Public Health Situation Analysis

El Niño

Global Climate Event

Covering July-September 2023

Population: El Niño affected countries
Reporting period: July-Sep 2023
Start date of crisis: July 2023
Typology of crisis: Heatwaves, drought, wildfires, floods, landslides, food insecurity, infectious diseases, cyclones

This living document was prepared by the Department of Alert and Response Coordination with inputs from relevant technical experts within WHO and partners. It may be updated periodically based on changes in the situation and availability of new data.

World Health Organization

Preface

This Public Health Situation Analysis (PHSA) identifies the current and potential health impacts that vulnerable populations may face as a result of the global El Niño climate event, and describes health systems' capacities to respond.

This document is intended for all health sector partners, including local and national authorities, non-governmental organizations (NGOs), donor agencies and United Nations agencies. It provides a common and comprehensive understanding of the crisis in order to inform health response planning. It is based on key documents and research products from members of the Worth Health Organization, World Meteorological Organization (WMO), other UN organizations, NGOs, and research institutes.

The ongoing El Niño is highly likely to have wide-ranging health implications on a global scale. In the coming months, the most severe health threats are likely to arise from malnutrition due to ongoing food insecurity compounded by the effects of El Niño. Detailed information on key health threats and at-risk countries is presented throughout the document. WHO acts as part of a UN-wide coordination and monitoring mechanism for El Niño, and supports countries through programmatic work to address key health threats, and via direct support to countries.

All efforts have been made to ensure the accuracy of the data, but this should not be considered a formal reference document of the World Health Organization.

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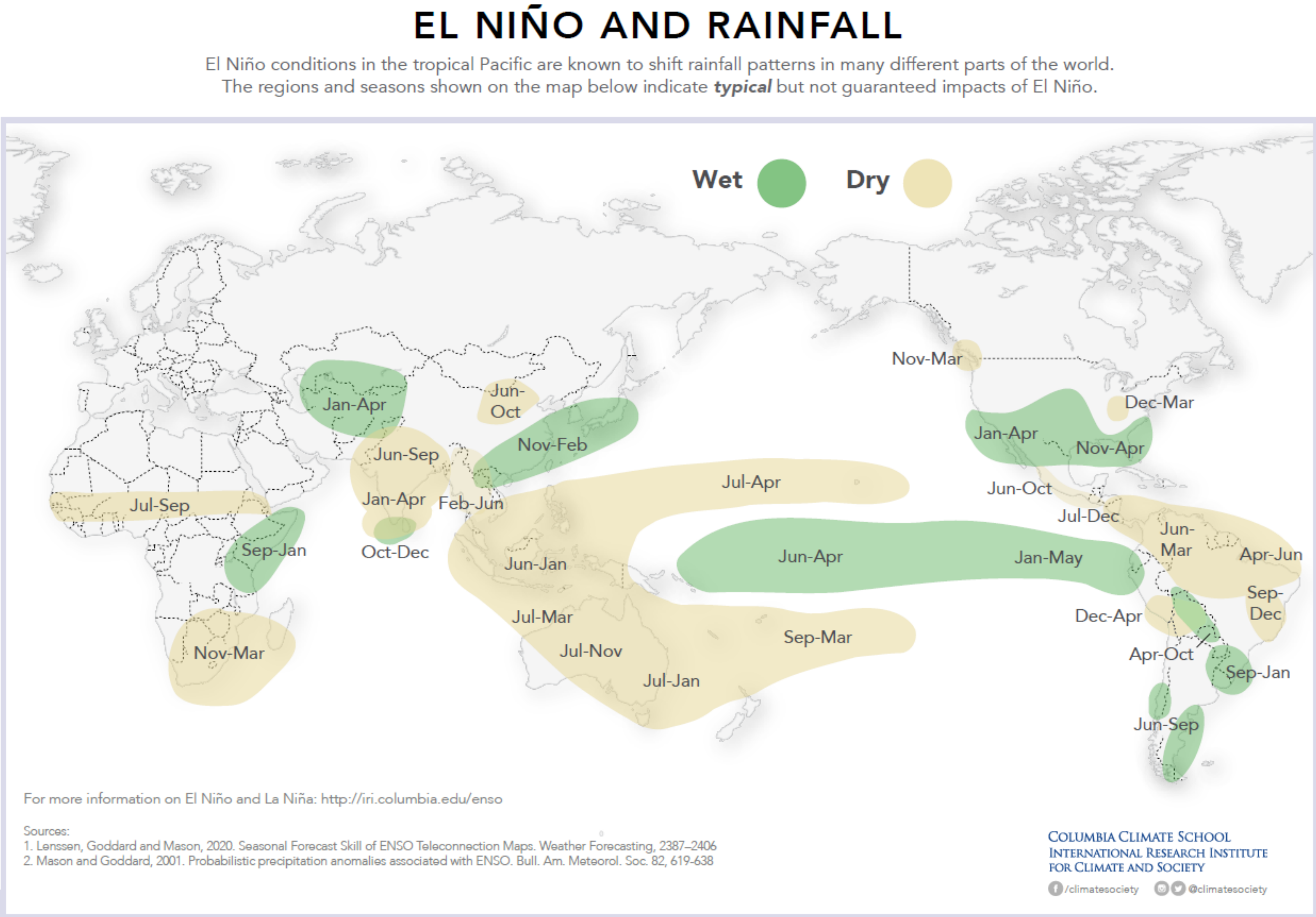
Overview of the 2023 El Niño climate pattern and its primary health effects

This section is adapted from *Update on El Niño: Priority countries for June-August 2023. Global ENSO Analysis Cell, May 2023*[1]. El Niño and La Niña are climate patterns in the Pacific Ocean that affect weather worldwide. During normal conditions in the Pacific Ocean, trade winds blow west along the Equator, taking warm water from South America towards Asia. To replace that warm water, cold water rises from the depths — a process called upwelling. El Niño and La Niña are two opposing climate patterns that break these normal conditions. Scientists call these phenomena the El Niño-Southern Oscillation (ENSO) cycle. El Niño and La Niña both have global impacts on weather, wildfires, ecosystems, and economies. Episodes of El Niño and La Niña typically last nine to 12 months, but can sometimes last for years; they typically start around April and peak in intensity between November and February of the following year. El Niño and La Niña events occur every two to



seven years on average, but they don't occur on a regular schedule. Generally, El Niño occurs more frequently than La Niña.[2]

Table 1: Historical El Niño climatic impacts on individual countries. Note that countries not listed may still be affected as ENSO effects are not consistent from year to year (Source: IASC)

Dry		Wet
Angola	Malaysia	Afghanistan
Aruba	Mali	Argentina
Australia	Marshall Islands	Azerbaijan
Bangladesh	Mauritania	Bahamas
Benin	Micronesia	Brazil (extreme southern region)
Bhutan	Mozambique	Burundi
Botswana	Myanmar	Chile
Brazil (northern region)	Namibia	China (western region)
Brunei	Nepal	Ecuador (northwestern region)
Burkina Faso	Nicaragua	Ethiopia (southeastern region)
Cambodia	Niger	India (south)
Cameroon	Nigeria	Iran (Islamic Republic of)
Canada (West coast region)	Pakistan (southeastern region)	Kazakhstan
Central African Republic	Palau	Kenya
Chad	Panama	Kyrgyzstan
Colombia	Papua New Guinea	Mexico (northern region)
Costa Rica	Peru (northeastern region)	Nauru
Côte d'Ivoire	Philippines	Pakistan (northern region)
Curaçao	Samoa	Paraguay
Djibouti	Senegal	Peru (northwestern region)
Democratic Republic of the Congo (extreme southern region)	Sierra Leone	Rwanda
El Salvador	Singapore	Somalia
Eritrea	Solomon Islands	Sri Lanka
Eswatini	South Africa	Tajikistan
Ethiopia (northern region)	South Sudan	Turkmenistan
Fiji	Sudan	Tuvalu
French Guiana	Suriname	Uganda
Gambia	Thailand	Uruguay
Ghana	Timor-Leste	United Republic of Tanzania
Grenada	Togo	United States of America (southern region)
Guatemala	Tonga	Uzbekistan
Guinea	Trinidad and Tobago	Kiribati (south-east region)
Guinea-Bissau	United States of America (Hawaii and Ohio River Valley)	
Guyana	Vanuatu	
Honduras	Venezuela (Bolivarian Republic of)	
India	Vietnam	
Indonesia	Zambia	
Kiribati (north-west region)	Zimbabwe	
Lesotho		
Madagascar		
Malawi		

El Niño conditions have developed as of June 2023, as the atmospheric response to the warmer-than-average tropical Pacific sea surface have started.[3] While significant uncertainty remains for the predicted El Niño duration and intensity, at this stage most models suggest that El Niño will persist at least until the end of 2023. It must be noted that this El Niño is taking place in the context of a very warm global ocean, and we don't know how this will affect El Niño's atmospheric conditions.

The primary immediate health risks related to El Niño over the next three months (July-Sep 2023) are summarized in Table 2. This table should be taken as broadly indicative, with considerable local variation in risks according to local effects and vulnerabilities (more detail in Annex). Further explanation about each health risk follows in the Health Status and Threats section (primarily taken from references 4, 5, and 6, except where specifically referenced). Country-level estimates can be found in the Annex.

Table 2: Key health risks in the context of El Niño, July-Sep 2023.

Public health risk	Likelihood	Public health consequences	Level of risk*	Rationale
Malnutrition	Almost Certain	Severe	Very High Risk	Increased food insecurity and diarrhoea results in malnutrition, especially in drought-affected regions. This may further contribute to population displacement.
Cholera and other diarrhoeal diseases	Highly likely	Severe	Very High Risk	Water contamination due to flooding or water scarcity in the event of droughts, highest risk in affected countries in east Africa.
Other waterborne and foodborne diseases	Likely	Moderate	High Risk	Water contamination, flooding, deteriorations in hygiene and sanitation
Malaria	Likely	Major	High Risk	Increased vector breeding. The majority of effects on malaria spread expected from El Niño can be expected in late 2023 and early 2024. Despite this, vector control programmes implemented in the short term may be effective against future transmission.
Arboviral diseases like dengue, Zika, chikungunya	Likely	Major	High Risk	Increased vector breeding and global distribution, changes in water storage practices. Risks are highest after periods of heavy rainfall. As with malaria, greater effects of El Niño on arboviral disease transmission will likely be seen later than September 2023, although early prevention measures today may be effective.
Other vector-borne diseases	Likely	Moderate	High Risk	Increased vector breeding, exposure to vectors and movement of animals
Rodent-borne diseases	Likely	Minor	Moderate Risk	Increased breeding and movement of rodents. As with malaria and arboviral diseases, the effects of El Niño on rodent-borne disease transmission may occur significantly later than September 2023
Vaccine-preventable diseases	Likely	Moderate	High Risk	Increased crowding due to flooding or displacement. An increase of meningitis cases in the Sahel region is possible in 2023 but more likely to occur in 2024.
Biotoxins: fish and shellfish poisoning	Likely	Minor	Moderate Risk	Increased sea surface temperatures resulting in algal proliferation. Associations between biotoxins and El Nino warrant further study, but some association has been observed in Caribbean and Pacific islands.
Heat stress and air pollution	Almost certain	Moderate	High Risk	Heat stress is the leading cause of weather-related death and can exacerbate underlying NCDs. Air pollution results from multiple mechanisms, including smoke from wildfires. Risk of wildfires is highest in SE Asia, esp. Indonesia. There are additionally increased risks in the United States of America and Canadian Pacific Northwests. Elsewhere (Australia, South America) risks will be higher after September 2023.
Worsening maternal and child health	Likely	Moderate	High Risk	Decreased access to health services, displacement, others
Direct injuries	Likely	Minimal	Low Risk	Flooding, storms, wildfires
Gender-based violence	Highly Likely	Moderate	High Risk	Reduced livelihoods, food insecurity, displacement, others
Conditions requiring mental health and psychosocial support	Highly Likely	Moderate	High Risk	Reduced livelihoods, food insecurity, displacement, others

*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

The following sub-regions have been identified as high priority for potential humanitarian challenges due to the **consequences of El Niño through September 2023**. Impacts of El Niño events are felt over a period of 1-2 years, and health risks vary by region, by country, within countries, and between time periods, with the most siginficant health impacts historically observed during the year after the onset of an El Niño event. For health risks and challenges expected after September 2023, please refer to the country risk table at the end of this document.

● **Central America and northern South America - high-risk countries**: Colombia (northern region), El Salvador, Guatemala, Guyana, Honduras, Nicaragua, Peru (northern region), Suriname, the Bolivarian Republic of Venezuela (northern region)

El Niño is typically associated with below normal rainfall in Central America from July to December and in northern parts of South America from June to March. Latest seasonal forecasts also indicate that below-normal rainfall is expected over May-July for all Central American countries, including El Salvador, Nicaragua, Guatemala and Honduras, as well as northern parts of Colombia and the Bolivarian Republic of Venezuela. Additionally, there are increased chances of above-normal temperatures, which contribute to the intensification of drought conditions.

Below-average rains may disrupt planting operations and affect development of the 2023 main *primera* (first harvest) maize crops and beans, normally planted in May/June and harvested from August. If dry conditions negatively impact the 2023 *primera* agricultural output, prices of white maize and beans, which are already at elevated levels, could increase, further constraining food access for vulnerable households.

Central American countries, along with Colombia and the Bolivarian Republic of Venezuela, are also likely to face an increase in health needs. These include rising malnutrition due to reduced agricultural yields; a higher risk of dengue and other arboviruses (such as chikungunya and Zika) between July and September, when dry conditions may increase *Aedes* mosquito breeding sites through increased water storage around homes, and higher temperatures reduce the viruses' extrinsic incubation period. Dry conditions could also lead to acute water shortages and weaken the capacity of households to deal with increased water prices, compounding humanitarian needs. In Colombia and the Bolivarian Republic of Venezuela, where northern regions are projected to be most affected in the coming months, this could exacerbate existing humanitarian needs and vulnerabilities. Water storage at places of work, schools, and other community settings, are also vulnerable to breeding of *Aedes* mosquitoes. El Niño is also associated with warmer temperatures throughout Central America and northern South America, increasing the likelihood of heatwaves in the region. People with chronic diseases that take daily medications have a greater risk of medical complications and death during a heatwave, as do older people and children.

Other parts of central America and the Caribbean will also be at risk of lower-than-average rainfall, but are considered less likely to require international humanitarian response. These include Costa Rica, Panama, and Trinidad and Tobago.

● **Southeast Asia - high-risk countries**: Indonesia, Papua New Guinea, Myanmar, the Philippines, Timor-Leste, Viet Nam

Analysis of previous El Niño impacts suggests that parts of Southeast Asia experience below-normal rainfall between June and January. The latest seasonal forecasts indicate that this pattern is likely to happen again, especially over southern and western Indonesia and Timor-Leste. There are also increased chances of above-normal temperatures, which could have additional impact on agricultural production as well as health and Water, Sanitation and Hygiene (WASH) impacts associated with extreme heat and drought. Signals are less clear for Timor-Leste, but there are indications that dry conditions could be a concern in the coming months.

In much of South-East Asia, El Niño is also historically associated with below-normal rainfall from June to September, during the height of the rainy (monsoon) season. Forecasts indicate drier-than-normal conditions starting from October-December, including in Viet Nam, Papua New Guinea and the Philippines. These countries are important to watch from August/September onward to understand the progression of their respective rainy seasons. In Myanmar, forecasts are less clear, but given compounding factors, including high prices and shortages of agricultural inputs, a small shock could have a significant impact.

In Indonesia, the impact on the main 2023 crops is expected to be limited, as the harvest was completed in mid-June. However, planting takes place in June/August and early development of the 2023 secondary crops, may be impacted. In Timor Leste, while the 2023 main season cereal output is estimated at above-average levels, secondary season crops are being planted now for harvest from September onwards and below-average rains could lead to a decline in area planted and yields. If output decreases, the country will need more imports to cover domestic needs.

In these countries, there is also a higher risk of dengue and other arboviruses (such as chikungunya and Zika) between July and September, when dry conditions may increase *Aedes* mosquito breeding sites through increased peri-domestic water storage, and higher temperatures reduce the viruses' extrinsic latent period.

Additionally, El Niño is associated with warmer temperatures throughout the region, increasing the likelihood of heatwaves. People with chronic diseases that take daily medications have a greater risk of complications and death during a heatwave, as do older people and children. The risk of wildfires also increases in hot, extremely dry conditions, such as drought, and during high winds. While these fires can harm and kill those in the proximity, smoke from wildfires can cause a range of health issues, including respiratory and cardiovascular problems. During both the 1997-1998 and 2015-2016 El Niño events, wildfires were exacerbated in Indonesia and Malaysia, causing major air quality issues in the entire region during the second half of 1997 and 2015.

- **South Asia - high-risk countries**: Sri Lanka

El Niño is a cause for concern for Sri Lanka's climate, leading to droughts, floods, and other extreme weather events. The main effects of El Niño in Sri Lanka are expected from October to December, beyond the timeframe of this document. El Niño is associated with higher levels of rainfall in Sri Lanka and the southern portion of India. While forecasts at this range still have significant uncertainty, they do indicate higher-than-normal rainfall is likely. Although abundant rains are generally favorable for crop development, the combination with the elevated temperatures may cause pest infestations, resulting in localized crop losses.

- **Pacific Islands**

For the Pacific islands, El Niño is associated during most of the year with higher-than-normal rainfall in some areas, and lower in others. Latest seasonal forecasts indicate a risk of dry conditions during July-September in, for example, the Marshall Islands and Samoa; and from October-December in Palau, Samoa, Tonga, and Vanuatu.

Meanwhile Nauru and parts of Kiribati – which usually see wetter-than-normal conditions under El Niño – are forecast to receive above-average rainfall through the end of the year. Tuvalu shows likely wetter-than-normal conditions from October-December. El Niño is associated with higher hurricane activity in the Central Pacific basin, with the United States National Oceanic and Atmospheric Administration predicting a 50% chance of above-normal tropical cyclone activity during the central Pacific hurricane season.

In the Pacific islands, the sowing, growing and harvesting of key crops occurs on a rotation basis throughout the year. With wet conditions, flooding could result in localised crop and food stock losses and damage infrastructure, including housing, roads and schools.

Heavy rainfall and flooding can damage water sources and sanitation facilities, carry runoff and waste into streams and lakes, and contaminate the water supply, leading to increased risk of water-borne diseases. However, for both Nauru (especially) and Kiribati, dry conditions have been a particular concern, so above-average rainfall could also bring positive impacts on agriculture. Both are also highly reliant on imports, potentially muting the effects of impacts on production.

- **East Africa – high risk countries**: Burundi, Ethiopia (southern region), Kenya, Somalia, Rwanda, United Republic of Tanzania, Uganda

In much of East Africa, El Niño is associated with higher-than-normal rainfall, and attendant risk of flooding, starting from around October. Current seasonal forecasts – while still uncertain at this stage – do indicate this shift is likely in southern Ethiopia, Kenya and Somalia, as well as to a slightly lesser extent in Burundi, Rwanda, and Uganda. While South Sudan itself is not associated with higher rainfall during El Niño, heavy March-April rains have kept Lake Victoria (the main source of water of the White Nile River, which crosses South Sudan) at near-historical records. If rains in October-December are above average over the Lake Victoria basin, the level of the lake would increase further, resulting in river overflows downstream, causing population displacement, as well as localized crop and livestock losses. However, in the areas not affected by floods, the El Niño-induced above-average rainfall could bring much needed relief to the areas affected by dry weather conditions, improving crop and livestock production.

Many of those countries facing the risk of wet conditions later in the year have already been faced with high levels of flooding this year. Notably, in parts of South Sudan, this could result in the fifth consecutive year of exceptionally widespread flooding, causing crop and livestock losses. In addition, if there are new floods, they would occur at a time when, at the end of the June-September rainy season floods normally recede, resulting in an expansion of permanently flooded areas, and in the loss of cultivable lands in areas (mainly Jonglei and Upper Nile States) already characterized by high deficits in cereal production and crisis levels and prevalence of food insecurity.

Those countries will also face an increased risk of some climate-sensitive diseases. East Africa is already facing one of the worst cholera outbreaks in years, one of the longest ever recorded in the region. Heavy rainfall and flooding, often leading to increased water contamination, will likely exacerbate and further prolong this outbreak in many countries. Flooding will also provide ideal conditions for mosquito multiplication and the emergence and/or exacerbation of Rift Valley Fever (RVF) and malaria later on in 2023.

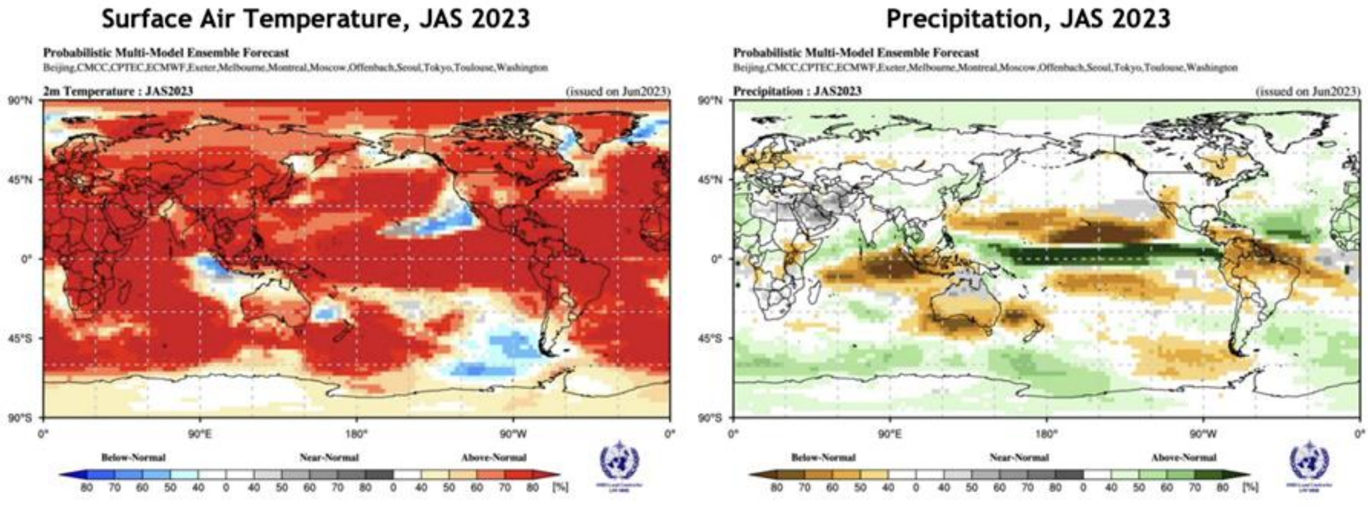
In other parts of the greater Horn of Africa, El Niño events typically cause drier-than-normal conditions during July-September. Latest seasonal forecasts also indicate this is likely in Djibouti, parts of South Sudan, and southern Sudan. In South Sudan this could have a severe impact on the 2023 main season agricultural production of the maize, sorghum and millet crops in the unimodal areas, and should be monitored. In the capital Juba, nominal food prices in June were at exceptionally high levels, with those of maize and sorghum more than twice their already high year-earlier values. Underlying the high food prices are insufficient supplies and the continuously difficult macroeconomic situation due to low foreign currency reserves and the weak national currency, constraining food access for large numbers of people. Similarly in Sudan, if forecasts for persistent dry conditions materialize, the 2023 main season crops are expected to be severely affected at the critical grain filling stage of development. This could push food prices to extremely high levels. According to the World Food Programme (WFP), the price of a local food basket, already 28% higher on a yearly basis in March 2023, is expected to increase by a further 25% in the lean season between June and September, if the conflict continues. WFP has projected that this increase in food prices, if it materializes, will prevent 18 million people from meeting their basic food needs. Below-average rains are also expected to negatively affect pasture and water availability for livestock. This, in turn, could further contribute to the ongoing displacement of families to neighbouring countries, including South Sudan, Chad and Ethiopia, adding further stress to humanitarian efforts and access to basic services in these countries.

Many of those countries facing the risk of wet conditions later in the year have already been faced with high levels of flooding this year. Notably, in South Sudan, this would result in the fifth consecutive year of exceptionally widespread flooding, causing crop and livestock losses. In addition, these new floods would occur at a time when, at the end of the June-September rainy season (as rains exacerbate river overflows), floods normally recede, resulting in an expansion of permanently flooded areas, and in the loss of cultivable lands in areas (mainly Jonglei and Upper Nile States) already characterized by high deficits in cereal production and high levels and prevalence of food insecurity.

Those countries at higher risk of flooding will also face an increased risk of disease including cholera, malaria, and RVF.

- **Spillover price/economic effects**

Beyond the direct country-level impacts mentioned above, the effects of an El Niño event on agricultural production could also impact broader trends in food prices, global inflation and economic performance. For example, India is a net exporter of cereals, and uncertainty over the 2023 main season crop could contribute to raising the price of rice on the domestic and international markets. This situation could potentially lead to consideration of extending the restriction on exports of rice and broken rice. Overall, international rice prices have been on a steady increase since mid-2022 and in April 2023 were higher than their year earlier levels. Floods and periods of drought can also be expected to impact the economic performance and food security of low-to-middle-income countries in Southeast Asia, including Indonesia, which heavily rely on their agricultural sectors. Likewise, the El Niño event is anticipated to disrupt food production in Central America's Dry Corridor, which could have adverse effects on both economic performance and food security in the region.



Map source: WMO. Surface air temperature and precipitation predictions, July-September 2023

Looking ahead:

Close monitoring of regional and national level forecasts, and consideration of anticipatory or early actions is recommended. In other regions, the historical weather shifts associated with El Niño occur later in the year, and this analysis will be updated as further seasonal forecasts become available. Other key regions to watch for in later months include:

- **Southern Africa:** El Niño is associated with drier-than-normal conditions starting around November. While this is not coming through in current seasonal forecasts, these remain a long way out and could evolve significantly. Countries that might be of particular concern due to underlying vulnerabilities include Madagascar, Malawi, Mozambique, and Zimbabwe, though other countries would also likely feel significant food security impacts. There would also be significant risk of spillover price impacts if food production in South Africa were significantly affected. It should be noted that this outlook will also be significantly impacted by other factors besides El Niño, including the Indian Ocean Dipole which historically has been as or more predictive of rainfall in the region. As always, the latest comprehensive seasonal forecasts - which are inclusive of all relevant indicators - should be closely monitored. El Niño being also associated with warmer temperatures throughout the region, heatwaves will be to monitor more closely during the austral summer period.
- **Horn of Africa:** Above-normal rainfall in southern areas from September to January, including during the short rainy season. In northern regions, current forecasts suggest below average rainfall over most parts of the region during June to September 2023, especially over central and north-eastern Ethiopia and parts of central and western South Sudan.
- **Sahel:** While El Niño is typically associated with lower-than-normal rainfall from July-September, the current seasonal forecast indicates a likelihood of higher-than-normal rainfall. Nevertheless, the outlook could change. If higher than normal rainfall materializes, floods should be expected, though it would also have beneficial agricultural impacts.
- **Caribbean:** Above-normal rainfall from November to April, particularly in the central, northern and western Caribbean.
- **South America:** Above-normal rainfall in various locations of central and southern South America between September-May, particularly around coastal areas.
- **Central Asia:** Above-normal rainfall from January to April, particularly in the Hindu Kush mountains

and surrounding regions.

- **Europe:** Below-normal temperatures from December to February, and altered rainfall patterns (e.g. more in the Mediterranean). In summer higher temperature than normal might be occurring

Health status and threats

(Image from World Health Organization[4])

◉ Key health risks

This section was adapted from *WHO: El Niño and Health – Global Overview – January 2016*[4] *and WMO/WHO Health and the El Niño Southern Oscillation (ENSO – June 2023*[5]*)*. El Niño conditions increase the probability of a range of extreme weather events, including droughts, floods, hurricanes, and heatwaves, all of which are detrimental to human health. The magnitude of health impacts associated with El Niño will vary depending on how intensely El Niño influences the local climate of an area as well as local health vulnerabilities, and preparedness and response capacities (see section on Health Resources and Services Availability). Health consequences associated with extreme weather conditions are interrelated, and can occur as a result of a range of factors:

- Both droughts and flooding may trigger food insecurity, increase malnutrition and thus enhance vulnerability to infectious diseases;
- Droughts, flooding and intense rainfall (including cyclones) may cause loss of life, significant population displacement, water and vector-borne disease outbreaks, and damage or close health facilities, thus reducing access to healthcare during the emergency and well beyond the event;
- 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;
- Damaged or flooded sanitation infrastructure may lead to water-borne diseases;
- Extremely hot and dry conditions may lead to heat waves, wildfires, increased smoke and deteriorated air quality, causing or exacerbating respiratory diseases and heat stress;
- Populations already affected by a humanitarian crisis (e.g. those in internally displaced persons and refugee camps) face heightened risk of the health consequences of both wet and dry conditions.

◉Malnutrition

Malnutrition due to El Niño is a consequence of El Niño's effects on both food security and increases in diarrheal diseases (see below). In Peru, a study found that children born during and after 1997–1998 El Niño, while controlling for other factors, were on average shorter and had less lean mass for their age and sex than expected had El Niño not occurred. According to recent research, "Warmer El Niño conditions predict worse child undernutrition in most of the developing world."[6] The same research estimated that almost six million additional children were underweight during the 2015 El Niño compared to if there had not been an El Niño, as much as three times higher increase than that caused by the COVID-19 pandemic. Existing hotspots of malnutrition are the most vulnerable.

◉Cholera and other diarrheal diseases

Outbreaks of such diseases can occur after flooding if the floodwaters become contaminated with human or animal waste. Drought reduces the water available for washing and sanitation, and also increases the risk of disease. Higher temperatures are also associated with an increase in gastro-intestinal infections.

It has been suggested that the El Niño in 1992 may have contributed to the spread of cholera to South America. Major cholera outbreaks in United Republic of Tanzania and other parts of East Africa have been associated with strong El Niño years such as 1997 and 2015; and in Peru, Colombia and Ecuador during the El Niño in 1982-3.[7]

◉Other waterborne and foodborne diseases

Other common illnesses linked to contaminated water supplies and flooding are typhoid fever, shigellosis, and hepatitis A and E. Food preparation practices may be similarly impacted.[8] Leptospirosis is a rodent-borne 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.[9]

Drought conditions can also lead to hygiene-related diseases and the increased concentration of pathogens in surface water.

◉ Malaria

Malaria impacts associated with El Niño will differ depending on local health vulnerability and health system capacities, as well as how El Niño and other climate drivers influences the local climate. The effects of ENSO on malaria are most pronounced in epidemic-prone areas where climate conditions are generally not suitable for year-round vector reproduction. 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. Decreased immunity acquired over time by inhabitants of these new malaria-prone areas can further increase the risk of outbreaks.

Malaria is a complex disease. Its transmission, via *Anopheles* mosquitoes, can be highly climate sensitive with temperature being a significant driver of the development rates of both mosquito vector and Plasmodium parasite. In addition, rainfall and humidity provide essential environmental characteristics for juvenile mosquito development and adult survivorship. The relationship between El Niño events, malaria, and other vector borne diseases has been well documented in Africa and parts of Latin America and Asia.[10]

In the epidemiology of malaria, there are desert and highland fringes, where rainfall and temperature, respectively, are critical parameters for disease transmission. In such highland fringe areas, such as the Himalayas, higher temperatures associated with El Niño particularly during the autumn and winter months may increase transmission of malaria in the high altitude/latitude areas of Asia. This has been shown for Northern Pakistan and is also likely for the other parts of the sub-Himalayan belt.

Effective malaria control in most higher latitude regions means that the latitudinal borders of malaria are not limited by temperature. Malaria epidemics may occur at these "control" fringes when public health infrastructure deteriorates. In areas of "unstable" malaria in developing countries, populations lack protective immunity and are prone to epidemics when weather conditions facilitate transmission. Many such areas across the globe experience drought or excessive rainfall due to El Niño.

◉ Arboviral diseases

El Niño is also expected to shift the dynamics of several arboviral diseases including dengue, chikungunya, and RVF, among other mosquito borne viral diseases. Unusual increases in temperature or rainfall can also increase mosquito densities and viral transmission which will facilitate potential epidemics. WHO has been working with its regional offices and Member States to monitor and decrease mosquito densities and prepare health services for early detection and diagnosis of these diseases for timely response and control of transmission at the local level before they turn into larger outbreaks. 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.

Mosquito vectors which breed in brackish water in coastal areas or urban-adapted vectors which breed in plastic containers are less sensitive to rainfall than sylvatic vectors.[11]

Dengue

Dengue is the most important and frequent arboviral disease in humans. In recent decades, the disease has undergone a dramatic resurgence worldwide and it currently affects over 129 countries. Dengue incidence is seasonal and is usually associated with warmer, more humid weather. There is some evidence to suggest that increased rainfall in many locations can affect the vector density and transmission potential. ENSO may also act indirectly by causing changes in water storage practices brought about by disruption of regular supplies. There is limited evidence of the association between El Niño and dengue in South America, Mexico, and some areas of Asia. Epidemics of dengue in islands in the South Pacific have been positively correlated with El Niño. However, generalizations should not be made about the association between ENSO and dengue transmission: whether or not an epidemic occurs depends not only on mosquito abundance but also on the history of dengue in that region. Although weather conditions may be favorable for dengue transmission in one area, increased transmission may not be apparent if the local population is already immune to the prevalent serotype. In addition, areas at higher altitudes may be at higher risk of encroaching dengue transmission due to ENSO than malaria. Regional studies are needed to determine whether El Niño is associated with a change in dengue activity.

Chikungunya

Chikungunya transmission is well established to be linked to El Niño events. Changes in transmission are expected to be similarly affected as with dengue, after consideration of current patterns of endemicity and the high densities of *Aedes* mosquitoes in the countries affected by El Niño.

Yellow fever

The association between El Niño and yellow fever has not been well-established, although there is some evidence of an increased number of epidemic foci in an El Niño year or the following year.

Rift Valley fever

Since 1950, each of the seven documented moderate or large RVF outbreaks in the Horn of Africa have been associated with El Niño-associated patterns of above-normal and widespread rainfall. As an example, the 1997/1998 El Niño event was linked to very heavy rainfall in north-eastern Kenya and southern Somalia, from October 1997 to January 1998; the rain was 60-100-fold heavier than normal. In December 1997, there was a large outbreak of RVF in the North Eastern Province of Kenya and Southern Somalia. The outbreak also killed a large number of cattle in the affected regions.

Zika

After emerging in the Americas in 2015, Zika virus rapidly spread across the continent, leading to the declaration of a Public Health Emergency of International Concern in November 2016. While evidence for a link between Zika virus transmission and El Niño events is sparse, it has been suggested that the concurrent El Niño contributed to Zika virus transmission, by increasing the spread of Zika Virus. Future effects of El Niño are unclear, but changes in transmission would likely be similar to the previous arboviruses transmitted by *Aedes* mosquitoes.[12]

Japanese Encephalitis

There is some evidence of association between transmission of Japanese Encephalitis and El Niño events. The nature of this link has not been well established – as with other arboviral illnesses, changes in climate are known to affect geospatial patterns of vector breeding across endemic regions. Despite this, Japanese Encephalitis virus is transmitted by *Culex* mosquitos, which may respond differently to El Niño events than other arboviral vectors.

Murray Valley Encephalitis and Ross River Virus disease

There is evidence that some arboviral diseases in Australia, where El Niño has a strong effect on the weather, are affected by the ENSO cycle: Murray Valley (Australian) Encephalitis and Ross River Virus disease.

◉ Other vector-borne diseases

Plague

Madagascar has the highest rates of plague in the world. During periods of high ENSO intensity, plague incidence is likely to increase via ENSO's impact on temperature and precipitation, leading to increases in rodent breeding, which can increase the spread of plague.[13] It has also been suggested that cooler temperatures could increase breeding of fleas.

Leishmaniasis

There is some evidence that transmission of Leishmaniasis, transmitted by the phlebotomine sand flies, is affected by El Niño events. It is well documented that transmission in some areas is decreased in El Niño years, and increased in subsequent La Niña years[14]. However, this does not appear to be universally true – the geospatial dynamics of transmission are likely complex and dependent on local environments[15].

Tick borne diseases

There is some evidence for association between tick borne illnesses and El Niño events. These diseases could could include, but may not be limited to Crimean-Congo haemorrhagic fever, Lyme disease and Kyasanur forest disease, where increased risk may be observed in and near their respective endemic regions.

◉ Rodent borne diseases

Hantavirus

Hantaviruses are transmitted via a range of rodents; transmission can occur due to rodent bites, or contact with urine, saliva, or feces. As with plague, increased rainfall can provide favorable conditions for rodent breeding.

◉ Vaccine-preventable diseases

Displacement, crowding and lack of access to vaccination are likely to increase the risk of several vaccine-preventable diseases such as measles and meningitis. Rates of meningitis are known to increase in Sahel countries in the year after the onset of an El Niño event in relation to the resulting decreases in precipitation between July and September. These drier than normal conditions and stronger Harmattan winds create favourable conditions for increased transmission of meningococcal meningitis.

In addition, weather conditions may be favorable for dengue transmission, and therefore, increasing the presence of dengue cases. In the past, dengue had masked the notification of confirmed measles or rubella cases given similarities on their clinical manifestations. To this end, WHO strongly recommends the implementation of active case finding in health facilities, community, and laboratory, to increase the sensitivity of the surveillance system for measles and rubella. Delays in the notification of suspected measles and rubella cases can trigger delays in the implementation of a rapid response, enabling expansion of virus transmission.

◉ Biotoxins: fish and shellfish poisoning

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. Some may cause illnesses without consumption because they release aerosolised toxins that can result in illness to many animals, including humans, when inhaled. High sea surface temperatures are thought to be a trigger in some bloom occurrences. However, environmental pollution is a major factor in the observed increase in the occurrence of blooms in recent years. There is some evidence that the occurrence and distribution of harmful coastal algal blooms is associated with El Niño, but a consistent relationship between shellfish poisoning cases and El Niño has not yet been investigated.

Ciguatera is the most frequent cause of human illness caused by ingestion of marine toxins, and is an important health problem in the parts of the Caribbean and Pacific Islands, where fish is a major source of protein. The risk of ciguatera fish poisoning has been found to increase during El Niño in some Pacific Islands.

◉ Effects of heat stress and air pollution

Extremely hot and dry conditions may lead to heat waves, wildfires, increased smoke and deteriorated air quality, causing or exacerbating respiratory diseases and heat stress. El Niño conditions, on top of climate change, make it almost certain that new global temperature records will be seen. Prior to 2023, 2016 was the hottest year on record as global temperatures were boosted by the 2015/2016 El Niño event. South Africa reported ENSO-related extreme heat in 2015-2016. Exposure to excessive heat can affect the health of many people, particularly older people, infants, people who work outdoors and those who are chronically ill, and can trigger exhaustion and heat stroke and lead to wide ranging impacts for human health, often amplifying existing conditions and resulting in premature death and disability. Heat stress is the leading cause of weather-related death and can exacerbate underlying illnesses including cardiovascular disease, kidney diseases, diabetes, psychological distress, asthma, and high temperatures can also increase the risk of accidents and some infectious disease. Specifically in Central American countries, high temperatures and extreme drought can aggravate the health conditions of agricultural workers, especially due to their effects on chronic kidney disease from non-traditional causes.

The risk of wildfires also increases in extremely dry conditions, such as drought, and during high winds. While these fires can harm and kill those in the proximity, wildfire smoke is also a major public health threat. Droughts and associated wildfires can contribute to increased environmental pollution. Air pollution resulting from fires can cause a range of health issues, including respiratory and cardiovascular problems. The El Niño-related drought of 1997 contributed to the exacerbation of wildfires in Brazil, Indonesia, and Malaysia. In 2015, air quality in six South East Asian countries was impacted by wildfires exacerbated by El Niño- related drought, including Indonesia where a state of emergency was declared due to hazardous air quality.

◉ Maternal and child health

Decreased access to WASH and to health services (see below) is likely to worsen maternal and child health in general. Several of the other health threats above, such as malaria and diarrhea, also have a disproportionately severe effect on pregnant women and small children. Additionally, researchers have shown that El Niño can result in suboptimal complementary feeding practices, by reducing access to food, and reducing the time mothers can spend with children.[16] High levels of heat can have adverse effects on rates of preterm birth, stillbirths, and low birth weight.[17]

◉ Direct injuries

Direct injuries due to El Niño may occur due to flooding, landslides due to heavy rain, storms, and wildfires. However, the overall public health impact of this health threat is expected to be low. During the 1997-1998 El Niño, central Ecuador and Peru received more than 10 times the typical levels of rainfall, resulting in flooding, extensive erosion and mudslides, and leading to the loss of lives; in Peru it caused the death of at least 374 people.[18]

◉ Gender-based violence

Gender-based violence affects one in three women globally and is exacerbated in emergency contexts where societal protections collapse and risks increase.[19] As a result of reduced livelihoods, coping mechanisms such as transactional sex may be employed, which increase the risk of this violence.

◉ Mental health and psychosocial support

In the context of El Niño, acute stress and exacerbations of mental health conditions are likely to result from Reduced livelihoods, food insecurity, displacement, and reduced access to health services. Further, during heatwaves, suicide rates, hospitalisations for psychiatric disorders, and emergency psychiatric visits have been shown to increase.[20]

◉ Determinants of health

Displacement

Droughts, flooding, fires and intense rainfall (including cyclones) may cause significant population displacement. Food insecurity is also a major driver of displacement (see below). Populations already affected by a humanitarian situation (e.g., in internally displaced persons and refugee camps) face a heightened risk of suffering health consequences of either wet or dry conditions.

Internally displaced people and refugees undertake long, exhausting journeys with inadequate access to food and water, sanitation and other basic services, which increases their risk of communicable diseases, particularly measles, and food- and waterborne diseases (on the other hand, basic services may be better in camps than in their place of origin and there may be deterioration upon their return). They may also be at risk of accidental injuries, hypothermia, burns, unwanted pregnancy and delivery-related complications, and various noncommunicable diseases due to the migration experience, and for refugees, restrictive entry and integration policies and exclusion.

Displacement affects the risk of Vector-Borne Diseases (VBDs): inadequate access to piped water and water storage; densely populated refugee camps, which facilitate transmission; and naïve populations may move to areas endemic for VBDs, or import of pathogens to places where vector is present but population is non-immune.

Refugees and migrants may arrive in the country of destination with poorly controlled noncommunicable diseases, as they did not have care on the journey. Maternity care is usually a first point of contact with health systems for female refugees and migrants.

Internally displaced people and refugees may also be at risk of poor mental health because of traumatic or stressful experiences. Many of them experience feelings of anxiety and sadness, hopelessness, difficulty sleeping, fatigue, irritability, anger or aches and pains. They may be at more risk of such as depression, anxiety and post-traumatic stress disorder than the host populations.

Refugees and migrants remain among the most vulnerable members of society and are often faced with xenophobia; discrimination; substandard living, housing and working conditions; and inadequate or restricted access to mainstream health services, for instance due to lack of necessary national documentation to access health services. Some of these issues also affect internaly displaced peoplel.

Migrants, particularly in an irregular situation, are often excluded from national programmes for health promotion, community engagement, disease prevention, treatment and care, as well as from financial protection in health. They can also face high user fees, low levels of health literacy, poor cultural competency among health providers, stigma and inadequate interpreting services. Migrant populations working as farm labourers may see their income and livelihoods affected by adverse effects on harvests related to El Niño climatic conditions.

Barriers are even greater for people with disabilities. Women and girls may find difficulty in accessing sexual and gender-based violence protection and response services. Refugee and migrant children, especially unaccompanied minors, are more likely to experience traumatic events and stressful situations, such as exploitation and abuse, and may struggle to access health care.

Assessment of the risk of vaccine-preventable diseases in displaced and refugee contexts must take into account vaccination coverage in both the displaced and refugee population and the host population, as well as mixing patterns. For example, even if measles vaccination coverage in the receiving host population is above 95% (the threshold required to avoid sustained transmission), suboptimal coverage in the migrant population can dilute the overall population immunity level to below the threshold and allow for an outbreak. If mixing between the migrant and host population is incomplete (which is usually the case), an outbreak can be sustained between members of the migrant population even if the overall population coverage is sufficiently high.

Conflict

Analysis of conflicts over extended time periods indicate the possible role of climate change and climate variability on the occurrence of conflicts, particularly in the tropics. In previous years, there have been a greater number of conflicts during El Niño years at both the global and continental scale. In addition, the spatial patterns of conflicts showed greater concentration of intensifying and consecutive hot spots in South and Southeast Asia, the Middle East, and Central and Eastern Africa during El Niño years versus. La Niña years. Specifically, intensifying hot spots of conflicts overlapped with the relatively arid and semi-arid areas of the Global South.

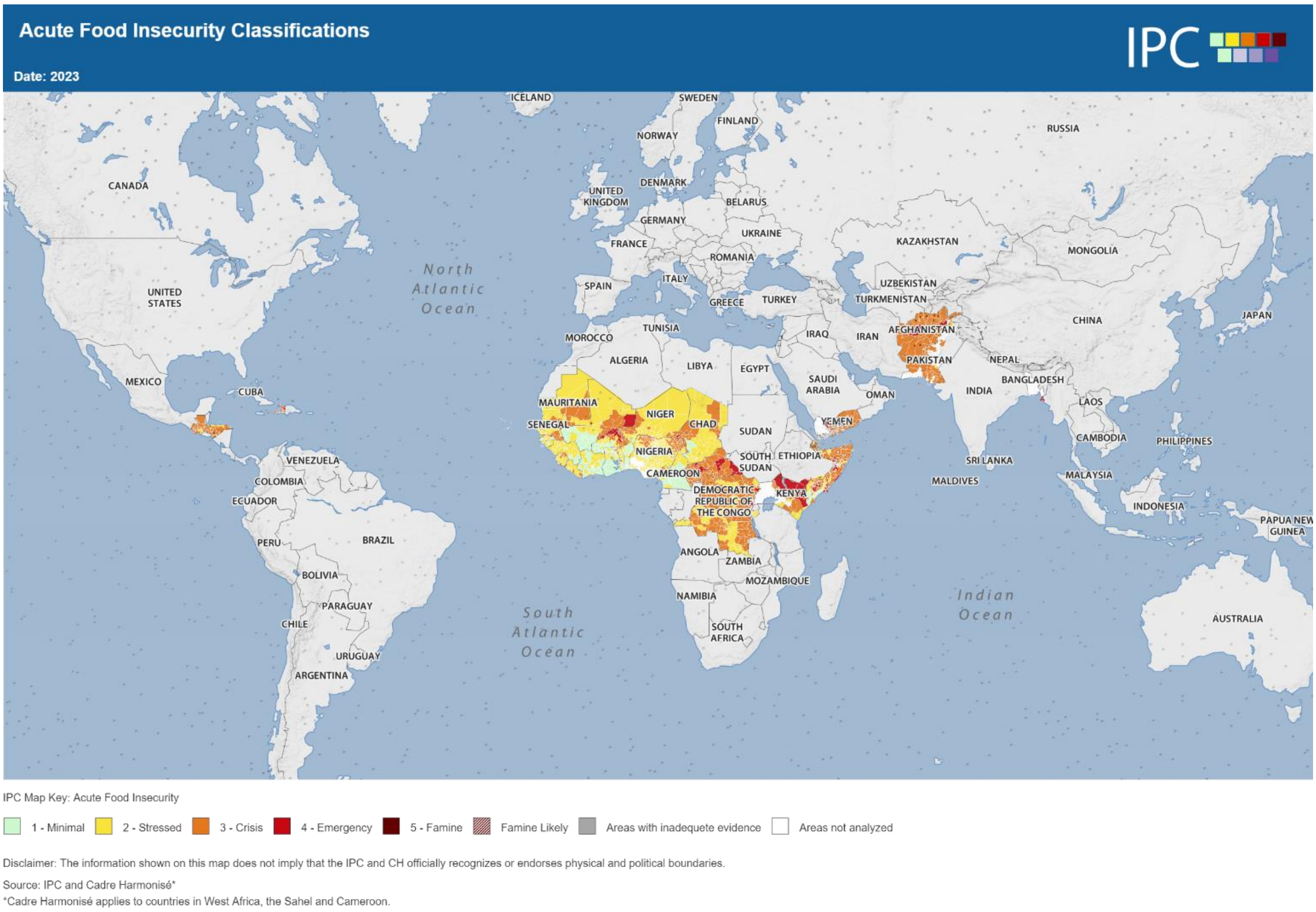
El Niño-related weather anomalies, such as prolonged droughts or flooding, can exacerbate existing tensions over resources like water or agricultural land. Although resource-related conflicts can be influenced by climate conditions, they are driven by a combination of social, economic, and political factors.

Conflict-affected settings are likely to further exacerbate the negative impact of El Niño on the affected populations, with internally displaced people and refugee populations especially vulnerable to consequences such as malnutrition, infectious diseases, and limited access to health services further exacerbating health impacts of non-communicable diseases.

Food insecurity

Both droughts and flooding may trigger food insecurity, which in turn increases malnutrition, and thus also enhances vulnerability to infectious diseases.[21] In 1991–1992, El Niño triggered the drought in southern Africa, affecting nearly 100 million people. Droughts in Brazil, north-eastern China, Indonesia, Marshall Islands, Papua New Guinea, and the Philippines have also been associated with El Niño. In 1997, central Ecuador and Peru received more than 10 times the typical levels of rainfall, resulting in flooding, extensive erosion and mudslides, and leading to, amongst other things, damage to food. The world food crisis of 1982-84, the most severe recorded, was linked to El Niño, including famines that struck populations in the Horn of Africa and the Sahel. El Niño-induced droughts and can lead to crop failures and reduced agricultural productivity, resulting in food shortages and increased malnutrition. Flooding can damage crops or food stores or force persons to move away from their food stores. Vulnerable populations, including children and marginalized communities, are at higher risk. Considerable global increases in food prices due to economic pressures, long-term droughts (such as in the Horn of Africa) and the impact of the COVID-19 pandemic will likely exacerbate the levels of food insecurity and malnutrition.

The map below shows food insecurity globally according to the Integrated Food Security Phase Classification (IPC) scale. Note that some countries or areas have not been analyzed, but that those countries with higher levels of food insecurity are frequently also those likely to be affected by short-term climatic change due to El Niño that could further aggravate food insecurity.



Map source: IPC. Higher-resolution data and updated country-level forecasts are available from ipcinfo.org.

Water, sanitation, and hygiene

Droughts, flooding and intense rainfall may significantly restrict access to safe water, sanitation and hygiene (WASH), and disrupt infrastructure. Damaged or flooded sanitation infrastructure may lead to water-borne diseases. Some of these threats can be mitigated by emergency reservoir management and emergency treatment, to prevent water-borne diseases, and the increase of arbovirus vectors.

Access to health services

Disruption of health services as a result of El Niño can occur due to a lack of water supply in drought situations or damage to health infrastructure, or infrastructure facilitating access to healthcare, by floods and cyclones, as well as reduced access as a result of displacement (see below for further information).

Multidimensional poverty and vulnerability

Pre-existing poverty and socioeconomic inequalities make vulnerable communities more susceptible to the impacts of El Niño. Limited access to resources, education, healthcare, and social safety nets can deepen the humanitarian crisis and prolong recovery efforts.

Where available, multidimensional poverty indices can be used to prioritize planning for the impact of El Niño at a sub-national level.[22]

Health Resources and Services Availability

Droughts, flooding and intense rainfall (including cyclones) may damage or close health facilities, thus reducing regular health service delivery and restricting access to healthcare during the emergency and well beyond the event. In 1997-98, central Ecuador and Peru received more than 10 times the typical levels of rainfall, resulting in flooding, extensive erosion and mudslides, and leading to, in Peru, destruction of an estimated 10% of existing health facilities.

Globally, there has been occasional or significant disruption in national transport infrastructure, roads, railways and airstrips, causing ruptures in supply chain continuity that may affect the response to El Niño. Due to recent Increases in the number of simultaneous events, there is a current lack of global emergency supplies in a market already under stress.

The impact of El Niño on health can be characterized according to the intersection of the likelihood of its severe effects and the underlying context, meaning the vulnerabilities and capacities of local populations and health services. The affected countries can be grouped into four broad categories of risk, using the INFORM Risk Index to characterize the context. The INFORM Risk index provides an indication of generalized risk of crisis occurring in a country based on structural conditions, and is informed by a collaboration between UN agencies, donors, NGOs, and research institutions. Countries are encouraged to conduct further sub-national assessments for operational planning purposes.

Countries in **bold** have been identified as high priority for potential humanitarian challenges through December 2023, according to the ENSO Analysis Cell. Countries in *italics* are key regions to watch for in later months, according to the ENSO Analysis Cell. Other countries likely to be affected by El Niño, according to the Food and Agriculture Organization (FAO), are also listed below in plain text.

Table 3: El Niño affected countries grouped by INFORM index

Low or Very Low INFORM	Medium INFORM
Argentina	*Angola*
Australia	Armenia
Bhutan	*Bolivia (Plurinational State of)*
Botswana	*Brazil*
Eswatini	Cambodia
Fiji	*Costa Rica*
Gabon	Côte d'Ivoire
Kazakhstan	*Dominican Republic*
Kyrgyzstan	*Ecuador*
Malaysia	**El Salvador**
Paraguay	**Guyana**
Sri Lanka	**Indonesia**
Turkmenistan	Lao People's Democratic Republic
United States of America	*Lesotho*
Uruguay	Malawi
Uzbekistan	*Mauritania*
Viet Nam	*Namibia*
	Nicaragua
	Panama
	Pacific Islands
	Peru (eastern region)
	Rwanda
	Senegal
	Tajikistan
	Thailand
	Timor-Leste
	Trinidad and Tobago
	Zambia

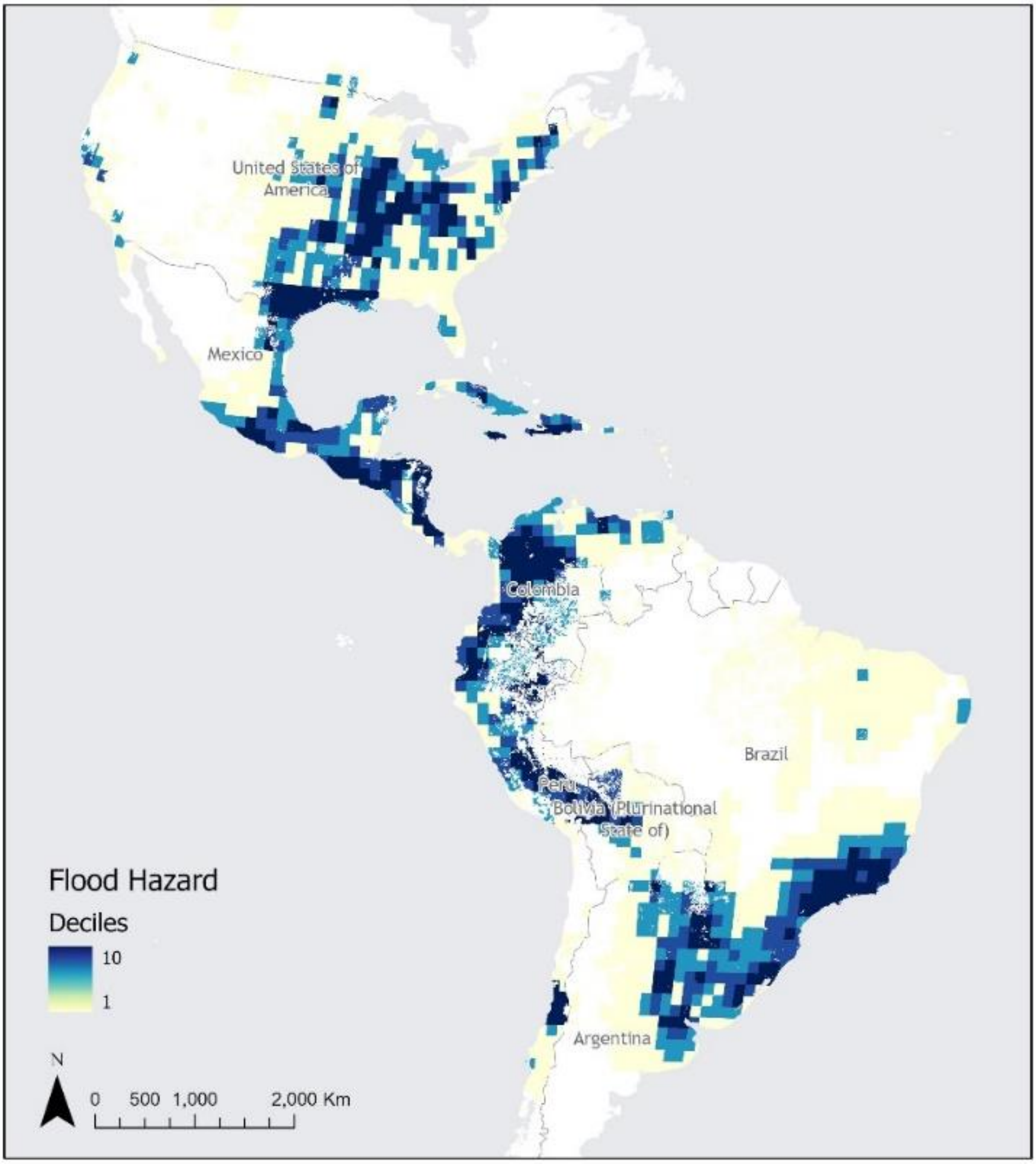
	Zimbabwe
High INFORM	**Very High INFORM**
Azerbaijan **Bangladesh** **Burundi** **Colombia (north)** *Djibouti* *Eritrea* **Guatemala** *Haiti* **Honduras** Iran (Islamic Republic of) *Mexico* Pakistan **Papua New Guinea** **Philippines** *South Africa* **United Republic of Tanzania** Türkiye **Venezuela (Bolivarian Republic of) (northern region)**	*Afghanistan* *Burkina Faso* *Chad* Democratic Republic of the Congo **Ethiopia (north, west)** Iraq **Kenya (southwest)** *Mali* *Mozambique* **Myanmar** *Niger* *Nigeria* **Somalia** **South Sudan** *Sudan* Syrian Arab Republic **Uganda**

Feature: Challenges to Health Infrastructure in the Americas

In the Americas region, after the COVID-19 pandemic, most health systems and services are in a phase of recovery, especially in providing continuity to essential health services, responding to waiting lists for external consultations and surgeries, community care, basic services and primary care.

Floods pose significant challenges to health infrastructures in the Americas region. A growing population is exposed to flooding due to extreme weather, sea level rise, and other climate change impacts.
The Global Flood Hazard Frequency and Distribution[23],[24] is a 2.5 minute (of longitude and latitude) grid derived from a global listing of extreme flood events between 1985 and 2003 (poor or missing data in the early/mid 1990s) compiled by Dartmouth Flood Observatory and georeferenced to the nearest degree. The map provides a means of assessing the relative distribution and frequency of global flood hazard.

Frequency of flood occurrence in the region of the Americas (1985 – 2003)



Sources
- Data: Flood exposure data from Dartmouth Flood Observatory (DFO)
- Cartography: WHO Detailed ADM0 Boundaries

Map production: PAHO Health Emergencies Department/ Health Emergency Information and Risk Assessment Unit\ GIS Team.

PAHO
Pan American Health Organization
World Health Organization Americas

In the Americas, about a quarter of hospitals (3 919 or 23%) are located in geographic areas exposed to flooding (see table below). These calculations were made taking into account different variables such as altitude, proximity to coast, distance to the nearest river or stream, and slope of land. Understanding the risk of floods on healthcare systems and implementing suitable mitigation measures in events like El Niño are crucial for protecting populations and healthcare facilities.

Table 4: Number of emergency hospitals exposed to floods in the region of the Americas

Subregion	Number of Hospitals Exposed
North America	1 411
Central America	165
Latin America	1,234
Andean	589
South Cone	332
Non-Latin Caribbean	19
Latin Caribbean	169
Grand Total	3 919

Source: PAHO Health Emergencies Department (PHE). Emergency hospitals in the Americas: natural hazards exposition. Data extracted from: [Emergency hospitals in the Americas: natural hazards exposition | Natural Hazards and Public Health Emergencies (arcgis.com)]

Humanitarian health response

Note: the following activities and agencies should not be considered exhaustive.

The key response areas for mitigating the health effects of El Niño are:

- Disease surveillance and control
- Safe water and sanitation services
- Risk Communication and Community engagement, health and hygiene promotion focused on the behaviours to adapt during flooding, drought, etc.
- Emergency health supplies
- Vaccination
- Continued access to health care

WHO protects human health from risks related to climate variability through its programmes on the environmental and social determinants of health, emergency preparedness and response, infectious disease prevention and control, improving health research and evidence, and health system strengthening. WHO is part of an UN-wide coordination and monitoring mechanisms for El Niño and is working closely with agencies like WMO. WHO is coordinating across the global, regional and country levels to provide information and technical support to Member States and health partners and enhance preparedness and readiness for El Niño associated health events.

WHO supports countries to identify high and imminent risks through national risk assessments and to build and maintain effective and functioning capacities and systems to prevent, detect, protect against, control and provide a public health response to public health emergencies of all types of emergencies, including those associated with climate-related hazards and diseases. This includes the development of multi-hazard emergency response plans complemented by hazard- and disease-specific contingency and readiness plans.

A joint WHO/WMO office supports WHO to improve health preparedness and decision making through the enhanced use of weather and climate information, including in relation to ENSO. The exact impacts of El Niño events cannot be precisely predicted, but WHO is providing support to countries where an El Niño impact is expected through the continuous monitoring of forecasts, risk assessments, strengthening of potential response efforts through updating of contingency plans, and strengthening of disease surveillance.

In many of the countries that will be most affected by El Niño, there are already ongoing crises and WHO has emergency response plans in place. WHO has pre-positioned stocks in place, including supplies for cholera, basic medical supplies, chlorine stocks, tools to build emergency latrines, kits to set up stabilization centres to treat severely malnourished children with medical complications in many of the countries that will be affected by an El Niño event. These include countries of the Sahel (Mali), the Horn of Africa (Somalia, Ethiopia), Pakistan, and Myanmar. In addition to this, both at headquarters level and at regional office level, WHO has emergency stocks available for immediate dispatch. With the advance warnings around El Niño, WHO will top up emergency stocks where needed, in addition to working with partners to further strengthen local surveillance systems, train medical staff, ensure availability of essential health services including through provision of temporary or mobile clinics, and coordinate humanitarian partners to optimize readiness and response. To achieve this, the availability of funding is essential.

In collaboration with WMO, WHO is supporting countries in the development of Heat Health Action Plans to coordinate preparedness and reduce heat health impacts. Activities include the strengthening surveillance and control of health impacts of heatwaves; improving the use of heatwave early warning systems by the health sector, building public health measures at the local level to increase community resilience to heatwaves; and preparing and protecting hospitals and other health infrastructure from heatwaves.

WHO is providing technical guidance to its Member States on risk management and mitigation measures for the health effects of wildfires, including collecting, analyzing and disseminating information related to the hazard, anticipating the most vulnerable regions to fire occurrence and developing emergency response plans.

WHO is also providing support to its Member States in developing and testing community based contingency plans, conducting risk and vulnerability assessments at the community level and mapping and engaging community health workers, community based organizations and civil societies.

WMO issues quarterly El Niño/La Niña updates on the monitoring and predicting of this phenomenon, prepared in collaboration with the International Research Institute for Climate and Society (IRI) and based on contributions from designated meteorological authorities around the world. These updates contain the observational monitoring of the current situation in the equatorial Pacific, and consensus-based outlook for the next season. WMO El Niño/La Niña Updates and GSCU are available to support governments, the United Nations partners, including the United Nations Inter-Agency Task Force on Natural Disaster Reduction, humanitarian organizations, decision-makers and stakeholders in climate sensitive sectors to mobilize preparedness actions and protect lives and livelihoods. WMO also issues regular Global Seasonal Climate Updates, which incorporate influences of the other major climate drivers such as the North Atlantic Oscillation, the Arctic Oscillation and the Indian Ocean Dipole.

FAO has developed Anticipatory Action (AA) standard procedures to be followed in most countries at risk of being affected by El Niño in 2023/24, where food security is a major concern.[25] For instance, there are active AA protocols in Burkina Faso, Chad, the Niger, Madagascar, Malawi, Zimbabwe, the Philippines, Pakistan and in Central American countries. In addition, FAO is ready to implement agricultural and livelihood-based interventions, in coordination with governments and humanitarian partners.

◉ Response in the Regions: Region of the Americas

Preparing to face the possible health effects caused by El Niño is an opportunity to put into practice lessons learned during the pandemic, such as the coordination of health services, the organization and development of contracting systems. and logistics to ensure medicines and supplies, as well as vulnerability assessment and risk mitigation of health establishments and services to ensure the response and continuity of health services with special emphasis on populations in conditions of vulnerability or neglect.

The Pan American Health Organization (PAHO; i.e., the WHO Regional Office for the Americas) has held informative events on forecasts of extreme hydrometeorological events, such as hurricanes and the El Niño phenomenon, and their possible impact on health and on facilities and services. Furthermore, according to the phenomenon's dynamics, PAHO has been interacting with Member States to emphasize preparedness and updating of contingency plans. In addition, Member States have been accompanied with support to the events that have been presented, e.g., water deficit in Uruguay, dengue outbreaks in Peru and Honduras, malaria in Colombia, among others.

PAHO continues to support Nicaragua, El Salvador, Honduras, Panama and Guatamala to strengthen disease surveillance and outbreak response with WHO's electronic early warning system EWARS in a box. Use of technology enables rapid disease detecrion and prompt response in the most difficult areas affected by the crisis. Training and capacity building of surveillance officers and affected communities under EWARS will further strengthen community-based reporting Interagency contacts have been initiated to join efforts to keep monitoring the situation in the region. Countries and specialized agencies have been asked to strengthen the capacity to translate weather and climate alerts into anticipatory actions for the health sector in order to reduce the impact on services or personnel and equipment and supplies in order to maintain access to health services for the population. The regional response team and the regional strategic reserve are kept alert to support any event where the countries need external support. PAHO advocates for use of a Health Sector Multi-Hazard Response Framework to events such as El Niño – more guidance is available here.

◉ Response in the Regions: European Region

Using data gathered through country assessments using the Strategic Tool for Assessing Risks (STAR), it is possible to identify risks associated with an El Niño event. WHO EURO supported several IHR States Parties (SP) in identifying priority risks and emergencies that could be caused by such an event. The data provided valuable insights into the risk levels and coping capacities associated with the following relevant risks:

1. **Extreme heat**: Five SP conducted assessments for this risk, with the risk levels for heat assessed as low by two SP, moderate by two SP, and high by one SP. Coping capacity evaluations revealed that one SP had a low capacity, and four SP had a high capacity to address extreme heat events.
2. **Floods**: The assessment encompassed 8 SP, with the risk of floods assessed as low by one SP, moderate by three SP, high by two SP, and very high by one SP. Coping capacity evaluations revealed that two SP had a low capacity, three SP had a partial capacity, and three SP had a high capacity to cope with floods.
3. **Drought**: Three SP conducted assessments for drought, with the risk levels assessed as very low by one SP, low by one SP, and moderate by one SP. Coping capacity evaluations revealed that one SP had a partial capacity, while one SP had a high capacity to cope with drought.
4. **Arboviruses**: This risk was assessed by 7 SP. Among these, two SP considered the risk to be very low, two SP assessed it as low, and three SP classified it as high. Coping capacity assessments indicated that two SP had a low capacity, and five SP had a partial capacity to respond to arboviruses.
5. **Urban/Wild fires:** This risk was assessed by 8 SP. Among these, one SP considered the risk to be low, 6 SP assessed it as moderate, and three one classified it as high. Coping capacity assessments indicated that 1 SP had a low capacity, 5 SP had a partial capacity to respond and two report high capacity to respond.

Potential monitoring indicators

The following are useful indicators that can be selected according to the country context to monitor the evolution of the health threats associated with El Niño:

Table 5: Potential monitoring indicators for use in moniotoring effects of El Niño

Indicator	Purpose	Comments
Number and percent of population in Integrated Food Security Phase Classification (IPC) 3-5 areas	Overview of impact on food insecurity and resulting health effects	
Number of affected people with access to safe water as per agreed standards (7.5 to 15 lt per day)	Track WASH status	Programmatic indicator of provision of safe water
Crude mortality rate	Overall impact indicator	
Excess mortality rate	Overall impact indicator	Overall indicator of El Niño related impacts on crude mortality
Under-5 mortality rate	Overall impact indicator	
Prevalence of Global Acute Malnutrition (GAM)	Nutrition impact indicator	
Prevalence of Severe Acute Malnutrition (SAM)	Nutrition impact indicator	response focus should be more on populations living in serious (>1%) and critical (>2%) SAM level
Incidence of various outbreak-prone diseases (e.g. cholera, arboviruses)	Monitor trends and success of interventions against key communicable diseases associated with El Niño	See risks table and local assessments for relevant diseases
Incidence of endemic communicable diseases (e.g. malaria, dengue)	Monitor trends and success of interventions against key communicable diseases associated with El Niño	See risks table and local assessments for relevant diseases
Number of Rapid Response Teams in districts affected by, or at risk of disease outbreaks	Assesses the response capacity to disease outbreaks at the district level	See risks table and local assessments for relevant diseases
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	Assesses the response capacity to disease outbreaks at the district level	See risks table and local assessments for relevant diseases
Number and status of water points for drinkable water per geographic area and population	Allows to target WASH response activities	Standards available
Percentage of at-risk districts with at least one health post or equivalent (including mobile unit) per 10 000 population	Measures access to primary health care	Allows directing additional resources to gap areas

Percentage of at-risk districts with at least one hospital per 50 000 Population	Measures access to primary health care	Allows directing additional resources to gap areas
Percentage of at-risk districts with BEmOC (Basic Emergency Obstetric Care) available per 125 000 population or less	Measures access to primary health care	Allows directing additional resources to gap areas
Percentage of at-risk provinces with CEmOC (Comprehensive Emergency Obstetric Care) available per 500 000 population or less	Measures access to primary health care	Allows directing additional resources to gap areas
Percentage of target population within less than one day return walk of therapeutic feeding centre	Measures access to treatment for severe acute malnutrition (SAM)	Allows directing additional resources to gap areas. WHO responsible for inpatient treatment of medical complications associated with SAM.
Percentage of health facilities conducting nutrition screening (MUAC or W/H)	Assesses the coverage of nutrition screening at health facilities level	Allows directing additional resources to gap areas
Percentage of targeted districts with a cholera treatment unit/center available within 5km of all affected communities	Measures access to key intervention for cholera	Allows directing additional resources to gap areas
Percentage of targeted districts with at least 90% (rural) or 95% (urban or camp) administrative coverage of measles vaccine	Assesses gaps in coverage for key vaccine-preventable diseases and allows for anticipatory or reactive vaccination campaigns	
Percentage of at-risk districts with at least one health facility with clinical management of rape available	Assesses access to key GBV intervention	CMR defined as 1) counseling; 2) emergency contraception; 3) HIV PEP
Emergency operations organigram and reporting lines established	Process indicator to assess readiness for response to El Niño-related health threats	Countries may wish to establish a unified response structure for El Niño rather than individual IMSs for individual aspects of El Niño health impact
Health coordination mechanism established in country	Process indicator to assess Health Partners' coordination for response to El Niño-related health threats	In countries without a Health Cluster or equivalent mechanism, a new coordination mechanism will be needed
Funding available for response	Process indicator to assess readiness for response to El Niño-related health threats	
Response supply chain mapped and updated quarterly	Assess overall supply situation in a country (all partners).	Supply assessment done and supply strategy in place. Supply manager in each country (OSL team lead or member) conducts an

		assessment of the overall supply situation and develops an end to end supply chain strategy (WHO only). Supply assessment tools are existing.
Number of health services discontinued by disasters resulting from the El Niño phenomenon	Reduce mortality associated with the loss of available health services during and after a health emergency or disaster.	Associated with Sendai Framework Target D7

Risks for El Niño-affected countries

WHO Region	Country	Historically, when ENSO shifts rainfall patterns (months)	Historical ENSO impacts on rainfall (dry/wet)	Historical temperature changes	Jul-Sep Seasonal Forecast (rainfall) [WMO]	Jul-Sep seasonal forecast (temperature) [WMO]	Oct-Dec Seasonal forecast (rainfall) [WMO]	JAS 2023	OND 2023	JFM 2024	AMJ 2024	JASOND 2024	Risk Class (INFORM Risk 2023)	Projected proportion population IPC classification >3	IDPs (UNHCR 2022)	Refugees (UNHCR 2022)	Current outbreak of cholera/ DD	Current outbreak of arboviral disease	Current outbreak of VPD	Current outbreak of vector-borne diseases (malaria, etc)
Africa	Angola	Nov to Mar	Dry	warmer	Below-normal NW	Above-normal	*Above-normal N*						Medium		-	25,514				
Africa	Benin	Jul to Sep	Dry		Above-normal	Above-normal							Medium			1,779				
Africa	Botswana	Nov to Mar	Dry	warmer	Equal chances	Above-normal	*Equal chances*						Low			733				
Africa	Burkina Faso	Jul to Sep	Dry		Above-normal	Above-normal				*meningitis*		meningitis	Very High		1,882,391	34,375				
Africa	Burundi	Oct to Jan	Wet		Below-normal	Above-normal	*Above-normal*						High	9%	8,495	84,636	cholera		cVDPV2	
Africa	Cameroon	Jul to Sep	Dry		Above-normal	Above-normal							Very High		989,079	473,887	cholera			
Africa	Central African Republic	Jul to Sep	Dry		Above-normal S; Equal chances N	Above-normal							Very High	39%	515,665	11,213				
Africa	Chad	Jul to Sep	Dry		Above-normal; Equal chances S	Above-normal		*increased refugees from Sudan*	*inreased refugees from Sudan*	*meningitis*		meningitis	Very High		381,289	592,764				
Africa	Côte d'Ivoire	Jul to Sep	Dry	warmer	Above-normal	Above-normal							Medium			5,636				
Africa	Democratic Republic of the Congo (extreme southern region)	Nov to Mar	Dry	warmer	Below-normal SE; Above-normal NW	Above-normal	*Above-normal*						Very High	25%	5,541,021	520,544	cholera			
Africa	Eritrea	Jul to Sep	Dry		Equal chances	Above-normal							High			119				
Africa	Eswatini	Nov to Mar	Dry	warmer	Equal chances	Above-normal	*Equal chances*						Low							
Africa	Ethiopia (north)	Jul to Sep	Dry		Equal chances	Above-normal		*increased refugees from Sudan*	*inreased refugees from Sudan*	*meningitis*		meningitis	Very High		2,730,000	879,598	cholera		measles	malaria
Africa	Ethiopia (southeast)	Oct to Jan	Wet		Below-normal	Above-normal	*Above-normal*		*flooding cholera RVF malaria*				Very High		2,730,000	879,598	cholera		measles	
Africa	Ghana	Jul to Sep	Dry	warmer	Above-normal	Above-normal							Medium			8,531				
Africa	Guinea	Jul to Sep	Dry	warmer	Above-normal	Above-normal							Medium			2,199				
Africa	Guinea-Bissau	Jul to Sep	Dry	warmer	Above-normal	Above-normal							Medium			24				

Africa	Kenya	Oct to Jan	Wet		Below-normal W; Above-normal E	Above-normal	*Above-normal*	*flooding cholera rift valley fever malaria*	*flooding cholera RVF malaria*				Very High	11%		504,473	cholera			
Africa	Lesotho	Nov to Mar	Dry	warmer	Equal chances	Above-normal	*Equal chances*						Medium	15%		251				
Africa	Madagascar	Nov to Mar	Dry		Equal chances	Above-normal	*Above-normal*				flood disasters	*flood disasters*	High	5%		119				
Africa	Malawi	Nov to Mar	Dry	warmer	Equal chances	Above-normal	*Equal chances*			*Food insecurity (drought related)*	*Food insecurity (drought related)*	*Food insecurity (drought related)*	Medium	20%		35,162	cholera			
Africa	Mali	Jul to Sep	Dry		Above-normal	Above-normal				*meningitis*			Very High		379,932	60,637				
Africa	Mauritania	Jul to Sep	Dry		Above-normal	Above-normal							Medium			100,981				
Africa	Mozambique	Nov to Mar	Dry	warmer	Equal chances	Above-normal	*Equal chances*	*cholera*	*cholera food insecurity*				Very High	10%	1,028,743	4,992	cholera			
Africa	Namibia	Nov to Mar	Dry	warmer	Equal chances	Above-normal	*Equal chances*				food insecurity (drought related)	food insecurity (drought related)	Medium	9%	-	4,685				
Africa	Niger	Jul to Sep	Dry		Above-normal	Above-normal				*meningitis*			Very High		376,809	255,307			meningitis	
Africa	Nigeria	Jul to Sep	Dry		Above-normal; Equal chances NE	Above-normal				*meningitis*			High		3,286,881	91,275	cholera		diptheria meningitis	
Africa	Rwanda	Oct to Jan	Wet		Below-normal	Above-normal	*Above-normal*	*flooding cholera RVF malaria*	*flooding cholera RVF malaria*				Medium			120,753				
Africa	Senegal	Jul to Sep	Dry		Above-normal	Above-normal							Medium			11,802				
Africa	Sierra Leone	Jul to Sep	Dry	warmer	Above-normal	Above-normal							Medium							
Africa	South Africa	Nov to Mar	Dry	warmer	Equal chances	Above-normal	*Equal chances*				food insecurity (drought related)	food insecurity (drought related)	High		-	66,596	cholera		measles	
Africa	South Sudan	Jul to Sep	Dry		Below-normal	Above-normal		*increased refugees from Sudan*	*inreased refugees from Sudan*		food insecurity (drought related)	food insecurity (drought related)	Very High	63%	1,474,679	308,369			measles	malaria (susp)
Africa	United Republic of Tanzania	Oct to Jan	Wet		Below-normal NW; Above-normal NE	Above-normal	*Above-normal E*	*flooding cholera RVF malaria*	*flooding cholera RVF malaria*				High	2%		206,229	cholera			
Africa	Gambia	Jul to Sep	Dry	warmer	Above-normal	Above-normal							Medium			3,685				
Africa	Togo	Jul to Sep	Dry		Above-normal	Above-normal							Medium			9,300				
Africa	Uganda	Oct to Jan	Wet		Below-normal	Above-normal	*Above-normal*	*flooding cholera RVF malaria*	*flooding cholera RVF malaria*				Very High	1%	-	1,463,523				

Africa	Zambia	Nov to Mar	Dry	warmer	Equal chances	Above-normal	*Equal chances*				food insecurity (drought related)	food insecurity (drought related)	Medium	10%		61,159	cholera			
Africa	Zimbabwe	Nov to Mar	Dry	warmer	Equal chances	Above-normal	*Equal chances*		*food insecurity*				Medium			10,475	cholera			
Americas	Argentina	Jun to Jan	Wet	warmer	Below-normal N; Above-normal S; equal chances C	Near-normal	Above-normal E						Low		-	4,094		dengue		
Americas	Aruba	Jul to Dec	Dry			Above-normal	Below-normal						-							
Americas	Bahamas	Nov to Apr	Wet	warmer	Above-normal	Above-normal	*Above-normal*						Low			10				
Americas	Brazil (extreme southern region)	Sep to Jan	Wet	warmer	Above-normal	Near-normal	Above-normal				(increased arbovirus transmission)		Medium			67,522		dengue		
Americas	Brazil (northern region)	Apr to Mar	Dry	warmer	Below-normal	Above-normal	Below-normal		smoke inhalation from wildfires food insecurity	food insecurity (increased arbovirus transmission)	(increased arbovirus transmission)		Medium			67,522		dengue		
Americas	Canada (West coast)	Nov to Mar	Dry	warmer	Mixed	Near-normal	Below-normal						Low							
Americas	Chile	Jun to Sep	Wet	warmer	Above-normal C; Below-normal S; Equal chances N	Above-normal (N) Near-normal (S)					smoke inhalation due to wildfires		Low		-	2,133				
Americas	Colombia	Jun to Mar	Dry	warmer	Below-normal	Above-normal	*Below-normal*				malaria dengue	malaria dengue	High		6,834,492	1,607		dengue		
Americas	Costa Rica	Jul to Dec	Dry	warmer	Mixed (transition area)	Above-normal	Below-normal				(dengue)	(dengue)	Medium			14,088		dengue		
Americas	Curaçao	Jul to Dec	Dry		Below-normal	Above-normal	Below-normal						-							
Americas	Ecuador (northwest)	Jan to May	Wet	warmer	Above-normal W; Below-normal E	Above-normal				*(leptospirosis) (cholera)*	*(leptospirosis) (cholera) (dengue)*		Medium			60,125		dengue		
Americas	El Salvador	Jul to Dec	Dry	warmer	Equal chances	Above-normal	*Equal-chances*						Medium		71,500	104				
Americas	French Guiana	Jun to Mar	Dry	warmer	Below-normal	Above-normal	Below-normal						-							
Americas	Grenada	Jun to Mar	Dry		Below-normal	Above-normal	Below-normal						Very Low							
Americas	Guatemala	Jul to Dec	Dry	warmer	Below-normal N	Above-normal	*Equal-chances*			*flood disasters*			High	24%		701		dengue		
Americas	Guyana	Jun to Mar	Dry	warmer	Below-normal	Above-normal	*Below-normal*		*food insecurity*	*food insecurity*	(dengue)	(dengue)	Medium			12				
Americas	Honduras	Jul to Dec	Dry	warmer	Below-normal	Above-normal	*Below-normal E*						High	25%	247,090	165		dengue		
Americas	Mexico (northern region)	Jan to Apr	Wet	cooler	Below-normal NW	Above-normal							High		262,411	95,579		dengue		

Americas	Nicaragua	Jul to Dec	Dry	warmer	Below-normal	Above-normal	*Below-normal*			*(dengue)*			**Medium**		-	312		dengue		
Americas	Panama	Jul to Dec	Dry	warmer	Mixed (transition area)	Above-normal	*Below-normal*						**High**			2,576		dengue		
Americas	Paraguay	Sept to Jan	Wet	warmer	Equal chances	Above-normal	*Above-normal S*						**Low**			5,420		dengue	measles	
Americas	Peru (northeast)	Jun to Mar	Dry	warmer	Below-normal	Above-normal	*Below-normal*						**Medium**			6,543		dengue		
Americas	Peru (northwest)	Jan to May	Wet	warmer	Below-normal	Above-normal				(cholera) (flood related disasters) (malaria)	(cholera) (flood related disasters) (malaria)	(dengue)	**Medium**			6,543				
Americas	Suriname	Jun to Mar	Dry	warmer	Below-normal	Above-normal	*Below-normal*		*food insecurity*	*food insecurity*	dengue	dengue	**Low**		-	25				
Americas	Trinidad and Tobago	Jun to Mar	Dry		Below-normal	Above-normal	Below-normal						**Low**			3,424				
Americas	Uruguay	Sep to Jan	Wet	warmer	Above-normal	Above-normal	*Above-normal*						**Low**			1,115				
Americas	United States of America (Hawaii)	July to Apr	Dry		Below-normal	Slightly above normal	Below-normal						**Low**							
Americas	United States of America (Ohio River Valley)	Dec to Mar	Dry	cooler	Equal-chances	Slightly above normal	Equal chances						**Low**			363,059				
Americas	United States of America (southern region)	Nov to Apr	Wet	cooler	Below-normal SW	Near-normal	Equal chances; Above-normal extreme SE				(hantavirus)		**Low**			363,059				
Americas	Venezuela (Bolivarian Republic of)	Jun to Mar	Dry	warmer	Below-normal	Above-normal	*Below-normal*		*food insecurity*	*food insecurity*	Malaria	Malaria	**High**			29,341		dengue		
Eastern Med.	Afghanistan	Jan to Apr	Wet		Near-normal; Equal chances E	Above-normal				*flood disasters, landslides*	flood disasters, landslides, cholera	malaria	**Very High**	**35%**	3,254,002	52,159	cholera			
Eastern Med.	Djibouti	Jul to Sep	Dry		Below-normal	Above-normal		*cholera*	*cholera*	*cholera*			**Medium**	**24%**		20,383				
Eastern Med.	Iran (Islamic Republic of)	Jan to Apr	Wet		Near-normal	Above-normal							**High**			3,425,091				
Eastern Med.	Pakistan (north)	Jan to Apr	Wet		Equal chances	Above-normal						malaria (highland fringes)	**High**	**5%**	-	1,743,785	cholera			malaria
Eastern Med.	Pakistan (southeast)	Jun to Sep	Dry		Near-normal (and equal chances)	Near-normal							**High**	**5%**	-	1,743,785	cholera			
Eastern Med.	Somalia	Oct to Jan	Wet		Above-normal	Above-normal	*Above-normal*	*population displacement flooding malaria cholera RVF*	*population displacement flooding malaria cholera RVF*	*population displacement*	*population displacement*		**Very High**	**39%**	2,967,500	16,023	cholera			

Eastern Med.	Sudan	Jul to Sep	Dry		Below-normal S	Above-normal				*meningitis*	food insecurity (drought related)	food insecurity (drought related)	**Very High**	**16%**	3,552,717	1,097,128			measles cVDPV2	
Europe	Azerbaijan	Jan to Apr	Wet		Equal chances	Slightly above normal							**High**		658,793	6,414				
Europe	Kazakhstan	Jan to Apr	Wet		Equal chances	Slightly above normal							**Very Low**			308				
Europe	Kyrgyzstan	Jan to Apr	Wet		Equal chances	Slightly above normal							**Low**			274				
Europe	Tajikistan	Jan to Apr	Wet		Equal chances	Above-normal							**Medium**			8,608				
Europe	Turkmenistan	Jan to Apr	Wet		Near-normal	Above-normal							**Low**			14				
Europe	Uzbekistan	Jan to Apr	Wet		Equal chances; near-normal S	Above-normal							**Low**			13,026				
S. E. Asia	Bangladesh	Jun to Sep	Dry		Equal chances	Above-normal				*(cholera)*			**High**	**31%**	-	952,384	cholera	dengue		
S. E. Asia	Bhutan	Jun to Sep	Dry		Equal-chances	Above-normal							**Low**							
S. E. Asia	India	Jun to Sep	Dry	warmer	Equal chances	Slightly above normal			*dengue (Arunachal Pradesh, Chhattisgarh, Haryana, Uttarakhand, Andaman and Nicobar Islands, Delhi, Daman and Diu.) malaria (Orissa, Chhattisgarh, Jharkhand, Bihar, Goa, eastern parts of Madhya Pradesh, part of Andhra Pradesh, Uttarakhand and Meghalaya)*	*Food insecurity (drought related)*	food insecurity (drought related)	food insecurity (drought related)	**High**			242,835				
S. E. Asia	India (southern region)	Oct to Dec	Wet		Above-normal far South	Above-normal	Below-normal SE						**High**			242,835				
S. E. Asia	Indonesia	Jun to Jan	Dry	warmer (but night frosts due to lack of cloud cover in eastern highland zones make these cooler)	Below-normal	Above-normal	*Below-normal*		*smoke inhalation from wildfires*	*Food insecurity (drought related)*	food insecurity (drought related) malaria (eastern highland fringes)	food insecurity (drought related) malaria (eastern highland fringes)	**Medium**			9,785			measles cVDPV2	

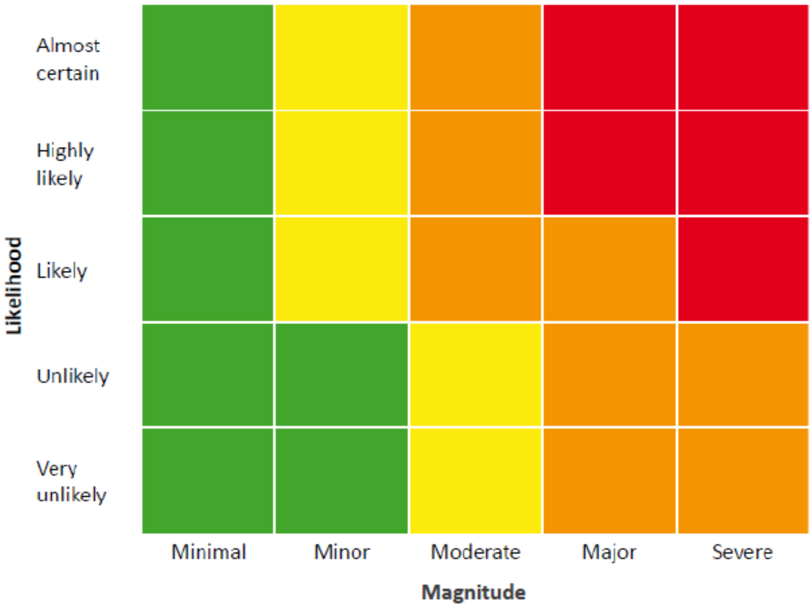
S. E. Asia	Myanmar	Jun to Sept	Dry	warmer (south)	Above-normal S	Above-normal							**Very High**		1,504,848	-				
S. E. Asia	Nepal	Jun to Sep	Dry		Equal chances	Above-normal							**Medium**		-	19,560			measles	
S. E. Asia	Sri Lanka	Oct to Dec	Wet		Above-normal	Mcec-normal	*Above-normal*		*malaria (southwest)*	*malaria (southwest)*	food insecurity (drought related)	food insecurity (drought related)	**Low**		8,540	504				
S. E. Asia	Thailand	Jun to Jan	Dry	warmer	Above-normal	Above-normal	Below-normal						**Medium**			94,472				
W. Pacific	Australia	July to March	Dry	warmer (east and south) cooler (north)	Below-normal S	Near-normal (N) Slightly above normal (S)	Below-normal			increased arbovirus transmission (MVE, RRV)	smoke inhalation due to wildfires	smoke inhalation due to wildfires	**Low**		-	54,430				
W. Pacific	Brunei	Jun to Jan	Dry	warmer	Below-normal	Above-normal	Below-normal						**Very Low**							
W. Pacific	Cambodia	Jun to Jan	Dry	warmer	Above-normal	Above-normal	*Below-normal*						**Medium**			24				
W. Pacific	China (western region)	Jan to Apr	Wet		Equal chances; Above-normal	Above-normal							**Medium**		-	320				
W. Pacific	Fiji	Sep to Mar	Dry		Equal-chances	Near-normal	*Below-normal*						**Low**			5				
W. Pacific	Kiribati	June to April (this country expands both over the Wet and Dry areas)	Wet/Dry (depends on the atoll)		Above-normal	Above-normal	*Above-normal*						**Low**							
W. Pacific	Malaysia	Jun to Jan	Dry	warmer	Below-normal S, above-normal N	Above-normal	Mixed						**Low**			134,554				
W. Pacific	Marshall Islands	July to April	Dry		Above-normal S; Below-normal N (transition area)	Above-normal	*Equal-chances*						**Medium**							
W. Pacific	Micronesia	July to April	Dry		Above-normal	Above-normal	*Mixed*						**Medium**							
W. Pacific	Nauru	June to April	Wet		Above-normal	Above-normal	*Above-normal*						**Low**		-	45				
W. Pacific	Palau	June to Jan	Dry		Above-normal	Above-normal	*Below-normal*						**Medium**							
W. Pacific	Papua New Guinea	June to Jan	Dry	cooler	Equal chances	Above-normal Near normal (extreme S)	*Below-normal S*				malaria (highland fringes)	flood disasters	**Low**		90,634	10,524				
W. Pacific	Philippines	Jun to Jan	Dry		Above-normal (except on the far N and S)	Above-normal	*Below-normal*				food insecurity (drought related)	food insecurity (drought related)	**High**		98,094	856	cholera			
W. Pacific	Samoa	Sep to Mar	Dry (but also has an above-average cyclone forecast)		Below-normal	Above-normal	*Below-normal*						**Low**							

W. Pacific	Singapore	Jun to Jan	Dry	warmer	Below-normal	Above-normal	Mixed						**Very Low**							
W. Pacific	Solomon Islands	Jun to Jan	Dry		Above-normal	Above-normal	*Equal-chances*						**Medium**		1,000					
W. Pacific	Timor-Leste	July to March	Dry	cooler	Nomal to Below-normal	Near-normal	*Below-normal*						**Medium**	**20%**						
W. Pacific	Tonga	Sep to Mar	Dry		Equal-chances	Above-normal	*Below-normal*						**Medium**							
W. Pacific	Tuvalu	June to April	Wet		Below-normal	Above-normal	*Above-normal*						**Medium**							
W. Pacific	Vanuatu	Sep to Mar	Dry		Equal chances	Above-normal	*Below-normal*						**Medium**							
W. Pacific	Viet Nam	Jun to Jan	Dry	warmer	Above-normal S	Above-normal	*Below-normal*						**Low**							

Note that the above table is subject to revisions, and may not be fully representative of all potential health threats in coming months. It may be revised in upcoming publications.

Risk assessment methodology

Risk Matrix



Risk levels

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.

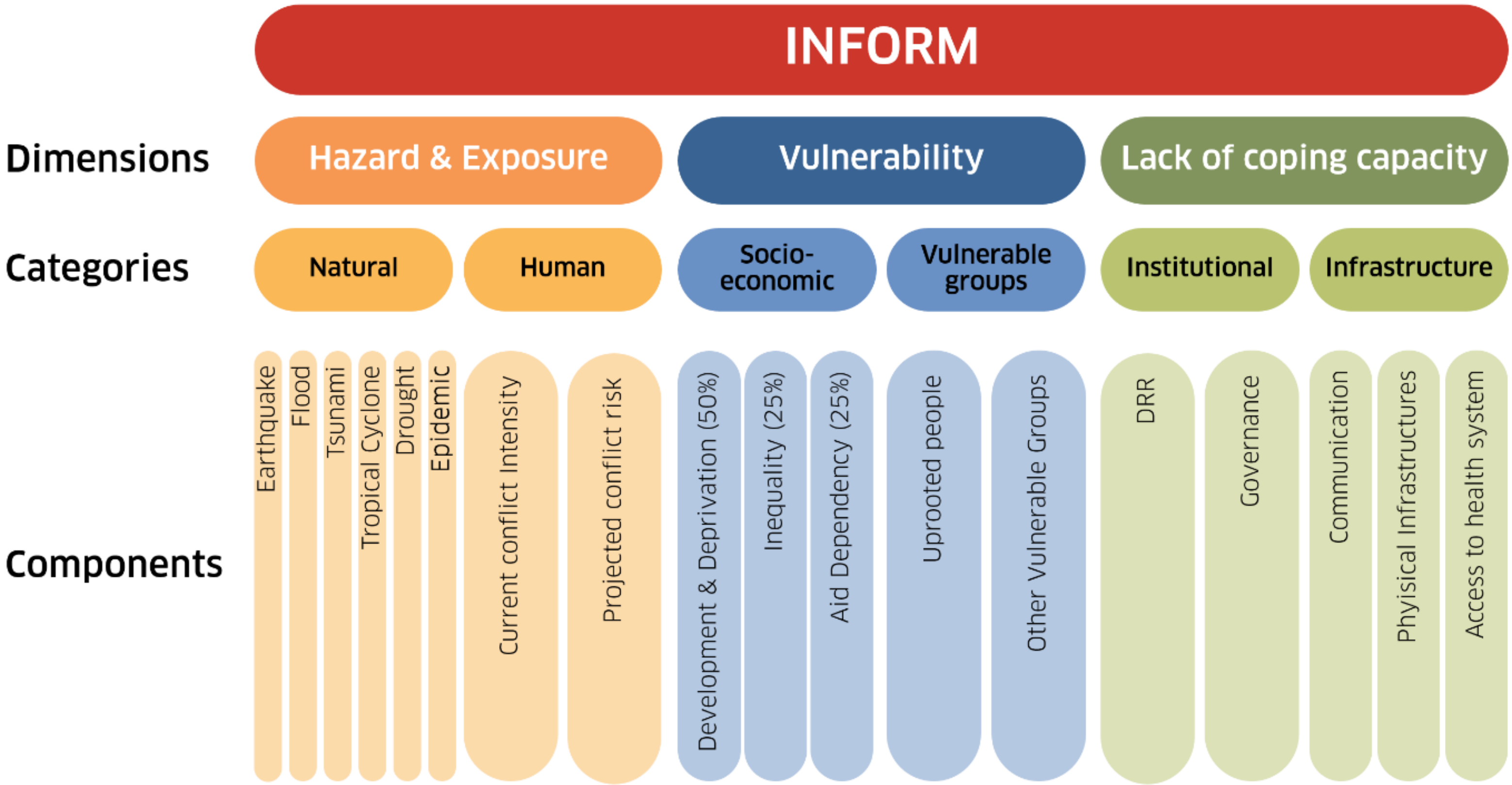
Yellow: **Moderate risk.** Could make a minor contribution to excess mortality/morbidity.

Green: **Low risk.** Unlikely to make a contribution to excess mortality/morbidity*

Grey: No plausible assessment can be made at this time.

Likelihood**	Magnitude	Risk
What is the likelihood that there will be an outbreak or substantial increase in the number of cases/issues*** in the coming three months?	What is the potential magnitude of the impact of an outbreak or substantial increase in the number of cases/issues on the population?	Considering the likelihood and magnitude of the impact, what is the risk in terms of excess morbidity/mortality to the population over the next three months?

INFORM Index methodology[26]



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