meningococcal infections in some settings through its influence on precipitation patterns.
Possible Actions	Identify zero-dose children and intensify routine vaccination. Identify risk of vaccine stock rupture and disruptions to vaccine cold chain and initiate mitigation measures. Train vaccinators, potentially even increasing the number, to plan for surge campaigns. Ensure that emergency response plans include routine vaccination and catch-up campaigns.
Public Health Risk/Technical Area	Biotoxins: fish and shellfish poisoning
Linkage with El Niño	Higher temperatures increase the growth of microorganisms, particularly in aquatic or marine ecosystems. Algal blooms are caused by rapid proliferation of dinoflagellates, diatoms, and blue-green algae, some of which produce potent toxins. Certain "harmful" blooms are associated with paralytic, diarrhoeal, and amnesic shellfish poisoning when planktonic biotoxins enter the food chain via clams and mussels. Sea surface temperature, ocean circulation and nutrient availability are important environmental drivers of harmful algal blooms. El Niño can alter these conditions through changes in sea surface temperature and marine ecosystem dynamics, potentially affecting the occurrence and geographic distribution of some harmful algal species^{cxxviii}. However, the relationship varies by region and species, and environmental pollution and eutrophication remain important drivers of bloom occurrence^{cxxix}. El Niño may influence the occurrence of harmful algal blooms and associated marine biotoxins in parts of the Pacific, including along the coasts of Peru and Chile and in some Pacific Island settings, as well as increase the risk of ciguatera fish poisoning in parts of the Pacific^{cxxx, cxxxi}. Harmful algal blooms may also affect fisheries and aquaculture, with potential implications for food security and livelihoods in affected coastal communities^{cxxxi}.
Possible Actions	Strengthen coordination between public health, food safety and environmental authorities to detect harmful algal blooms and rapidly communicate consumption advisories where required.

	Ensure PHC and emergency services are able to recognize and manage suspected poisoning and establish referral pathways for severe neurological or other complications.
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Public Health Risk/Technical Area	Respiratory Illness / Air Pollution
Linkage with El Niño	El Niño conditions can increase global and regional temperatures, and when superimposed on long-term climate change, can contribute to record-breaking heat. El Niño can contribute to drought and wildfire risk in some regions, increasing exposure to smoke and deteriorating air quality. Wildfire smoke, especially fine particulate matter (PM _{2.5}), is associated with increased respiratory and cardiovascular morbidity and mortality. Heat-related mortality has been estimated to have increased substantially since the 1990s, with a record-high estimate of 154 000 from wildfire-smoke-derived PM _{2.5} in 2024 ^{cxxxiii} .
Possible Actions	Integrate air-quality information and wildfire-smoke alerts into public health preparedness and risk communication, with specific advice for people with respiratory or cardiovascular disease, older people, children and pregnant women. Ensure continuity of PHC and essential NCD services, including access to medicines. Prepare health care facilities for increased presentations of acute respiratory and cardiovascular conditions.

Public Health Risk/Technical Area	Maternal, newborn and child health
Linkage with El Niño	El Niño-related droughts, floods and other climate shocks may reduce access to safe water, sanitation and hygiene (WASH), health services, food and social support systems, with potentially severe consequences for maternal, newborn and child health. Pregnant women, infants and young children are particularly vulnerable to the indirect effects of food insecurity, malnutrition, infectious diseases, displacement and disruption of health services. Many of the climate-sensitive diseases discussed above can have disproportionately severe consequences during pregnancy and early childhood ^{cxxxiv, cxxxv, cxxxvi, cxxxvii} . Heat exposure is increasingly being linked to complications in maternal, fetal and neonatal health ^{cxxxviii, cxxxix} .
Possible Actions	Protect continuity of essential maternal, newborn and child health services through PHC and referral networks. Ensure adequate age-appropriate medicines, commodities and supplies. Maintain functioning referral and emergency obstetric and newborn care pathways, and use outreach or mobile services where access to fixed facilities is disrupted.

Public Health Risk/Technical Area	Direct injuries
Linkage with El Niño	Direct injuries during El Niño periods may occur where El Niño-related climate anomalies increase the likelihood or severity of floods, landslides, storms, droughts and wildfires. The direct injury burden is often geographically concentrated and event-specific, so it should not be assumed to be low in all settings.
Possible Actions	Ensure health facilities in areas at risk of floods, storms, landslides and wildfires are prepared for increased trauma caseloads, including essential supplies, trained staff, triage and referral arrangements. Strengthen emergency care capacity at PHC and secondary care levels, and maintain functional ambulance services, referral pathways and mass-casualty arrangements where relevant.

Public Health Risk/Technical Area	Gender-based violence
Linkage with El Niño	Nearly one in three women globally is impacted by gender-based violence, most by an intimate partner. In emergency contexts the risk of both intimate partner violence and sexual violence is exacerbated ^{cxl} . Displacement, loss of livelihood, food insecurity, overcrowding, disruption of social networks and reduced access to protection and support services can increase the risks of gender-based violence ^{cxli, cxlii} . Women and girls may also face heightened risks when collecting water, fuel or food, particularly during droughts and other resource shortages ^{cxliii} . Increased exposure to indoor heat has also shown to increase household conflict and violence against women. ^{cxliv}
Possible Actions	1. Emergency preparedness and response plans should recognize, anticipate and plan to mitigate the risks of gender-based violence with actions and activities that are costed and financed. 2. Implement clinical management of rape and intimate partner violence for emergency settings training for health workers who are likely to be deployed in emergencies or who are already providing health care in emergencies. 3. Integrate a minimum set of GBV indicators in HMIS and HeRAMS in emergency contexts to monitor need for services and response, including quality of care/service readiness to deliver response. 4. Implement RESPECT women second edition (2025) interventions that show promising evidence in humanitarian contexts and address the risk factors identified as particular to humanitarian contexts as part of risk mitigation.

Public Health Risk/Technical Area	Mental health problems
Linkage with El Niño	El Niño amplifies hazards such as drought, flooding, extreme heat, food insecurity and displacement, through which climate variability affects mental health and psychosocial well-being. WHO identifies climate change as a rising threat to mental health, acting through both direct and indirect pathways, including the erosion of the social, environmental and economic determinants of mental health such as livelihoods, food and water security, and social cohesion. Reported impacts range from emotional distress, anxiety, depression and grief to suicidal behaviour. For most people these are understandable reactions to disrupted lives rather than a mental health condition; for some they can worsen a diagnosable condition, while hazard-related damage to health facilities can interrupt care for people already living with a mental health condition, among those the evidence shows are disproportionately affected. These risks fall unevenly, concentrating among people already affected by humanitarian crises, displaced populations, children, older people, pregnant and postpartum women, people with disabilities, and the rural and agricultural communities whose livelihoods are most climate-exposed. El Niño offers a preview of the mental health risks of a changing climate. WHO accordingly recommends integrating mental health and psychosocial support into climate and health action, making MHPSS an essential component of climate preparedness, anticipatory action and response rather than an optional add-on^{cxiv}.
Possible Actions	Integrate mental health and psychosocial support into PHC and community-based preparedness and response, prioritizing populations affected by displacement, livelihood loss, disasters and disruption of social support systems. Maintain continuity of care and essential psychotropic medicines for people with existing mental health conditions. Strengthen psychological first aid and community support at PHC level, and ensure referral pathways for people requiring specialized care.

Public Health Risk/Technical Area	NCDs
Linkage with El Niño	El Niño may exacerbate NCD-related morbidity and increase mortality through (1) a risk-multiplying effect of El Niño-linked biological hazards (2) the direct effect of heat on people living with NCDs (PLWNCDs) and (3) impact on health facilities and the health system. El Niño can alter the occurrence, geographic distribution, intensity and predictability of biological hazards, including outbreaks of infectious diseases. Such outbreaks can have disproportionately severe consequences for PLWNCDs. Pre-existing cardiovascular disease, diabetes, chronic respiratory disease and other NCDs can increase vulnerability to severe

	outcomes from infectious diseases, meaning that increases in infectious disease transmission may translate into greater morbidity and mortality among PLWNCDs. Infectious disease outbreaks can also impact PLWNCDs indirectly through disruption of health-service delivery. For example, during outbreaks, health facilities, resources and personnel may be redirected. These effects can interrupt treatment, routine follow-up, medication refills, diagnostic services and management of NCD complications. Extreme temperatures place additional physiological stress on people with cardiovascular, respiratory, renal and metabolic conditions and can contribute to acute exacerbations and increased demand for emergency care. Climate change may increase the risk of cardiovascular disease through three main exposure pathways: directly via air pollution and extreme temperatures and indirectly via changes to dietary options^{cxlvi}. Increasing temperatures can compromise outdoor air quality by increasing the production of tropospheric ozone^{cxlvii}. Ozone exposure will contribute to increased respiratory tract irritation, chronic pulmonary disease hospitalizations, and lung disease mortality^{cxlviii , cxlix}. Growing evidence indicates that warmer and drier climates will result in an increased area burned by bushfires, resulting in greater air pollution^{cl}. More intense bush fires may therefore increase the risk of respiratory illness (and also cardiovascular events), particularly among susceptible groups such as asthmatics, children, and the older people^{cli}. Temperature and potential drought implications are significant for the number of people living in hunger-prone and chronic food insecure situations, with consequences for increased susceptibility and reduced resilience to NCDs and infectious diseases^{clii}. El Niño-related floods, wildfires, displacement and damage to health facilities, transport networks, power systems and supply chains may further disproportionality impact PLWNCDs, for example impacting their access to essential medicines such as insulin, routine follow-up, dialysis and cancer care. Flooding and damage to roads and transport networks can prevent patients from physically accessing health facilities while also preventing health workers from reaching facilities, resulting in shortages of personnel. Disruptions to transport and supply chains can interrupt the availability of essential NCD medicines, while interruptions to water and power supplies can compromise the delivery of essential services. Facilities with poor heat resilience may experience dangerously high indoor temperatures, while inadequate flood resilience can result in damage to infrastructure, equipment and stocks of essential medicines. These disruptions pose particular risks for PLWNCDs because many depend on continuity of medication for survival and prevention of complications, require timely access to emergency care when complications occur, and are especially vulnerable to reductions in the quality and availability of services -and poor inpatient conditions- needed to manage acute NCD exacerbations.
Possible Actions	Possible preventative actions should prioritize PLWNCDs for whom even brief interruptions to treatment or services can result in severe complications or death. This includes, for example, people with diabetes requiring insulin, people with chronic kidney disease receiving renal replacement therapy,

	patients awaiting life-saving surgery, patients requiring long-term oxygen therapy and people with active cancer receiving systemic therapy. Possible actions may include: • Maintain registers for each high-risk group and ensure that there is a disaster relief plan for these groups (e.g. INS guidance for renal disease) that matches patients to a resilient facility in the event of disruption. Plans should also include risk sensitization communication for these patient groups (e.g. how to manage their condition in the event of heat, flood, etc; the need to accelerate patient preparedness via keeping copies of medical records, personal stockpiles of medicine if applicable and contacts of key health facilities). • Resilient supply chains which consider the specific needs of highest risk NCDs, including: cold chain for insulin, substantial clean water access for dialysis and dialysis supplies, oxygen supply, emergency NCD kits (or equivalent) for continuity at PHC, access to food/food baskets for people on adapted diets. • Climate resilient health facility adaptation brings significant potential benefits to PLWNCDs. Together with obstetrics, this is the group who are most vulnerable to service disruption and poor conditions within health facilities. • Incorporate planning for health workforce capacity for NCD management in emergency response plans, via alternative arrangements such as task sharing (PEN-HEARTS). Where possible, consider including community health workers in capacity building activities. • Integrate NCD comorbidities into infectious disease surveillance, ensure resulting data informs needs analyses.
Public Health Risk/Technical Area	NTDs: Schistosomiasis and snakebite envenoming
Linkage with El Niño	NTDs have diverse transmission pathways and environmental determinants. El Niño should therefore not be assumed to increase all NTD risks uniformly. Changes in rainfall, temperature, flooding and drought can modify vectors and intermediate-host habitats, human exposure, water and sanitation conditions, population movement and access to health services. The direction and magnitude of these effects remain highly disease- and context-specific. Snakebite envenoming is a WHO-prioritized NTD causing an estimated 1.8 to 2.7 million cases of envenoming and 81 410 to 137 880 deaths annually, with the greatest burden in rural populations with limited access to health care^{cliii}. Climate variability can influence snakebite risk by changing snake activity, habitat and patterns of human exposure. Evidence from Costa Rica found associations between snakebite incidence, ENSO variability, temperature, rainfall and socioeconomic vulnerability, while studies elsewhere demonstrate considerable geographic variation in these relationships. El

	Niño should therefore be considered a potential modifier of snakebite risk in endemic areas rather than a uniform global driver^{cliv, clv}. Schistosomiasis transmission depends on contact with contaminated freshwater and the presence of suitable freshwater snail hosts. Temperature, rainfall, flooding, drought and changes in water availability can influence snail habitats and patterns of human water contact. However, these relationships are non-linear and geographically specific, and climatic changes may increase transmission suitability in some locations while reducing it in others^{clvi, clvii, clviii}.
Possible Actions	Snakebite envenoming preparedness in endemic areas may include climate-informed surveillance, mapping of populations and facilities at risk, ensuring appropriate availability and distribution of quality-assured antivenoms, maintaining referral and transport pathways, training health workers and strengthening community awareness and appropriate care-seeking^{clix}.

Annex 3: Monitoring Service Availability and Health System Functionality

Monitoring health-service availability and health-system functionality is an essential component of preparedness and response during El Niño events. Climate-related hazards associated with El Niño, including flooding, drought, extreme heat and wildfires, can increase demands on health services. In parallel, these hazards can disrupt access and delivery of care through damage to health facilities, interruptions to water and electricity, supply-chain failures and reduced availability of health workers.

Monitoring should therefore extend beyond disease surveillance, to understand functionality and accessibility of health facilities in at-risk or impacted areas. Integrating data assessing health facility status with epidemiological surveillance enables earlier identification of service disruption, better prioritization of resource allocation and more targeted support to the most affected populations (see **Annex 5** for a short list of suggested indicators to monitor).

Countries should use or, if needed, adapt established national platforms wherever possible rather than creating parallel reporting structures. A range of national and WHO-supported tools can contribute to this process, depending on the context and information needs. These may include routine health information and surveillance systems, as well as complementary tools such as WHO's Health Resources and Services Availability Monitoring System (HeRAMS) and EWARS-in-a-Box. While these tools serve different purposes, together they can contribute to a broader understanding of evolving health risks, service availability and health-system functionality during emergencies.

HeRAMS is presented below as one practical example which provides a standardized approach to ensure that core information on health resources and services availability is readily accessible to decision-makers at national, regional and global levels in emergency settings^{clx}.

HeRAMS: a Case Study in Monitoring Health System Functionality

HeRAMS monitors the health of health systems in near-real time, enabling the identification of health system gaps, inequalities and service disruptions across geographic areas and health service domains. Its mission is to support countries in the systematic collection, analysis and dissemination of information on the availability of essential health services and resources at the point of service delivery, while strengthening health information systems through the maintenance and regular updating of authoritative health facility master lists.

Designed to be rapidly deployable and scalable in emergency settings and fragile contexts, HeRAMS can also be integrated into routine health information systems. Its modular architecture supports emergency preparedness and response, health systems strengthening, universal health coverage and the humanitarian-development nexus. In HeRAMS, all modalities through which health services are delivered are defined as Health Service Delivery

Units (HSDUs), including hospitals, PHC centers, mobile clinics and other service delivery platforms.

As of March 2026, HeRAMS is being implemented in 26 countries and territories, covering over 60 000 Health Service Delivery Units through either nationwide or sub-national deployments. National implementations are operational in countries such as Afghanistan, Burkina Faso, Chad, Comoros, the Central African Republic, Iraq, Libya, Mali, Niger, the occupied Palestinian territory, Somalia, Sudan, Ukraine and Yemen, while sub-national implementations continue in settings including Bangladesh (Cox's Bazar), the Democratic Republic of the Congo (Ituri), Ethiopia, Mozambique (north-east), Nigeria (north-east), Pakistan (Balochistan), the Philippines (Mindanao and National Capital Region) and the Syrian Arab Republic (north-east)^{clxi}.

A recent HeRAMS analysis on the impact on disasters on health systems provides valuable insights into the resilience of health systems exposed to disasters and climate-related shocks^{clxii}: approximately 3800 facilities (around 7% of HSDUs [see **Table A3.1**]) reported as non-operational, with a widely unevenly distributed burden across contexts. Sudan reports the highest proportion of non-operational facilities (35%), reflecting the severe impact of ongoing conflict and displacement. In contrast, Afghanistan and Iraq report fewer than 1% of monitored facilities as non-operational.

The analysis further highlights the lingering effects of natural hazards on health systems and health services delivery. In several countries, a significant proportion of health facilities affected by disasters during the previous five years remain non-operational. For example, Bangladesh, 44.5% in north-east Nigeria, 41.7% in Afghanistan, 41.2% in north-east Mozambique and 28% in Iraq remained non-operational at the time of reporting. Although the absolute numbers vary across countries, these findings demonstrate that climate- and disaster-related shocks can have prolonged consequences for health system functionality and access to care.

The relevance of health facility monitoring for climate-related preparedness and response is increasing as countries face more frequent and severe floods, droughts, storms and other extreme weather events associated with climate variability and climate change. The system provides a mechanism for identifying health facilities that may be vulnerable to disruption, and allows for near-real time monitoring during disasters, and as the response and recovery unfold, providing an essential continuum of data and analysis.

In addition to health systems operationality and service availability, HeRAMS monitors critical indicators that are fundamental to understanding health system resilience, including water, sanitation and hygiene (WASH), electricity access, energy sources, communications and other essential facility capacities. These data provide important insights into the ability of health facilities to withstand and continue operating during climate-related shocks and other emergencies. For example, a recent HeRAMS assessment in the Central African Republic

examined electricity access and the extent of health facility solarization across the health system, generating evidence on energy resilience and identifying opportunities to strengthen the continuity of essential health services during power disruptions and climate-related events^{clxiii}. Together, these assessments further strengthen the evidence base for climate-resilient and sustainable health systems.

HeRAMS therefore represents a critical tool for understanding the operational status, functionality and resilience of health systems in countries facing humanitarian crises, conflict and climate-related hazards. Expanding implementation to countries and regions where HeRAMS is not yet available would improve situational awareness, support evidence-based preparedness and response planning, and strengthen efforts to mitigate and adapt to the health impacts of climate-related disasters and other emergencies.

Table A3.1. HeRAMS Overview of Health System Functionality in Countries as of 06 May 2026

Country	Total Health Service Delivery Units	Non-operational Health Service Delivery Units	% of health facilities impacted by disasters over the past 5 years that remain non-operational	Latest HeRAMS report
Afghanistan	4242	39 <1%	5 41.7%	https://www.who.int/publications/m/item/herams-afghanistan-status-update-summary-report-2024-11
Burkina Faso	2937	137 4.7%	18 16.8%	https://www.who.int/publications/m/item/herams-burkina-status-update-report-august-2023-operational-status-of-the-health-system
Bangladesh (Cox's Bazar)	112	3 2.7%	1 50%	https://www.who.int/publications/m/item/herams-coxs-bazar-status-update-report-2024-03-operational-status-of-the-health-system
Central African Republic	1089	61 5.6%	10 27.8%	https://www.who.int/publications/m/item/herams-central-african-republic-natural-disasters-2026-02
Democratic Republic of the Congo (Ituri)	1025	88 8.6%	4 13.3%	https://www.who.int/publications/m/item/herams-ituri-baseline-report-2023-operational-status-of-the-health-system
Ethiopia	6698	891 13.3%	54 6.9%	https://www.who.int/publications/m/item/herams-ethiopia-afar-baseline-report-2023-operational-status-of-the-health-system

Iraq	4982	49 <1%	7 28%	https://www.who.int/publications/m/item/herams-iraq-status-update-report-2024-11-operational-status-of-the-health-system
Libya	190	5 2.6%	1 100%	
Mali ¹	4048	69 1.7%	4 11.1%	https://www.who.int/publications/m/item/herams-mali-status-update-summary-report-2024-10
Mozambique (Northeast)	640	43 6.7%	14 41.2%	https://www.who.int/publications/m/item/herams-mozambique-cabo-delgado-status-update-report-2024-08-operational-status-of-the-health-system
Niger	3469	178 5.1%	16 15%	https://www.who.int/publications/m/item/herams-niger-baseline-report-2023-operational-status-of-the-health-system
Nigeria (Northeast)	2191	237 10.8%	97 44.5%	
Sudan	4878	1705 35%	26 5%	https://www.who.int/publications/m/item/herams-sudan-infographics-2024-12
Somalia	417	19 4.6%	0	
Syrian Arab Republic (Northeast)	110	3 2.7%	0	https://www.who.int/publications/m/item/herams-northeast-syria-baseline-report-2024-operational-status-of-the-health-system
Yemen	5516	333 6%	33 21.6%	https://www.who.int/publications/m/item/herams-yemen-summary-update-report-2025-08
¹ exclude over 4000 community health workers monitored through HerAMS				

Annex 4: Community Protection Considerations for El Niño-Related Public Health Risks

El Niño-related climate anomalies can intensify public health risks through droughts, floods, cyclones, heatwaves, food insecurity, displacement, disease outbreaks, disruption of essential services and aggravate preexisting vulnerabilities. These risks are not experienced equally. Their impact depends on the exposure, vulnerability, preparedness actions and coping capacity of communities. In contexts of preexisting fragility and particularly among people already affected by humanitarian crises, displacement, poverty, food insecurity, weak access to health care, unsafe water and sanitation, and higher protection risks, the impact is more severe, longer lasting and likely to create higher mortality and longer term health consequences.

In this context, community protection provides an important operational lens for preparedness, anticipatory action and response. As defined by [WHO, UNICEF and IFRC in Defining community protection: a core concept for strengthening the global architecture for health emergency preparedness, response and resilience](#), community protection refers to community-centred health emergency management that engages and involves people who are at risk or affected in decisions taken to protect their health and well-being. It places emphasis on equity, accountability, community resilience, and the need to consciously protect the health, well-being and livelihoods of those at risk or affected.

For El Niño-related public health risks, community protection should support three complementary areas of action:

- **Community engagement, risk communication and infodemic management** should guide preparedness and response. Communities and people with lived experience should be involved in identifying local risks, vulnerable groups, barriers to service access, preferred communication channels and feasible protective actions. Community feedback, social listening, local risk mapping and participatory assessments can help adapt messages and interventions for drought, flooding, heat, cholera, malaria, dengue, malnutrition, displacement and other health risks.
- **Population and environmental public health interventions** should be acceptable, feasible and context-specific. In El Niño-affected settings, this includes community-supported WASH measures, safe water storage, hygiene promotion, waste management, drainage, vector control, vaccination, early detection of outbreaks, and measures to protect health facilities and continuity of care. These actions are especially relevant where flooding increases cholera, Acute Watery Diarrhoea (AWD), malaria, dengue and leptospirosis risks, or where drought and heat increase water scarcity, malnutrition, air pollution and heat-related illness. Preparedness efforts should also strengthen the resilience of PHC services and ensure that communities continue to have access to essential health services before, during and after climate-

related shocks. This includes maintaining routine immunization, maternal, newborn and child health services, nutrition programmes, management of chronic diseases, mental health and psychosocial support, and referral systems, particularly in remote, underserved and climate-vulnerable areas.

- **Multisectoral action for social and economic protection** is essential to reduce direct and indirect health impacts. El Niño-related shocks can disrupt livelihoods, food systems, education, protection services and social cohesion. As a result, populations may suffer from increased psychosocial distress and barriers to care, gender-based violence, and force households to adopt harmful coping strategies including child labour, early marriage, and family separation. Health preparedness and response at the community level should include food security, nutrition, WASH, education, shelter, protection, social protection and livelihoods support actions to achieve better health outcomes.

Operational priorities should include community-level risk, vulnerability mapping and capacity assessments; co-development of local preparedness and response plans; tools that ensure the continuity of essential community health services and community self-help and home based care, strengthened community-based surveillance and early warning; training and support for community health workers, volunteers and local leaders; safe and inclusive feedback mechanisms; and testing of contingency plans through simulations or after-action reviews. These actions should be prioritised where El Niño-related hazards overlap with high humanitarian need, weak health systems, displacement, food insecurity, climate-sensitive disease risks and limited coping capacity.

Community health workers (CHWs) and other trusted community actors play a particularly important role in El Niño preparedness and response. As frontline health workers embedded within communities, CHWs can support risk communication, community engagement, social listening, surveillance and early warning, health promotion, referral of vulnerable individuals, continuity of essential services, and rapid identification of emerging health threats. Strengthening CHW capacity, supervision, safety, supplies and integration into preparedness and response plans can significantly improve the reach, timeliness and effectiveness of public health interventions during climate-related emergencies.

A community protection approach also aligns closely with the [Emergency ready primary health care \(ERPHC\) framework](#), which seeks to strengthen preparedness and resilience through frontline health systems and communities. ERPHC emphasizes the integration of community engagement, community-based surveillance, infection prevention and control, emergency service delivery, and continuity of essential health services within routine PHC systems. Applying ERPHC principles to El Niño preparedness can help ensure that communities, health facilities and local authorities are better connected, able to detect and respond to emerging risks earlier, maintain essential services during crises, and recover more rapidly following climate-related shocks.

Integrating community protection into El Niño preparedness is essential to ensure that public health actions are not only technically sound, but also trusted, locally feasible, protective and equitable and owned by communities. It can also strengthen community resilience by building local capacities to anticipate, withstand, adapt to and recover from climate-related health risks while preserving essential health services and social support systems, and support better targeting of limited resources by identifying who is most at risk, which barriers prevent protective action, and which local capacities can be strengthened before, during and after climate-related shocks.

Annex 5: Potential Monitoring Indicators

The following are useful indicators that can be selected according to the country context to monitor the evolution of health threats associated with El Niño. Note that they are a list of suggestions and not comprehensive. Other areas that could be useful to consider include laboratory functionality, availability of emergency medical supplies and cold chain functionality.

Table A5.1. Potential indicators related to hazard, vulnerability and coping capacity assessment

Hazard	Vulnerability	Coping Capacity
Number and percent of population in Integrated Food Security Phase Classification (IPC) 3-5 areas	Number of affected people with access to safe water as per agreed standards (7.5 to 15 lt per day)	Number of Rapid Response Teams in districts affected by, or at risk of disease outbreaks
Incidence of various outbreak-prone diseases (e.g. cholera, arboviruses)	Crude mortality rate	Number of surveillance staff and community health workers trained in early warning and reporting of communicable diseases in districts affected by or at risk of disease outbreaks
Incidence of endemic communicable diseases (e.g. malaria, dengue)	Excess mortality rate	Number and status of water points for drinkable water per geographic area and population
	Under-5 mortality rate	Percentage of at-risk districts with at least one health post or equivalent (including mobile unit) per 10 000 population
	Prevalence of Global Acute Malnutrition (GAM)	Percentage of at-risk districts with at least one hospital per 50 000 population
	Prevalence of Severe Acute Malnutrition (SAM)	Percentage of at-risk districts with BEmOC (Basic Emergency Obstetric Care) available per 125 000 population or less
		Percentage of at-risk provinces with CEmOC (Comprehensive Emergency Obstetric Care) available per 500 000 population or less
		Percentage of target population within less than one day return walk of therapeutic feeding centre
		Percentage of health facilities conducting nutrition screening (MUAC or W/H)
		Percentage of targeted districts with a cholera treatment unit/center available within 5km of all affected communities
		Percentage of targeted districts with at least 90% (rural) or 95% (urban or camp)

		administrative coverage of measles vaccine Percentage of at-risk districts with at least one health facility with clinical management of rape available Emergency operations organigram and reporting lines established Health coordination mechanism established in country
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References

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- ⁱ Office for the Coordination of Humanitarian Affairs (2026). An Inter-Agency Report of the Global ENSO Analysis Cell: El Niño Status and Humanitarian Outlook (<https://www.unocha.org/publications/report/world/inter-agency-report-global-enso-analysis-cell-el-nino-status-and-humanitarian-outlook>).
- ⁱⁱ World Meteorological Organization (2026). El Niño is forecast to intensify, increasing likelihood of extreme weather (<https://wmo.int/news/media-centre/el-nino-forecast-intensify-increasing-likelihood-of-extreme-weather>).
- ⁱⁱⁱ World Meteorological Organization (2026). El Niño is forecast to intensify, increasing likelihood of extreme weather (<https://wmo.int/news/media-centre/el-nino-forecast-intensify-increasing-likelihood-of-extreme-weather>).
- ^{iv} World Meteorological Organization (2026). Global Seasonal Climate Update for July-August-September 2026 (<https://wmo.int/media/update/global-seasonal-climate-update-july-august-september-2026>).
- ^v Office for the Coordination of Humanitarian Affairs (2026). An Inter-Agency Report of the Global ENSO Analysis Cell: El Niño Status and Humanitarian Outlook (<https://www.unocha.org/publications/report/world/inter-agency-report-global-enso-analysis-cell-el-nino-status-and-humanitarian-outlook>).
- ^{vi} World Health Organization (2016). El Niño and Health: Global Overview - January 2016 (https://cdn.who.int/media/docs/default-source/climate-change/who_el_nino_and_health_global_report_21jan2016.pdf).
- ^{vii} World Health Organization (2016). El Niño and Health: Global Overview - January 2016 (https://cdn.who.int/media/docs/default-source/climate-change/who_el_nino_and_health_global_report_21jan2016.pdf).
- ^{viii} World Health Organization (2023). Public Health Situation Analysis: El Niño – Global Climate Event – Covering October-December 2023 (https://cdn.who.int/media/docs/default-source/documents/emergencies/phsa-el-nino-2023_update-oct-2023.pdf).
- ^{ix} World Health Organization (draft). Health consequences of ENSO: a scoping review. July 2024.
- ^x Lakhoo DP, Brink N, Radebe L, Craig MH, Pham MD, Haghighi MM, et al. A systematic review and meta-analysis of heat exposure impacts on maternal, fetal and neonatal health. *Nat Med.* 2025;31(2):684–94 (<https://doi.org/10.1038/s41591-024-03395-8>).
- ^{xi} World Meteorological Organization (2026). Global Seasonal Climate Update for July-August-September 2026 (<https://wmo.int/media/update/global-seasonal-climate-update-july-august-september-2026>).
- ^{xii} IASC ENSO (2026). An Inter-Agency Report of the Global ENSO Analysis Cell: El Niño Status and Humanitarian Outlook (<https://www.unocha.org/publications/report/world/inter-agency-report-global-enso-analysis-cell-el-nino-status-and-humanitarian-outlook>).
- ^{xiii} IASC ENSO (2026). An Inter-Agency Report of the Global ENSO Analysis Cell: El Niño Status and Humanitarian Outlook (<https://www.unocha.org/publications/report/world/inter-agency-report-global-enso-analysis-cell-el-nino-status-and-humanitarian-outlook>).
- ^{xiv} IASC ENSO (2026). An Inter-Agency Report of the Global ENSO Analysis Cell: El Niño Status and Humanitarian Outlook (<https://www.unocha.org/publications/report/world/inter-agency-report-global-enso-analysis-cell-el-nino-status-and-humanitarian-outlook>).
- ^{xv} IASC ENSO (2026). An Inter-Agency Report of the Global ENSO Analysis Cell: El Niño Status and Humanitarian Outlook (<https://www.unocha.org/publications/report/world/inter-agency-report-global-enso-analysis-cell-el-nino-status-and-humanitarian-outlook>).
- ^{xvi} United Nations Office for Disaster Risk Reduction (UNDRR), & International Science Council (ISC). (2025). UNDRR-ISC Hazard Information Profiles – 2025 Update. United Nations Office for Disaster Risk Reduction; International Science Council (<https://doi.org/10.24948/2025.05>).
- ^{xvii} World Health Organization (2023). Public Health Situation Analysis: El Niño – Global Climate Event – Covering October-December 2023 (https://cdn.who.int/media/docs/default-source/documents/emergencies/phsa-el-nino-2023_update-oct-2023.pdf).
- ^{xviii} World Health Organization (2016). El Niño and Health: Global Overview - January 2016 (https://cdn.who.int/media/docs/default-source/climate-change/who_el_nino_and_health_global_report_21jan2016.pdf).

- ^{xix} World Meteorological Organization (2025). WMO confirms 2024 as warmest year on record at about 1.55°C above pre-industrial level (<https://wmo.int/news/media-centre/wmo-confirms-2024-warmest-year-record-about-155degc-above-pre-industrial-level>).
- ^{xx} World Health Organization (2026). Fact Sheet: Health and Health (<https://www.who.int/news-room/fact-sheets/detail/climate-change-heat-and-health>).
- ^{xxi} Danysh, H.E., Gilman, R.H., Wells, J.C. et al. El Niño adversely affected childhood stature and lean mass in northern Peru. *Clim Chang Responses* 1, 7 (2014) (<https://doi.org/10.1186/s40665-014-0007-z>).
- ^{xxii} Anttila-Hughes, J. K., Jina, A. S., & McCord, G. C. (2021). ENSO impacts child undernutrition in the global tropics. *Nature communications*, 12(1), 5785 (<https://doi.org/10.1038/s41467-021-26048-7>).
- ^{xxiii} Food and Agriculture Organization of the United Nations & World Food Programme (2024). El Niño's Impact on Food and Nutrition Security in Southern Africa: Lesson Learned for Improved Coordination and Response (https://alnap.hacdn.io/media/documents/El_nino_Lesson_Learned_Brief_FINAL_WFPFAO_6_02_2024_KM_E_GB_1_1.pdf).
- ^{xxiv} Xinyue Liu et al., Unveiling the role of climate in spatially synchronized locust outbreak risks. *Sci.Adv.*10,eadj1164 (2024) (<https://doi.org/10.1126/sciadv.adj1164>).
- ^{xxv} Cerbaro, V. A., Fraisse, C. W., Watson, J. A., & Peres, N. A. (2026). Influence of the El Niño-Southern Oscillation on Botrytis infection risk in Florida. *Agricultural and Forest Meteorology*, 376, 110917.
- ^{xxvi} Semenza, J.C. Cascading risks of waterborne diseases from climate change. *Nat Immunol* 21, 484–487 (2020) (<https://doi.org/10.1038/s41590-020-0631-7>).
- ^{xxvii} Emont JP, Ko AI, Homasi-Paelate A, Ituaso-Conway N, Nilles EJ. Epidemiological Investigation of a Diarrhea Outbreak in the South Pacific Island Nation of Tuvalu During a Severe La Nina-Associated Drought Emergency in 2011. *The American journal of tropical medicine and hygiene*. 2017;96:576–82 (<https://doi.org/10.4269/ajtmh.16-0812>).
- ^{xxviii} Semenza, J.C. Cascading risks of waterborne diseases from climate change. *Nat Immunol* 21, 484–487 (2020) (<https://doi.org/10.1038/s41590-020-0631-7>).
- ^{xxix} Levy, K., Woster, A. P., Goldstein, R. S., & Carlton, E. J. (2016). Untangling the Impacts of Climate Change on Waterborne Diseases: a Systematic Review of Relationships between Diarrheal Diseases and Temperature, Rainfall, Flooding, and Drought. *Environmental science & technology*, 50(10), 4905–4922 (<https://doi.org/10.1021/acs.est.5b06186>).
- ^{xxx} Bennett, A., Epstein, L. D., Gilman, R. H., Cama, V., Bern, C., Cabrera, L., Lescano, A. G., Patz, J., Carcamo, C., Sterling, C. R., & Checkley, W. (2012). Effects of the 1997-1998 El Niño episode on community rates of diarrhea. *American journal of public health*, 102(7), e63–e69 (<https://doi.org/10.2105/AJPH.2011.300573>).
- ^{xxxi} Levy, K., Smith, S. M., & Carlton, E. J. (2018). Climate Change Impacts on Waterborne Diseases: Moving Toward Designing Interventions. *Current environmental health reports*, 5(2), 272–282 (<https://doi.org/10.1007/s40572-018-0199-7>).
- ^{xxxii} Levy K, Smith SM, Carlton EJ. Climate Change Impacts on Waterborne Diseases: Moving Toward Designing Interventions. *Curr Environ Health Rep*. 2017 Jun; 5(2) : 272-282. PMID: 29721700; PMCID: OMC6119235 (<https://doi.org/10.1007/s40572-018-0199-7>).
- ^{xxxiii} Semenza, J.C. Cascading risks of waterborne diseases from climate change. *Nat Immunol* 21, 484–487 (2020) (<https://doi.org/10.1038/s41590-020-0631-7>).
- ^{xxxiv} Froelich BA, Daines DA. In hot water: effects of climate change on Vibrio-human interactions. *Environ Microbiol*. 2020 Oct;22(10):4101-4111. Epub 2020 Mar 10. PMID: 32114705 (<https://doi.org/10.1111/1462-2920.14967>).
- ^{xxxv} Sheikh HI, Najiah M, Fadhlin A, Laith AA, Nor MM2, Jalal KCA, Kasan NA. Temperature Upshift Mostly but not Always Enhances the Growth of Vibrio Species: A Systematic Review. *Front. Mar. Sci*. 9:959830 (<https://doi.org/10.3389/fmars.2022.959830>).
- ^{xxxvi} Baker-Austin, C., Trinanes, J., Taylor, N. G. H., Hartnell, R., Siitonen, A., & Martinez-Urtaza, J. (2013). Emerging Vibrio risk at high latitudes in response to ocean warming. *Nature Climate Change*, 3, 73–77 (<https://doi.org/10.1038/nclimate1628>).
- ^{xxxvii} Trinanes, J., & Martinez-Urtaza, J. (2021). Future scenarios of risk of Vibrio infections in a warming planet: A global mapping study. *The Lancet Planetary Health*, 5(7), e426–e435 ([https://doi.org/10.1016/S2542-5196\(21\)00169-8](https://doi.org/10.1016/S2542-5196(21)00169-8)).
- ^{xxxviii} Moore, S. M., Azman, A. S., Zaitchik, B. F., Mintz, E. D., Brunkard, J., Legros, D., Hill, A., McKay, H., Luquero, F. J., Olson, D., & Lessler, J. (2017). El Niño and the shifting geography of cholera in Africa. *Proceedings of the National Academy of Sciences of the United States of America*, 114(17), 4436–4441 (<https://doi.org/10.1073/pnas.1617218114>).

- xxxix Pan American Health Organization. Inocuidad de alimentos en situaciones de desastres naturales y migraciones. 1999 (https://iris.paho.org/bitstream/handle/10665.2/51872/inocuidadalimentos_spa.pdf?sequence=1&isAllowed=y).
- xl Ramírez, I. J., & Lee, J. (2022). Deconstructing the spatial effects of El Niño and vulnerability on cholera rates in Peru: Wavelet and GIS analyses. *Spatial and Spatio-Temporal Epidemiology*, 40, 100474 (<https://doi.org/10.1016/j.sste.2021.100474>).
- xli World Health Organization (2026). Cholera upsurge (2021–July 2026) (<https://www.who.int/emergencies/situations/cholera-upsurge>).
- xlii UNICEF. (2024). UNICEF Eastern and Southern Africa response to El Niño 2024–2025. UNICEF Eastern and Southern Africa Regional Office (<https://www.unicef.org/esa/media/15521/file/UNICEF-ESA-Response-to-El-Nino-2025.pdf>).
- xliii Herrera-Pérez, Dennis, Saavedra-Barón, Alexandra, & Fernández-Mogollón, Jorge. (2019). Leptospirosis y coinfecciones durante el niño costero en un hospital del norte peruano. *Revista Peruana de Medicina Experimental y Salud Publica*, 36(1), 148–150 (<https://doi.org/10.17843/rpmesp.2019.361.4068>).
- xliv Levy K, Smith SM, Carlton EJ. Climate Change Impacts on Waterborne Diseases: Moving Toward Designing Interventions. *Curr Environ Health Rep*. 2017 Jun; 5(2) : 272–282. PMID: 29721700; PMCID: OMC6119235 (<https://doi.org/10.1007/s40572-018-0199-7>).
- xlv Semenza, J.C. Cascading risks of waterborne diseases from climate change. *Nat Immunol* 21, 484–487 (2020) (<https://doi.org/10.1038/s41590-020-0631-7>).
- xlvi Global Task Force on Cholera Control (2026). Guidelines & technical documents (<https://www.gtfcc.org/page-resources/guidelines-technical-documents/>).
- xlvii Levy K, Smith SM, Carlton EJ. Climate Change Impacts on Waterborne Diseases: Moving Toward Designing Interventions. *Curr Environ Health Rep*. 2017 Jun; 5(2) : 272–282. PMID: 29721700; PMCID: OMC6119235 (<https://doi.org/10.1007/s40572-018-0199-7>).
- xlviii Semenza, J.C. Cascading risks of waterborne diseases from climate change. *Nat Immunol* 21, 484–487 (2020) (<https://doi.org/10.1038/s41590-020-0631-7>).
- xlix Climate-resilient water safety plans: managing health risks associated with climate variability and change. Geneva: World Health Organization; 2017 (<https://iris.who.int/handle/10665/258722>).
- ¹ Semenza, J.C. Cascading risks of waterborne diseases from climate change. *Nat Immunol* 21, 484–487 (2020) (<https://doi.org/10.1038/s41590-020-0631-7>).
- ⁱⁱ International Research Institute for Climate and Society, Columbia University. (2015). 2015 El Niño: Notes for the East African Malaria Community (<https://iri.columbia.edu/wp-content/uploads/2015/10/ElNiño-Malaria-Oct-2015.pdf>).
- ⁱⁱⁱ World Health Organization. (2023). World malaria report. Licence: CC BY-NC-SA 3.0 IGO (<https://www.who.int/teams/global-malaria-programme/reports/world-malaria-report-2023>).
- ⁱⁱⁱⁱ Patz, J. A., Campbell-Lendrum, D., Holloway, T., & Foley, J. A. (2005). Impact of regional climate change on human health. *Nature*, 438, 310–317 (<https://doi.org/10.1038/nature04188>).
- ^{liv} Bouma, M. J., & van der Kaay, H. J. (1996). The El Niño Southern Oscillation and the historic malaria epidemics on the Indian subcontinent and Sri Lanka: An early warning system for future epidemics? *Tropical Medicine & International Health*, 1(1), 86–96 (<https://doi.org/10.1046/j.1365-3156.1996.d01-7.x>).
- ^{lv} Chaves, L. F., & Koenraadt, C. J. M. (2010). Climate change and highland malaria: fresh air for a hot debate. *Quarterly Review of Biology*, 85(1), 27–55 (<https://doi.org/10.1086/650284>).
- ^{lvi} Thomson, M. C., Connor, S. J., & D'Alessandro, U. (1999). Predicting malaria infection in Gambian children from satellite data and El Niño–Southern Oscillation events (<https://doi.org/10.4269/ajtmh.1999.61.2>).
- ^{lvii} Bouma, M. J., & van der Kaay, H. J. (1996). The El Niño Southern Oscillation and the historic malaria epidemics on the Indian subcontinent and Sri Lanka: An early warning system for future epidemics? *Tropical Medicine & International Health*, 1(1), 86–96 (<https://doi.org/10.1046/j.1365-3156.1996.d01-7.x>).
- ^{lviii} Chaves, L. F., & Koenraadt, C. J. M. (2010). Climate change and highland malaria: fresh air for a hot debate. *Quarterly Review of Biology*, 85(1), 27–55 (<https://doi.org/10.1086/650284>).
- ^{lix} Thomson, M. C., Connor, S. J., & D'Alessandro, U. (1999). Predicting malaria infection in Gambian children from satellite data and El Niño–Southern Oscillation events (<https://doi.org/10.4269/ajtmh.1999.61.2>).
- ^{lx} World Health Organization. (2023). World malaria report. Licence: CC BY-NC-SA 3.0 IGO (<https://www.who.int/teams/global-malaria-programme/reports/world-malaria-report-2023>).
- ^{lxi} World Health Organization. (2023). World malaria report. Licence: CC BY-NC-SA 3.0 IGO (<https://www.who.int/teams/global-malaria-programme/reports/world-malaria-report-2023>).

- lxii World Health Organization. (2023). World malaria report. Licence: CC BY-NC-SA 3.0 IGO (<https://www.who.int/teams/global-malaria-programme/reports/world-malaria-report-2023>).
- lxiii World Health Organization. (2023). World malaria report. Licence: CC BY-NC-SA 3.0 IGO (<https://www.who.int/teams/global-malaria-programme/reports/world-malaria-report-2023>).
- lxiv International Research Institute for Climate and Society. (2015). El Niño: Notes for the East African Malaria Community. (<https://iri.columbia.edu/wp-content/uploads/2015/10/ElNiño-Malaria-Oct-2015.pdf>).
- lxv Kovats, R. S., Bouma, M. J., Hajat, S., Worrall, E., & Haines, A. (2003). El Niño and health. *The Lancet*, 362(9394), 1481–1489 ([https://doi.org/10.1016/s0140-6736\(03\)14695-8](https://doi.org/10.1016/s0140-6736(03)14695-8)).
- lxvi International Research Institute for Climate and Society, Columbia University. (2015). 2015 El Niño: Notes for the East African Malaria Community (<https://iri.columbia.edu/wp-content/uploads/2015/10/ElNino-Malaria-Oct-2015.pdf>).
- lxvii International Research Institute for Climate and Society, Columbia University. (2015). 2015 El Niño: Notes for the East African Malaria Community (<https://iri.columbia.edu/wp-content/uploads/2015/10/ElNino-Malaria-Oct-2015.pdf>).
- lxviii Zhou, G., Minakawa, N., Githeko, A. K., & Yan, G. (2004). Association between climate variability and malaria epidemics in the East African highlands. *Proceedings of the National Academy of Sciences*, 101(8), 2375–2380 (<https://doi.org/10.1073/pnas.0308714100>).
- lxix Bouma, M. J., & van der Kaay, H. J. (1996). The El Niño Southern Oscillation and the historic malaria epidemics on the Indian subcontinent and Sri Lanka: An early warning system for future epidemics? *Tropical Medicine & International Health*, 1(1), 86–96 (<https://doi.org/10.4269/ajtmh.1999.61.2>).
- lxx Bouma, M. J., Dye, C., & van der Kaay, H. J. (1996). Falciparum malaria and climate change in the northwest frontier province of Pakistan. *American Journal of Tropical Medicine and Hygiene* (<https://doi.org/10.4269/ajtmh.1996.55.131>).
- lxxi Hay, S. I., Cox, J., Rogers, D. J., Randolph, S. E., Stern, D. I., Shanks, G. D., Myers, M. F., & Snow, R. W. (2002). Climate change and the resurgence of malaria in the East African highlands. *Nature*, 415, 905–909 (<https://doi.org/10.1038/415905a>).
- lxxii World Health Organization. (2023). World malaria report. Licence: CC BY-NC-SA 3.0 IGO (<https://www.who.int/teams/global-malaria-programme/reports/world-malaria-report-2023>).
- lxxiii World Health Organization (2023). Preventive chemotherapies (<https://www.who.int/teams/global-malaria-programme/prevention/preventive-chemotherapies>).
- lxxiv World Health Organization (2025). WHO guidelines for malaria (<https://app.magicapp.org/#/guideline/LwRMXj>).
- lxxv Anyamba, A., Chretien, J. P., Britch, S. C. et al. (2019). Global Disease Outbreaks Associated with the 2015–2016 El Niño Event. *Scientific Reports*, 9, 1930 (<https://doi.org/10.1038/s41598-018-38034-z>).
- lxxvi Delrieu, M., Martinet, J.-P., O'Connor, O., et al. (2023). Temperature and transmission of chikungunya, dengue, and Zika viruses: A systematic review of experimental studies on *Aedes aegypti* and *Aedes albopictus*. *Current Research in Parasitology & Vector-Borne Diseases*, 4, 100139 (<https://doi.org/10.1016/j.crpvbd.2023.100139>).
- lxxvii Mokhtar, S., Ratterree, D. C. P., Britt, A. F., Fisher, R., & Ndeffo-Mbah, M. L. (2024). Global risk of dengue outbreaks and the impact of El Niño events. *Environmental Research*, 262, 119830 (<https://doi.org/10.1016/j.envres.2024.119830>).
- lxxviii Tian, Y., Xu, Y., Liang, Y. et al. Rising dengue risk with increasing El Niño–Southern Oscillation amplitude and teleconnections. *Nat Commun* 16, 8629 (2025) (<https://doi.org/10.1038/s41467-025-63655-0>).
- lxxix Judson SD et al. Yellow fever re-emergence in Tolima, Colombia 2024–25: an eco-epidemiological study (<https://doi.org/10.64898/2026.01.16.26344301>).
- lxxx Anyamba, A., Chretien, J. P., Britch, S. C., Soebiyanto, R. P., Small, J. L., Jepsen, R., Forshey, B. M., Sanchez, J. L., Smith, R. D., Harris, R., Tucker, C. J., Karesh, W. B., & Linthicum, K. J. (2019). Global Disease Outbreaks Associated with the 2015–2016 El Niño Event. *Scientific reports*, 9(1), 1930 (<https://doi.org/10.1038/s41598-018-38034-z>).
- lxxxi C. Caminade, J. Turner, S. Metelmann, J.C. Hesson, M.S.C. Blagrove, T. Solomon, A.P. Morse, & M. Baylis, Global risk model for vector-borne transmission of Zika virus reveals the role of El Niño 2015, *Proc. Natl. Acad. Sci. U.S.A.* 114 (1) 119–124 (<https://doi.org/10.1073/pnas.1614303114>).
- lxxxii Pirani M, Lorenz C, de Azevedo TS, Barbosa GL, Blangiardo M, et al. (2024) Effects of the El Niño–Southern Oscillation and seasonal weather conditions on *Aedes aegypti* infestation in the State of São Paulo (Brazil): A Bayesian spatio-temporal study. *PLOS Neglected Tropical Diseases* 18(9): e0012397 (<https://doi.org/10.1371/journal.pntd.0012397>).

- ^{lxxxiii} Anyamba, A., Chretien, JP., Britch, S.C. et al. Global Disease Outbreaks Associated with the 2015–2016 El Niño Event. *Sci Rep* 9, 1930 (2019) (<https://doi.org/10.1038/s41598-018-38034-z>).
- ^{lxxxiv} Delrieu, M., Martinet, J.-P., O'Connor, O., et al. (2023). Temperature and transmission of chikungunya, dengue, and Zika viruses: A systematic review of experimental studies on *Aedes aegypti* and *Aedes albopictus*. *Current Research in Parasitology & Vector-Borne Diseases*, 4, 100139 (<https://doi.org/10.1016/j.crpvbd.2023.100139>).
- ^{lxxxv} Urban yellow fever risk management: handbook for national preparedness and response planning. Geneva: World Health Organization; 2026. Licence: CC BY-NC-SA 3.0 IGO (<https://iris.who.int/handle/10665/386783>).
- ^{lxxxvi} World Health Organization. (2017). Global vector control response 2017–2030. Geneva: World Health Organization. ISBN 978-92-4-151297-8 (<https://iris.who.int/handle/10665/259002>).
- ^{lxxxvii} World Health Organization. (2024). Global Arbovirus Initiative: preparing for the next pandemic by tackling mosquito-borne viruses with epidemic and pandemic potential. Geneva: World Health Organization. ISBN 978-92-4-008894-8 (<https://iris.who.int/handle/10665/376630>).
- ^{lxxxviii} A. Anyamba, J. Chretien, J. Small, C.J. Tucker, P.B. Formenty, J.H. Richardson, S.C. Britch, D.C. Schnabel, R.L. Erickson, & K.J. Linthicum, Prediction of a Rift Valley fever outbreak, *Proc. Natl. Acad. Sci. U.S.A.* 106 (3) 955-959 (2009) (<https://doi.org/10.1073/pnas.0806490106>).
- ^{lxxxix} Linthicum, K. J., Anyamba, A., Tucker, C. J., Kelley, P. W., Myers, M. F., & Peters, C. J. (1999). Climate and satellite indicators to forecast Rift Valley fever epidemics in Kenya. *Science* (New York, N.Y.), 285(5426), 397–400 (<https://doi.org/10.1126/science.285.5426.397>).
- ^{xc} Esser, H. J., Mögling, R., Cleton, N. B., van der Jeugd, H., Sprong, H., Stroo, A., Koopmans, M. P. G., de Boer, W. F., & Reusken, C. B. E. M. (2019). Risk factors associated with sustained circulation of six zoonotic arboviruses: a systematic review for selection of surveillance sites in non-endemic areas. *Parasites & vectors*, 12(1), 265 (<https://doi.org/10.1186/s13071-019-3515-7>).
- ^{xci} World Health Organization (2024). Rift Valley Fever: fact sheet (<https://www.who.int/news-room/fact-sheets/detail/rift-valley-fever>).
- ^{xcii} Esser, H. J., Mögling, R., Cleton, N. B., van der Jeugd, H., Sprong, H., Stroo, A., Koopmans, M. P. G., de Boer, W. F., & Reusken, C. B. E. M. (2019). Risk factors associated with sustained circulation of six zoonotic arboviruses: a systematic review for selection of surveillance sites in non-endemic areas. *Parasites & vectors*, 12(1), 265 (<https://doi.org/10.1186/s13071-019-3515-7>).
- ^{xciii} World Health Organization (2026). Risk evaluation of Rift Valley Fever virus (RVFV) lineages and their public health impact (https://cdn.who.int/media/docs/default-source/documents/emergencies/rift-valley-fever/26052026rvfv_risk_evaluation_final.pdf?sfvrsn=c747acc7_3&download=true).
- ^{xciv} World Health Organization (2026). Risk evaluation of Rift Valley Fever virus (RVFV) lineages and their public health impact (https://cdn.who.int/media/docs/default-source/documents/emergencies/rift-valley-fever/26052026rvfv_risk_evaluation_final.pdf?sfvrsn=c747acc7_3&download=true).
- ^{xcv} Food and Agriculture Organization of the United Nations (2026). RVF Decision Support Tool (<https://data.apps.fao.org/rvf>).
- ^{xcvi} World Health Organization. (2024). Japanese encephalitis: fact sheet (<https://www.who.int/news-room/fact-sheets/detail/japanese-encephalitis>).
- ^{xcvii} World Health Organization. (2024). Japanese encephalitis: fact sheet (<https://www.who.int/news-room/fact-sheets/detail/japanese-encephalitis>).
- ^{xcviii} Bi, P., Tong, S., Donald, K., Parton, K., & Ni, J. (2007). Climate variability and transmission of Japanese encephalitis in eastern China. *Vector-Borne and Zoonotic Diseases*, 7(4), 599–604 (<https://doi.org/10.1089/153036603768395807>).
- ^{xcix} Nicholls N. (1986). A method for predicting Murray Valley encephalitis in southeast Australia using the Southern Oscillation. *The Australian journal of experimental biology and medical science*, 64 (Pt 6), 587–594 (<https://doi.org/10.1038/icb.1986.62>).
- ^c Woodruff, R. E., Guest, C. S., Garner, M. G., Becker, N., Lindesay, J., Carvan, T., & Ebi, K. (2002). Predicting Ross River virus epidemics from regional weather data. *Epidemiology*, 13(4), 384-393 (<https://doi.org/10.1097/00001648-200207000-00005>).
- ^{ci} A. Trebski, L. Gourlay, R. Gibb, N. Imirzian, & D.W. Redding, Climate sensitivity is widely but unevenly spread across zoonotic diseases, *Proc. Natl. Acad. Sci. U.S.A.* 122 (50) e2422851122 (2025) (<https://doi.org/10.1073/pnas.2422851122>).
- ^{cii} Anyamba, A., Chretien, JP., Britch, S.C. et al. Global Disease Outbreaks Associated with the 2015–2016 El Niño Event. *Sci Rep* 9, 1930 (2019) (<https://doi.org/10.1038/s41598-018-38034-z>).

- ^{ciii} Kreppel KS, Caminade C, Telfer S, Rajerison M, Rahalison L, et al. (2014) A Non-Stationary Relationship between Global Climate Phenomena and Human Plague Incidence in Madagascar. *PLOS Neglected Tropical Diseases* 8(10): e3155 (<https://doi.org/10.1371/journal.pntd.0003155>).
- ^{civ} A. Trebski, L. Gourlay, R. Gibb, N. Imirzian, & D.W. Redding, Climate sensitivity is widely but unevenly spread across zoonotic diseases, *Proc. Natl. Acad. Sci. U.S.A.* 122 (50) e2422851122 (2025) (<https://doi.org/10.1073/pnas.2422851122>).
- ^{cv} World Health Organization (2023). Leishmaniasis: fact sheet (<https://www.who.int/news-room/fact-sheets/detail/leishmaniasis>).
- ^{cvi} Franke, C. R., Ziller, M., Staubach, C., & Latif, M. (2002). Impact of El Niño/Southern Oscillation on Visceral Leishmaniasis, Brazil. *Emerging Infectious Diseases*, 8(9), 914-917 (<https://doi.org/10.3201/eid0809.010523>).
- ^{cvi} Da Silva AS, Andreoli RV, de Souza RAF, et al. (2021). Impact of El Niño on the dynamics of American cutaneous leishmaniasis in a municipality in the western Amazon. *Acta Tropica*, 222,106032 (<https://doi.org/10.1016/j.actatropica.2021.106032>).
- ^{cvi} World Health Organization (2023). Leishmaniasis: fact sheet (<https://www.who.int/news-room/fact-sheets/detail/leishmaniasis>).
- ^{cix} Esser, H. J., Mögling, R., Cleton, N. B., van der Jeugd, H., Sprong, H., Stroo, A., Koopmans, M. P. G., de Boer, W. F., & Reusken, C. B. E. M. (2019). Risk factors associated with sustained circulation of six zoonotic arboviruses: a systematic review for selection of surveillance sites in non-endemic areas. *Parasites & vectors*, 12(1), 265 (<https://doi.org/10.1186/s13071-019-3515-7>).
- ^{cx} Singh, P., Kumar, P., & Dhiman, R. C. (2022). Kyasanur forest disease and climatic attributes in India. *Journal of vector borne diseases*, 59(1), 79–85 (<https://doi.org/10.4103/0972-9062.331408>).
- ^{cx} Couper, L. I., MacDonald, A. J., & Mordecai, E. A. (2021). Impact of prior and projected climate change on US Lyme disease incidence. *Global change biology*, 27(4), 738–754 (<https://doi.org/10.1111/gcb.15435>).
- ^{cxii} Esser, H. J., Mögling, R., Cleton, N. B., van der Jeugd, H., Sprong, H., Stroo, A., Koopmans, M. P. G., de Boer, W. F., & Reusken, C. B. E. M. (2019). Risk factors associated with sustained circulation of six zoonotic arboviruses: a systematic review for selection of surveillance sites in non-endemic areas. *Parasites & vectors*, 12(1), 265 (<https://doi.org/10.1186/s13071-019-3515-7>).
- ^{cxiii} Singh, P., Kumar, P., & Dhiman, R. C. (2022). Kyasanur forest disease and climatic attributes in India. *Journal of vector borne diseases*, 59(1), 79–85 (<https://doi.org/10.4103/0972-9062.331408>).
- ^{cxiv} Esser, H. J., Mögling, R., Cleton, N. B., van der Jeugd, H., Sprong, H., Stroo, A., Koopmans, M. P. G., de Boer, W. F., & Reusken, C. B. E. M. (2019). Risk factors associated with sustained circulation of six zoonotic arboviruses: a systematic review for selection of surveillance sites in non-endemic areas. *Parasites & vectors*, 12(1), 265 (<https://doi.org/10.1186/s13071-019-3515-7>).
- ^{cxv} World Health Organization. (2026). Hantavirus: fact sheet (<https://www.who.int/news-room/fact-sheets/detail/hantavirus>).
- ^{cxvi} World Health Organization. (2026). Hantavirus: fact sheet (<https://www.who.int/news-room/fact-sheets/detail/hantavirus>).
- ^{cxvii} World Health Organization. (2026). Hantavirus: fact sheet (<https://www.who.int/news-room/fact-sheets/detail/hantavirus>).
- ^{cxviii} Hjelle, B., & Glass, G. E. (2000). Outbreak of hantavirus infection in the Four Corners region of the United States in the wake of the 1997-1998 El Nino-southern oscillation. *The Journal of infectious diseases*, 181(5), 1569–1573 (<https://doi.org/10.1086/315467>).
- ^{cxix} Terry L. Yates, James N. Mills, Cheryl A. Parmenter, Thomas G. Ksiazek, Robert R. Parmenter, John R. Vande Castle, Charles H. Calisher, Stuart T. Nichol, Kenneth D. Abbott, Joni C. Young, Michael L. Morrison, Barry J. Beaty, Jonathan L. Dunnum, Robert J. Baker, Jorge Salazar-Bravo, Clarence J. Peters, The Ecology and Evolutionary History of an Emergent Disease: Hantavirus Pulmonary Syndrome: Evidence from two El Niño episodes in the American Southwest suggests that El Niño–driven precipitation, the initial catalyst of a trophic cascade that results in a delayed density-dependent rodent response, is sufficient to predict heightened risk for human contraction of hantavirus pulmonary syndrome, *BioScience*, Volume 52, Issue 11, November 2002, Pages 989–998 ([https://doi.org/10.1641/0006-3568\(2002\)052\[0989:TEAEHO\]2.0.CO;2](https://doi.org/10.1641/0006-3568(2002)052[0989:TEAEHO]2.0.CO;2)).
- ^{cxix} World Health Organization. Leptospirosis. Geneva: World Health Organization (<https://www.who.int/news-room/fact-sheets/detail/leptospirosis>).
- ^{cxix} Helepola NDB, Ariyaratne K, Dissanayake DS. The interrelationship between meteorological parameters and leptospirosis incidence in Hambantota district, Sri Lanka 2008–2017 and practical implications. *PLoS One*. 2021;16(1):e0245366 (<https://doi.org/10.1371/journal.pone.0245366>).

- cxix Hacker KP, Sacramento GA, Cruz JS, de Oliveira D, Nery N Jr, Lindow JC, Carvalho M, Hagan JE, Diggle PJ, Begon M, Reis MG, Wunder EA Jr, Ko AI, Costa F. Influence of rainfall on *Leptospira* infection and disease in a tropical urban setting, Brazil. *Emerg Infect Dis.* 2020;26(2):311–321 (<https://doi.org/10.3201/eid2602.190102>).
- cxix World Health Organization. (2025). Measles: fact sheet (<https://www.who.int/news-room/fact-sheets/detail/measles>).
- cxix World Health Organization. (2025). Meningitis: fact sheet (<https://www.who.int/news-room/fact-sheets/detail/meningitis>).
- cxix Barnidge, I. T., Ferreira, A. J. F., Kovats, S., Velasco, S. R. M., Leyland, A., Galvao, L. A., Santos, G. F., Paixao, E. S., Barreto, M. L., Brickley, E. B., Pescarini, J. M., & Global Health Research Unit on the Social and Environmental Determinants of Health Inequalities (SEDHI) (2026). Effects of hydro-meteorological and geological disasters on vaccine-preventable disease outbreaks and routine immunisation amongst children: A scoping review. *PLOS global public health*, 6(6), e0005712 (<https://doi.org/10.1371/journal.pgph.0005712>).
- cxix Sultan, B., Labadi, K., Guégan, J. F., & Janicot, S. (2005). Climate drives the meningitis epidemics onset in West Africa. *PLoS Medicine*, 2(1), e6 (<https://doi.org/10.1371/journal.pmed.0020006>).
- cxix Molesworth, A. M., Thomson, M. C., Connor, S. J., et al. (2003). Where is the meningitis belt? Defining an area at risk of epidemic meningitis in Africa. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 96(3), 242–249 ([https://doi.org/10.1016/s0035-9203\(02\)90089-1](https://doi.org/10.1016/s0035-9203(02)90089-1)).
- cxix Gobler, C. J. (2020). Climate change and harmful algal blooms: insights and perspective. *Harmful algae*, 91, 101731 (<https://doi.org/10.1016/j.hal.2019.101731>).
- cxix Hallegraeff, G.M. (2010). OCEAN CLIMATE CHANGE, PHYTOPLANKTON COMMUNITY RESPONSES, AND HARMFUL ALGAL BLOOMS: A FORMIDABLE PREDICTIVE CHALLENGE1. *Journal of Phycology*, 46: 220-235 (<https://doi.org/10.1111/j.1529-8817.2010.00815.x>).
- cxix Trainer, V. L., Moore, S. K., Hallegraeff, G., Kudela, R. M., Clement, A., Mardones, J. I., & Cochlan, W. P. (2020). Pelagic harmful algal blooms and climate change: Lessons from nature's experiments with extremes. *Harmful algae*, 91, 101591 (<https://doi.org/10.1016/j.hal.2019.101731>).
- cxix Hales, S., Weinstein, P. and Woodward, A. (1999). Ciguatera (Fish Poisoning), El Niño, and Pacific Sea Surface Temperatures. *Ecosystem Health*, 5: 20-25 (<https://doi.org/10.1046/j.1526-0992.1999.09903.x>).
- cxix Trainer, V. L., Moore, S. K., Hallegraeff, G., Kudela, R. M., Clement, A., Mardones, J. I., & Cochlan, W. P. (2020). Pelagic harmful algal blooms and climate change: Lessons from nature's experiments with extremes. *Harmful algae*, 91, 101591 (<https://doi.org/10.1016/j.hal.2019.101731>).
- cxix Romanello, M., Walawender, M., Hsu, S. C., Moskeland, A., Palmeiro-Silva, Y., Scamman, D., ... & Costello, A. (2025). The 2025 report of the Lancet Countdown on health and climate change: climate change action offers a lifeline. *The Lancet*, 406(10521), 2804-2857 ([https://doi.org/10.1016/s0140-6736\(25\)01919-1](https://doi.org/10.1016/s0140-6736(25)01919-1)).
- cxix Chersich, M. F., Pham, M. D., Areal, A., Haghighi, M. M., Manyuchi, A., Swift, C. P., Wernecke, B., Robinson, M., Hetem, R., Boeckmann, M., Hajat, S., & Climate Change and Heat-Health Study Group (2020). Associations between high temperatures in pregnancy and risk of preterm birth, low birth weight, and stillbirths: systematic review and meta-analysis. *BMJ (Clinical research ed.)*, 371, m3811 (<https://doi.org/10.1136/bmj.m3811>).
- cxix Thiede, B. C., & Gray, C. (2020). Climate exposures and child undernutrition: Evidence from Indonesia. *Social science & medicine* (1982), 265, 113298 (<https://doi.org/10.1016/j.socscimed.2020.113298>).
- cxix World Health Organization. (2025). Measles: fact sheet (<https://www.who.int/news-room/fact-sheets/detail/measles>).
- cxix Arunda MO, Sorcher R, Canabarro APF, Svallfors S, Endler M, Gemzell-Danielsson K, et al. Climate change and sexual and reproductive health and rights research in low-income and middle-income countries: a scoping review. *BMJ Public Health*. 2024;2:e001090 (<https://doi.org/10.1136/bmjph-2024-001090>).
- cxix Lakhoo, D. P., Brink, N., Radebe, L., Craig, M. H., Pham, M. D., Haghighi, M. M., Wise, A., Solarin, I., Luchters, S., Maimela, G., Chersich, M. F., Heat-Health Study Group, & HIGH Horizons Study Group (2025). A systematic review and meta-analysis of heat exposure impacts on maternal, fetal and neonatal health. *Nature medicine*, 31(2), 684–694 (<https://doi.org/10.1038/s41591-024-03395-8>).
- cxix World Health Organization (2023). Protecting maternal, newborn and child health from the impacts of climate change: A call for action (<https://iris.who.int/handle/10665/374272>).
- cxl World Health Organization. (2024). Violence against women: fact sheet (<https://www.who.int/news-room/fact-sheets/detail/violence-against-women>).
- cxli UNWOMEN. (2025). How gender inequality and climate change are interconnected (<https://www.unwomen.org/en/articles/explainer/how-gender-inequality-and-climate-change-are-interconnected>).
- cxlii UNFPA. (2025). Climate change: Climate change undermines sexual and reproductive health and rights (<https://www.unfpa.org/climate-change>).

- cxliii UNFPA. (2025). Climate change: Climate change undermines sexual and reproductive health and rights (<https://www.unfpa.org/climate-change>).
- cxliv Mulambo, C. H., Thakur, R., & Mathew, S. (2025). Hot weather and violence against women: A global scoping review. *International Journal of Environmental Research and Public Health*, 22(7), 1069.
- cxlv World Health Organization (2022). Mental health and climate change: policy brief (<https://www.who.int/publications/i/item/9789240045125>).
- cxlvi Friel, S., Bowen, K., Campbell-Lendrum, D., Frumkin, H., McMichael, A. J., & Rasanathan, K. (2011). Climate change, noncommunicable diseases, and development: The relationships and common policy opportunities. In J. Fielding, R. Brownson & L. Green (Eds.), *Annual review of public health* (pp. 133-147). *Annual Reviews* (<https://doi.org/10.1146/annurev-publhealth-071910-140612>).
- cxlvii Epstein PR. 2008. Fossil fuels, allergies, and a host of other ills. *J. Allergy Clin. Immunol.* 122:471–72 (<https://doi.org/10.1016/j.jaci.2008.07.015>).
- cxlviii Ewing R, Bartholomew K, Winkelman S, Walters J, Chen D. 2007. *Growing Cooler: The Evidence on Urban Development and Climate Change*. Washington, DC: Urban Land Inst (<https://forms.cupertino.org/inc/pdf/SR85/Exhibit%20I%20-%20Growing%20Cooler.pdf>).
- cxlix Ezzati M, Lopez AD, Rodgers A, Vander Hoorn S, Murray CJ. 2002. Selected major risk factors and global and regional burden of disease. *Lancet* 360:1347–60 ([https://doi.org/10.1016/s0140-6736\(02\)11403-6](https://doi.org/10.1016/s0140-6736(02)11403-6)).
- cl Reisen F, Brown S. 2006. Implications for community health from exposure to bushfire air toxics. *Environ. Chem.* 3:235–43 (<https://doi.org/10.1071/EN06008>).
- cli Friel S, Dangour AD, Garnett T, Lock K, Chalabi Z, et al. 2009. Public health benefits of strategies to reduce greenhouse-gas emissions: food and agriculture. *Lancet* 374:2016–25 ([https://doi.org/10.1016/s0140-6736\(09\)61753-0](https://doi.org/10.1016/s0140-6736(09)61753-0)).
- clii Friel, S., Bowen, K., Campbell-Lendrum, D., Frumkin, H., McMichael, A. J., & Rasanathan, K. (2011). Climate change, noncommunicable diseases, and development: The relationships and common policy opportunities. In J. Fielding, R. Brownson & L. Green (Eds.), *Annual review of public health* (pp. 133-147). *Annual Reviews* (<https://doi.org/10.1146/annurev-publhealth-071910-140612>).
- cliii World Health Organization. (2026). Snakebite envenoming (<https://www.who.int/news-room/fact-sheets/detail/snakebite-envenoming>).
- cliv Chaves LF, Chuang TW, Sasa M, Gutiérrez JM. Snakebites are associated with poverty, weather fluctuations, and El Niño. *Sci Adv.* 2015 Sep 11;1(8):e1500249. 1500249. PMID: 26601254; PMCID: PMC4643785 (<https://doi.org/10.1126/sciadv.1500249>).
- clv Bravo-Vega C, Santos-Vega M, Cordovez JM (2022) Disentangling snakebite dynamics in Colombia: How does rainfall and temperature drive snakebite temporal patterns? *PLoS Negl Trop Dis* 16(3): e0010270 (<https://doi.org/10.1371/journal.pntd.0010270>).
- clvi World Health Organization. (2026). Schistosomiasis: fact sheet (<https://www.who.int/news-room/fact-sheets/detail/schistosomiasis>).
- clvii World Health Organization (2026). Schistosomiasis: fact sheet (<https://www.who.int/news-room/fact-sheets/detail/schistosomiasis>).
- clviii Glidden, C.K., Singleton, A.L., Chamberlin, A. et al. Climate and urbanization drive changes in the habitat suitability of *Schistosoma mansoni* competent snails in Brazil. *Nat Commun* 15, 4838 (2024). (<https://doi.org/10.1038/s41467-024-48335-9>).
- clix Snakebite envenoming: a strategy for prevention and control. Geneva: World Health Organization; 2019. Licence: CC BY-NC-SA 3.0 IGO (<https://iris.who.int/handle/10665/324838>).
- clx WHO (2026). Health Resources and Services Availability Monitoring System (HeRAMS) (<https://www.who.int/initiatives/herams>).
- clxi HeRAMS country implementations snapshot March 2026 (<https://www.who.int/publications/m/item/herams-country-implementations-snapshot-2026-03>).
- clxii HeRAMS impact on disaster on health systems (<https://www.who.int/publications/m/item/herams-disaster-health-systems-2026-05>).
- clxiii HeRAMS Central African Republic: Electricity access in health care facilities (<https://www.who.int/publications/m/item/herams-central-african-republic-electricity-access-2025-12>).