Public Health Situation Analysis

El Niño

Global Climate Event

Covering October-December 2023

Population: El Niño affected countries
Reporting period: October-December 2023
Start date of event: June 2023
Typology of event: Heatwaves, drought, wildfires, floods, landslides, food insecurity, infectious diseases, cyclones

This document has been prepared by the Department of Alert and Response Coordination with inputs from relevant technical experts within WHO and partners.

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 event in order to inform health response planning. It is based on key documents and research products from members of the World Health Organization, World Meteorological Organization (WMO), other UN organizations, NGOs, and research institutes.

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.

What is new in this edition?

This is the second edition of this Public Health Situation Analysis. The first version can be found here.

- This edition updates the climate forecast for the months of October through December 2023 and re-assesses the health risks in the updated context. Most risks remain unchanged.
- The risk table has been divided into separate tables for wet versus dry effects of El Niño.
- Health system information from the HeRAMS system has been added.
- Additional Regional information has been added.
- Additional information on Health Cluster response activities has been added.
- Cross-referencing to the INFORM risk has been updated to 2024 INFORM classifications.
- Linkage to the WHO Dynamic Preparedness Metric has been added.
- An updated IPC food insecurity map has been included.
- Additional potential monitoring indicators have been added.
- A section on information gaps and suggested methods to obtain information has been added.
- Other minor editorial changes have been made.

No further updates to this document are expected unless there are major unanticipated changes in the global risks.

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Executive Summary

The current El Niño event was first declared in June 2023. Since the first El Niño Public Health Situation Analysis published in July 2023, evolving climate forecasts have warranted an update to this document. The past three months have already demonstrated that several of the predicted weather-related risks and attendant health consequences associated with El Niño have already come to pass in multiple settings around the globe (with the caveat that any climate-related event is multifactorial and thus difficult to attribute specifically to El Niño). These have included a large dengue outbreak in Bangladesh, forest fires in Australia, increases in the water quality risk and alterations to the crop cycle in Central America, widespread flooding in northern India, heat waves in southern Europe, increases in cholera in East Africa, and increases in wildfires and associated air pollution in Indonesia. Even with some negative effects already observed, most of the negative health effects of El Niño are projected as still to come: the ongoing El Niño is highly likely to have wide-ranging health implications on a global scale well into 2024.

This document is organized around several main themes: a description of the El Niño climate pattern and the sub-regions and locations most likely to be affected; the anticipated health risks, their anticipated relative importance, and rationale for their inclusion; the anticipated influence of El Niño on key determinants of health; a discussion of the availability of health resources and services relevant to the response to health threats associated with El Niño, and potential threats to health infrastructure itself; and an overview of the humanitarian health response being undertaken to mitigate the aforementioned risks. A table of climate forecasts and detailed risks per country can be found in the Annex.

In the coming months, the most severe health risks are likely to arise from malnutrition due to ongoing food insecurity, compounded by the effects of El Niño. Other very high risks include cholera and other waterborne diseases; heat stress and air pollution; malaria; and arboviral diseases such as dengue, Zika virus disease, and chikungunya. Stakeholders focused on specific health risks are referred to the risk tables 2a and 2b and the narratives under the section 'Health Risks'.

Health resources and services to address the health risks associated with El Niño, and their vulnerability to the effects of El Niño, vary greatly from one country to another, and within countries. 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. The ultimate impact of El Niño on health can be characterized according to the intersection of the likelihood of its severe effects (as per the risk tables) versus the consequences in the underlying context. Many of the locations projected to be affected by El Niño are already suffering humanitarian emergencies and thus already have highly vulnerable health systems. Stakeholders focused on health systems strengthening and broad humanitarian response are referred to the 'Health Resources and Services Availability' section of this PHSA for information relevant to mitigating the effects of El Niño on health systems.

The key humanitarian response elements for mitigating the health effects of El Niño are: disease surveillance and control, provision of safe water and sanitation services, risk communication and community engagement, provision of emergency health supplies, vaccination, prevention of sexual exploitation and abuse, and assuring continued access to health care. WHO acts as part of an 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. WHO and partners already have emergency response plans in place in many crisis-affected countries projected to be most affected by El Niño, and are supporting local authorities to mitigate these effects. For humanitarian response stakeholders at the regional, national or sub-national levels, in order to ensure optimal evidence-based operational decision-making, the findings in this PHSA should be contextualized with more granular local information; the table in the Annex may serve as a starting point.

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 October 2023 – March 2024. Global ENSO Analysis Cell, October 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. The episodes can vary significantly in intensity from one occurrence to the next. El Niño and La Niña events occur every two to seven years on average, but they do not occur on a regular schedule. Generally, El Niño occurs more frequently than La Niña.[2]

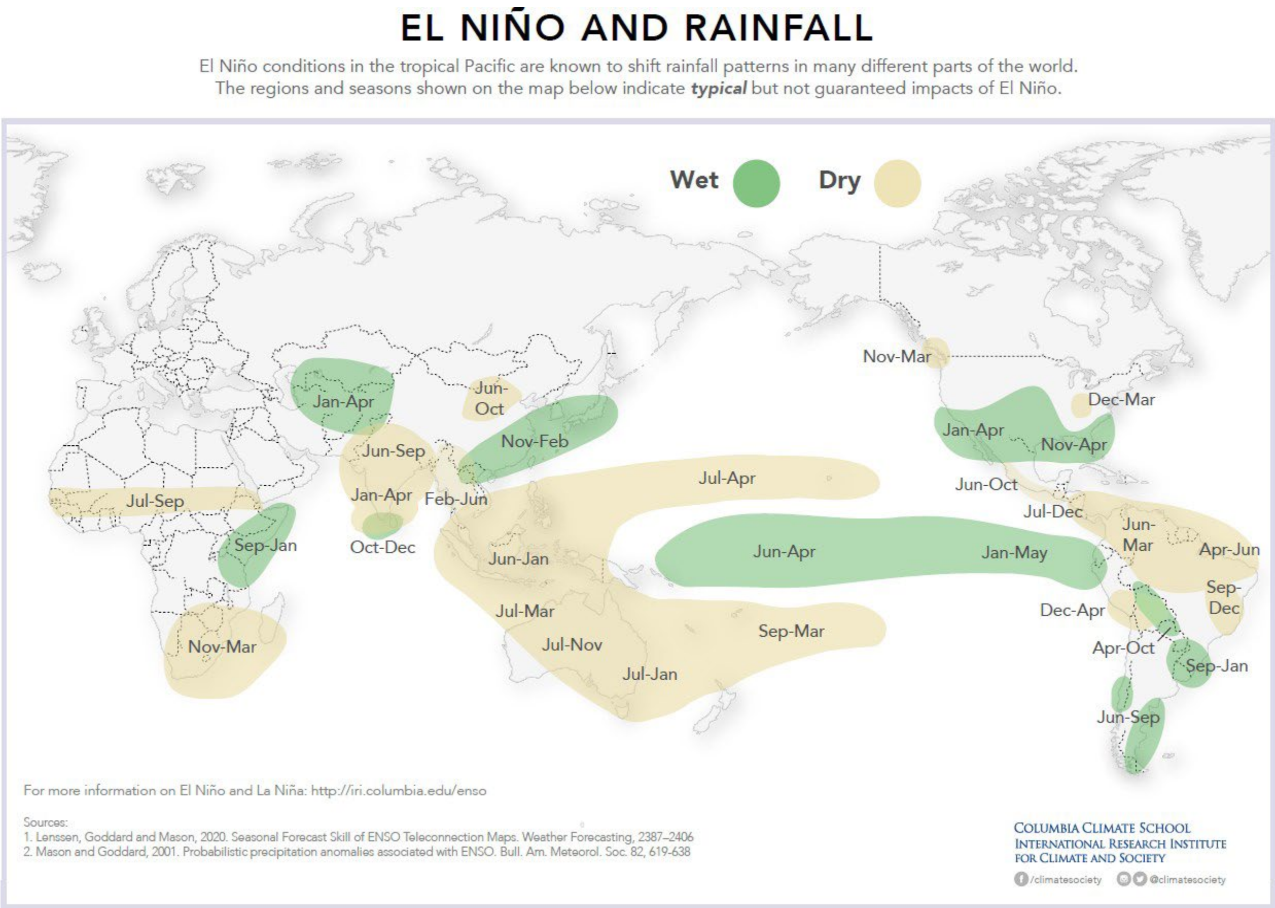


Table 1: Historical El Niño climatic impacts on individual countries. Note that countries not listed may still be affected as ENSO effects are not consistent from year to year (Source: IASC)

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	Kiribati (south-east region)
Colombia*	Papua New Guinea	Kyrgyzstan
Costa Rica	Peru (northeastern region)	Mexico (northern region)
Côte d'Ivoire	Philippines	Nauru
Curaçao	Samoa	Pakistan (northern region)
Djibouti	Senegal	Paraguay
Democratic Republic of the Congo* (extreme southern region)	Sierra Leone	Peru (northwestern region)
El Salvador	Singapore	Rwanda
Eritrea	Solomon Islands	Somalia*
Eswatini	South Africa	Sri Lanka
Ethiopia* (northern region)	South Sudan*	Tajikistan
Fiji*	Sudan*	Turkmenistan
French Guiana	Suriname	Tuvalu
Gambia	Thailand	Uganda
Ghana	Timor-Leste	Uruguay
Grenada	Togo	United Republic of Tanzania
Guatemala	Tonga	United States of America (southern region)
Guinea	Trinidad and Tobago	Uzbekistan
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		

* Countries with activated Health Clusters; the Pacific Health Cluster is coordinated out of Fiji

El Niño conditions began in June 2023, as the atmospheric response to the warmer-than-average tropical Pacific ocean surface started.[3] According to NOAA/CPC, in August, sea surface temperatures (SSTs) were above average across the equatorial Pacific Ocean. Recent forecasts of the World Meteorological Organization (WMO) Global Producing Centres of Long-Range Forecasts suggest it is almost certain (>95% chance) that El Niño will continue into early 2024. It must be noted that this El Niño is taking place in the context of a very warm global ocean, and there is uncertainty about how this will affect El Niño's atmospheric conditions.

There is increasing confidence in a “strong” El Niño event (71%) but this does not necessarily mean strong El Niño impacts locally. It is important to note that El Niño and La Niña are not the only factors that drive global and regional climate patterns, and that the magnitudes of ENSO indicators do not directly correspond to the magnitudes of their effects. At the regional level, seasonal outlooks assess the relative effects of both the ENSO state and other locally relevant climate drivers. Impacts – including on food insecurity and health – can

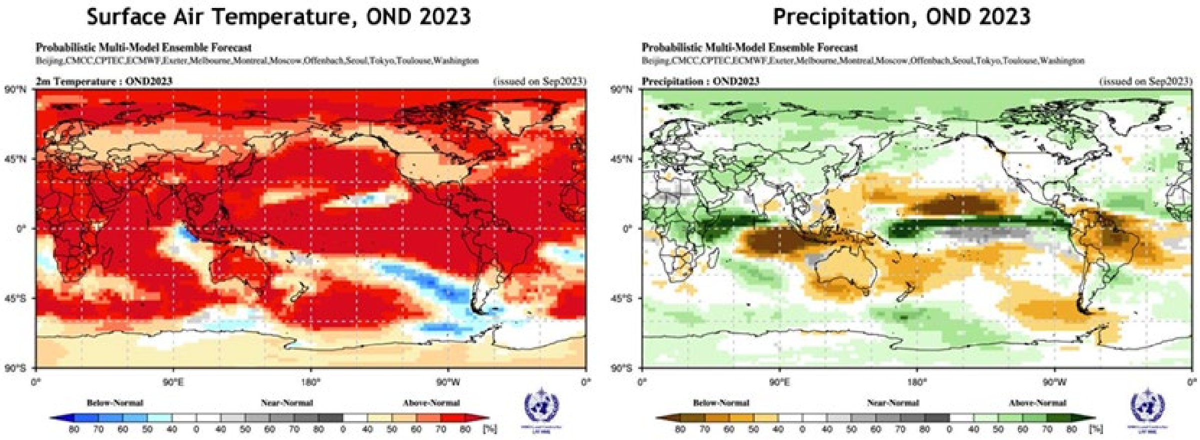


Figure 1. Probabilistic forecasts of surface air temperature and precipitation for the season October-December 2023. The tercile category with the highest forecast probability is indicated by shaded areas. The most likely category for below-normal, above-normal, and near-normal is depicted in blue, red, and grey shadings respectively for temperature, and orange, green and grey shadings respectively for precipitation. White areas indicate equal chances for all categories in both cases. The baseline period is 1993-2009.

often peak well after the shift in rainfall itself. The temperature and precipitation forecasts for October-November-December 2023 can be found in the figure below, and are generally in line with expectations for this time period.

Map source: WMO. Surface air temperature and precipitation predictions, October-December 2023

Temperature forecast summary – Oct-Nov-Dec 2023 (source: GSCU)

Higher than usual temperatures are expected over almost the entire Northern Hemisphere except for an area off the south-west coast of North America that extends into the central Pacific. The largest possible increase in above-normal temperatures in the Northern Hemisphere is predicted generally south of about 45^{o}N (see maps above for reference on degrees latitude/longitude), and also over parts of Central and East Asia, north-eastern parts of North America, and in the regions north of 65^{o}N. Elsewhere in the Northern Hemisphere, including Greenland, Europe and Asia between 45^{o} and 65^{o}N, and in North America north of about 30^{o}N, there is a moderately increased probability for above-normal temperatures.

There are also enhanced probabilities for above-normal temperatures over most of the Southern Hemisphere, except for the areas bordering the eastern tropical Indian Ocean, and southeast Pacific between 120^{o} and 70^{o}W, where probabilities for below normal temperature are enhanced. Over most other Southern Hemisphere land areas north of about 30^{o}S, there are strongly increased probabilities for above-normal temperatures. However, over New Zealand, and over the central and eastern Pacific Ocean islands south of about 20^{o}S. the probabilities for above-normal temperatures are only weakly increased. For South America there is no clear indication of climate anomalies south of about 35^{o}, extending to the southern tip of the continent. For country-level forecasts, please see Annex 1.

Rainfall forecast summary – Oct-Nov-Dec 2023 (source: GSCU)

Predictions for rainfall are similar to some of the historical rainfall impacts of El Niño, which is expected to strengthen in OND 2023. Probabilities for above-normal rainfall are enhanced over a narrow band along and just north of the equator from 150^{o}E extending across the equator to the west coast of South America. Across most of the Pacific Ocean south of about 30^{o}N, and immediately to the north of the wet band, rainfall is predicted to be below-normal.

South of the equator and east of Southeast Asian countries, an area of strong enhancement in below-normal rainfall extends into the Indian Ocean to about 60^{o}E. This area of below-normal rainfall extends southeast towards the western coast of Australia, where it further extends eastward towards Tasmania. East of the Southeast Asian countries, an area of below-normal rainfall extends towards the southeast to the Date Line where it curves south-westward towards the southeast coast of Australia. There is a weakly enhanced probability for below-normal rainfall over much of Australia.

The probability for above-normal rainfall is enhanced in the Indian Ocean north of the equator and extends towards the eastern coast of Africa and into the Greater Horn of Africa, where along the equator it extends further towards western Africa. There is a weak enhancement in the probability of above-normal rainfall over the Arabian Peninsula, central and northern Asia, parts of eastern Asia, and northern Caribbean.

Over North America, there is a weakly enhanced probability of above-normal rainfall north of 55ºN and merges with the expectations for above-normal rainfall in the Arctic latitudes. The probability for below-normal rainfall is enhanced across much of the northern part of South America north of about 25ºS, southern parts of Central America and the southern Caribbean. The probability for above-normal rainfall is enhanced in South America below 30ºS. However, over the extreme southern tip of the continent the probability for below-normal rainfall is enhanced and extends westward along 55ºS to about 120º W. For country-level forecasts, please see Annex 1.

Risk overview by subregion (condensed from IASC ENSO Analysis Cell)

The following sub-regions have been identified as high priority for potential humanitarian challenges due to the **consequences of El Niño through March 2024**. 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 significant health impacts historically observed during the year after the onset of an El Niño event. For health risks and challenges expected after December 2023, please refer to the country risk table at the end of this document. It must be noted that for the data in this annexed table, from January-March, confidence on forecasts is lower considering the longer lead time. Close monitoring of regional and national level forecasts, and consideration of anticipatory or early actions is recommended.

Note: countries are grouped in this section according to the IASC ENSO Analysis Cell groupings, rather than by WHO Region.

- **Central America and northern South America**

High-risk countries (dry): Colombia (north), El Salvador, Guatemala, Guyana, Honduras, Nicaragua, Peru (east), Suriname, the Bolivarian Republic of Venezuela (north)
High-risk countries (wet): Ecuador, Colombia (west)

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. Additionally, there are increased chances of above-normal temperatures, which contribute to the intensification of drought conditions. Latest seasonal forecasts show less of a signal for dry conditions during October-December in El Salvador, Guatemala, Honduras, and Nicaragua (east coast of Central America). However, given that this region has been experiencing dry conditions, and early forecasts suggest a return to dry conditions during Jan-March, these countries remain a priority. In Guyana, Suriname, and northern parts of Colombia, Venezuela and east Peru, dry conditions continue to be expected for the coming months. Meanwhile, El Niño is typically associated with above-average rainfall during the first months of the year in northwest South America. Early forecasts appear to indicate this shift in parts of Ecuador and Colombia. 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.

El Niño conditions typically suppress Atlantic tropical cyclone activity. However, warm sea surface temperature observed in the Tropical North Atlantic tend to have opposing effects, contributing to higher Atlantic Hurricane Season activity and an increased frequency of extreme rainfall during the wet season. Therefore, the current record-warm Atlantic sea temperatures are likely to counterbalance the usually limiting atmospheric conditions associated with El Niño, and the United States' National Oceanic and Atmospheric Administration (NOAA) forecasters have increased the likelihood of an above-normal Atlantic hurricane season from 30 per cent (issued in May) to 60 per cent as of August.

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), as dry conditions may increase *Aedes* mosquito breeding sites through increased water storage around homes, and higher temperatures reduce the viruses' extrinsic incubation period – there is a projected very high risk in El Salvador, high risk in all other countries listed above. 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 who take daily medications have a greater risk of medical complications and death during a heatwave, as do older people and children.

It has already been noted that in the case of Panama, the lack of rain has increased the risk to the fresh water supply and raised the Water Quality Risk Index. Rainfall and drought patterns in the Mesoamerican Dry Corridor have also affected northern Panama (with rainfall in the dry arc) and deepening the effects of the dry season in Central American countries, altering the crop cycle, similar to the phenomena of 2015-2016. Above-normal rainfall is expected from November to April, particularly in the central, northern and western Caribbean.

- **Southeast Asia**

  High-risk countries (dry): Indonesia, Lao People's Democratic Republic, Papua New Guinea, Philippines, Timor-Leste

Analysis of previous El Niño impacts suggests that parts of Southeast Asia typically experience below-normal rainfall through January. The latest seasonal forecasts indicate a particularly high likelihood of below-normal rainfall in Indonesia, Papua New Guinea, the Philippines and Timor-Leste. Forecasts also indicate below-normal rainfall in the Lao People's Democratic Republic and southern Viet Nam. These areas are also influenced by the Indian Ocean Dipole (IOD). A positive IOD event was declared by the Australia Bureau of Meteorology (BOM) on 19 September. Forecast models indicate this is highly likely and that this positive IOD will be sustained to at least the end of 2023. A positive IOD typically suppresses austral winter and spring rainfall over much of the Indo-Pacific, and if it coincides with El Niño, it can exacerbate El Niño's drying effect. It is important to note that many of these areas have been in their dry season, so minimal rainfall has been expected. What needs to be watched carefully is the potentially extreme dry period coupled with a poor rainy season which will begin from October onwards, when planting of the 2024 main crops is expected to start.

In Indonesia, the 2023 main crops were harvested by mid-June and the output is estimated at an above-average level. The 2023 secondary crops, planted in June/August and for harvest towards the end of the year, have been affected by below-average rains between June-August in parts of the country, and if dryness continues a below-average 2023 production is forecast. In Timor-Leste, the 2023 main season cereal output is estimated at an above-average level, and the secondary season has progressed favourably so far. Still, concerns exist that the below-average precipitation amounts and above-average temperatures between December 2023 and February 2024, amplified by a positive IOD, could affect yields of late-planted crops. A decline in agricultural output would increase import requirements, and considering recent surges in global rice prices, domestic food prices are likely to increase significantly. In the Philippines, the dry weather condition will coincide with critical growing stages of the main season rice crop and could have negative effects on yields – particularly for the breadbasket regions of Mindanao and Luzon. In West Papua, Indonesia and in Papua New Guinea, El Niño is historically associated with drought-like conditions and wildfires that can cause considerable damage to grasslands for livestock and disrupt subsistence food supplies, worsening the already critical acute food insecurity situation.

While not considered as high a priority for humanitarian planning, close monitoring should continue for other parts of the region. This includes Cambodia, where the projected shift to dry conditions later in the year falls outside the main rainfall season, but where there is concern with a possible later onset of the monsoon season. In the Lao People's Democratic Republic, well below-average rainfall amounts since late April reduced sowings and yields in the northern parts of the country, where 20 percent of rice and 80 percent of maize is grown. The reduced production is likely to exacerbate the already high food prices.

Increased risk of transmission of dengue and other arboviruses (such as chikungunya and Zika) is expected, as dry conditions are likely to increase *Aedes* mosquito breeding sites through increased peri-domestic water storage, and higher temperatures reduce the viruses' extrinsic latent period. There is a projected very high risk of dengue in Indonesia, Myanmar, the Philippines and Viet Nam, and a high risk in Papua New Guinea and Timor-Leste. There is a projected very high risk of Zika in Indonesia, the Philippines, and Viet Nam, a high risk in Myanmar and Timor-Leste, and a moderate risk in Papua New Guinea.

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. Increased exposure to pests, air pollution and wind-related hazards are likely to contribute to an increased incidence of allergies and skin diseases.

In countries where agricultural output is decreased, imports will be required to cover domestic needs, and with increasing food prices, the resulting food insecurity will likely exacerbate already existing nutritional challenges such as stunting and wasting. The nutritional status of vulnerable groups such as children, pregnant and lactating women need to be monitored closely for negative impacts.

- **South and Central Asia**

High-risk countries (wet): Afghanistan, Pakistan, Sri Lanka, Tajikistan, Turkmenistan

From October to December, El Niño is usually associated with higher levels of rainfall in parts of Sri Lanka and the southern portion of India. Current forecasts do suggest higher rainfall is expected in southwestern areas during this period. Very high levels of rainfall have already been reported in northern India this summer, leading to widespread flooding in Himachal Pradesh and Uttarakhand; these may or may not be linked directly to the effects of El Niño. Although abundant rains are generally favorable for crop development, the combination with the elevated temperatures for the forecast period may cause pest infestations, resulting in localized crop losses. Other Central and South Asian countries typically see higher than normal precipitation from January to April during El Niño events. In Afghanistan, Pakistan, Tajikistan and Turkmenistan, early forecasts do suggest this is likely for the January-March outlook, though uncertainty remains. This is likely to increase challenges for effective winterization. In Afghanistan, above-average rainfall will potentially support the 2024 winter crops after three years of drought. However, heavy precipitation can also lead to floods and landslides, destroying crops, triggering higher livestock mortality, and increasing health and nutritional needs. Northern Pakistan may face severe flooding due to increased snow and heavy winter precipitation, leading to livestock losses and crop failures of the 2024 wheat crop, the country's main staple, adding upward pressure to already high prices, which in August 2023 were at near-record level, ranging from 60 to almost 180 percent higher year-on-year. Conditions should also be watched in other countries in the region – including Azerbaijan, Kazakhstan, Kyrgyzstan, the Islamic Republic of Iran, and Uzbekistan - which face a similar outlook, though face generally lower levels of underlying vulnerability and/or lack of coping capacity.

Reduced harvests, floods, and other extreme weather conditions in this region will impact health and nutritional status of the affected populations, with especially Afghanistan being highly vulnerable. Flooding will lead to challenges to access to safe drinking water and will likely increase the impact of water-borne diseases such as cholera, with risks increased especially in the spring in Afghanistan and surrounding countries. Harvest losses coupled with increasing food prices are expected to lead to increased levels of malnutrition amongst vulnerable populations such as young children, pregnant and lactating women, and the elderly, requiring close monitoring of nutritional status. Higher temperatures and increased creation of breeding sites for *Aedes* mosquitoes can contribute to the exacerbation of ongoing dengue and chikungunya outbreaks. Increased malaria transmission can be expected especially in highland areas in the region starting in the springtime, affecting potentially non-immune populations.

- **Europe and North America**

The European region is projected to be affected by multiple climatic patterns over the coming fall and winter period. This complex weather system, consisting of many large and small weather drivers, includes an El Niño event, as well as measures of the Arctic Oscillation / North Atlantic Oscillation indices that indicate anomalies in the Polar Vortex, and finally stratospheric changes in wind directions every 14 months or so that are represented by the Quasi-Biennial Oscillation.

During an El Niño winter, the polar jet stream is pushed further north, bringing warmer-than-normal temperatures to the northern United States of America and western Canada, while associated changes in the southerly Pacific jet stream bring low pressure and storms with increased precipitation and cooler weather to the Southern United States, leading to more snowfall in the central and southern United States, as well as part of the mid-Atlantic and higher elevations of the southwestern United States. The Polar Vortex does not have a warm/cold or a clear positive/negative phase, but is expressed as having strong or weak modes. A weak Polar Vortex creates a weak jet stream pattern, meaning it has a harder time containing the cold air, which can now escape from the polar regions into the United States and Europe. The QBO affects the Polar Vortex and the power and direction of the winds in the polar jet stream, which in turn change the weather patterns across the United States, Canada, and Europe. With an easterly QBO, a negative wind stream above the tropical regions weakens the Polar Vortex and the stratospheric winter circulation, leading to colder winters in the United States, Canada and Europe.

The interplay between these weather phenomena is complex, affecting the reliability of forecasts for the northern regions. At present, fall/winter climate forecasts indicate a high probability of a colder-than-normal winter over the central, southern, and southeastern United States, especially during the January-March period. In terms of precipitation, there is an equal-to-higher probability for more precipitation (and snowfall) over the southern and eastern parts of the United States, with less precipitation expected across the northern parts of the United States. Canada looks to be warmer than normal but the model predictions are also more uncertain as it is further North. For Europe, forecasts indicate warmer-than-normal scenarios early on, with a colder scenario more likely in the middle and later parts of winter (December to February), especially in high-lying regions of Scandinavia and central Europe, and altered rainfall patterns (e.g., more in the Mediterranean).

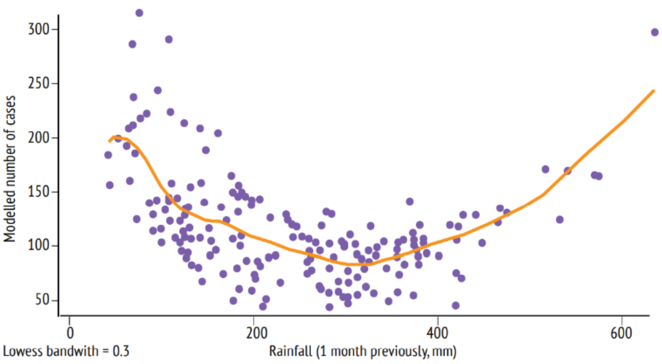
Associated health impacts to consider are that the continued Southern European heat waves with associated wildfires can contribute to (aggravated) respiratory tract conditions, as well as a greater risk of complications and a higher mortality risk in people with chronic diseases who take daily medications. Higher temperatures can also increase the risk of transmission of vector-borne diseases in this region. Colder winter conditions and increased snowfall in the southern United States can contribute to cold exposure amongst the homeless and those living in poor quality shelter, as well as increased risk of respiratory tract infections including influenza.

- **Australia and the 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-than-normal rainfall in others. The latest seasonal forecasts indicate a risk of dry conditions through the January-March outlook in Fiji, Samoa, Tonga, and Vanuatu. The Marshall Islands, the Federated States of Micronesia, the Solomon Islands, Tuvalu and parts of Kiribati – which usually see wetter-than-normal conditions under El Niño – are forecast to receive above average rainfall through the January-March period. This could provide positive impacts as countries such as Kiribati and Tuvalu have been facing three years of drought. Increased temperatures and reduced rainfall associated with El Niño place Australia at high risk for wildfires; Australia has experienced record heat in September 2023 and is already experiencing an increase in wildfires despite not yet entering into its summer season. El Niño is also typically associated with higher tropical cyclone activity in the Central Pacific basin.

With wet conditions, flooding could result in localised crop and food stock losses that could contribute to increased levels of malnutrition, especially in vulnerable populations. Floods can damage infrastructure, including housing, roads, health facilities and schools. Heavy rainfall and flooding can furthermore 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, as demonstrated in the figure below.

Figure 10. Monthly cases of diarrhoea (dots) versus monthly rainfall (line) of previous month in Suva (Fiji)



Source: McIver et al. 2012

Note: Figure based on a time-series Poisson regression model. The solid orange line is a Lowess smooth illustrating a typical "U-shaped" relationship.

Across much of this region, the projected higher temperatures increase the likelihood of heatwaves. People with chronic diseases who take daily medications have a greater risk of complications and death during a heatwave, as do older people and children. The increased 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.

- **East Africa / Greater Horn of Africa**

High risk (wet conditions Oct-Dec): Burundi, Ethiopia (south), Kenya, Somalia, South Sudan, Rwanda, Uganda, and the United Republic of Tanzania

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 do indicate this shift is very likely to emerge, reinforced by ongoing positive Indian Ocean Dipole (IOD) conditions. There is a particularly high chance for above-normal rainfall in southern Ethiopia, northern Kenya, and Somalia. A similar shift is also expected in Burundi, Rwanda, and Uganda. South Sudan, although not directly affected by El Niño-related increases in rainfall, is also particularly vulnerable to flooding caused by abundant rainfall in the Lake Victoria Basin, with lake levels already higher than average due to above-average precipitation received in the first half of 2023. The heightened risk of downstream river overflows can lead to a fifth consecutive year of exceptionally widespread floods and of an expansion of permanently flooded areas in an area of the country characterized by the highest cereal production deficit and by the highest prevalence and severity of acute food insecurity. Additional risks are population displacement, and 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, boosting crop and livestock production, despite likely substantial but localized flood-related losses.

These 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 in late 2023. Flooding and associated population displacements also increase the risk of malnutrition in affected populations.

- **Southern Africa**

High risk (dry): Angola, Eswatini, Lesotho, Zambia, Zimbabwe
High risk (dry/wet): Madagascar, Malawi, Mozambique

El Niño is usually associated with drier-than-normal conditions between November and March. Current seasonal forecasts indicate likely below-normal rainfall during the October-December period in parts of southern Angola, Lesotho, Mozambique, and Zimbabwe. A similar shift is also expected in parts of Botswana, Namibia, and South Africa, though demands for mobilizing additional assistance may be more limited. There would also be significant risk of spillover price impacts if production in South Africa were significantly affected. According to early forecasts for January-March, southern Madagascar – which is forecast to receive above-average rain during the coming months – may experience below-average rainfall. A further shift toward dry conditions may also be seen for Angola, southern Democratic Republic of the Congo, and Zambia. Between December and March, cyclones are also likely in Madagascar and Mozambique, bringing flooding and associated impacts. Malawi and Zimbabwe have also been significantly affected during previous cyclone seasons. It must be noted that the currently positive IOD (climate index) normally reinforces dry conditions in parts of the southern African region, but is associated with higher rainfall in coastal and northeastern regions – an effect in the other direction from El Niño.

El Niño is also associated with warmer temperatures throughout the region, and heatwaves and their associated health impacts will need to be monitored closely during the austral summer period. In general, below-average rains during the outlook period coincide with the 2023/24 main cropping season (crops are expected to be planted in November and harvested from March), which can negatively impact food security and the nutritional status of vulnerable populations (children, pregnant and lactating women, and the elderly).

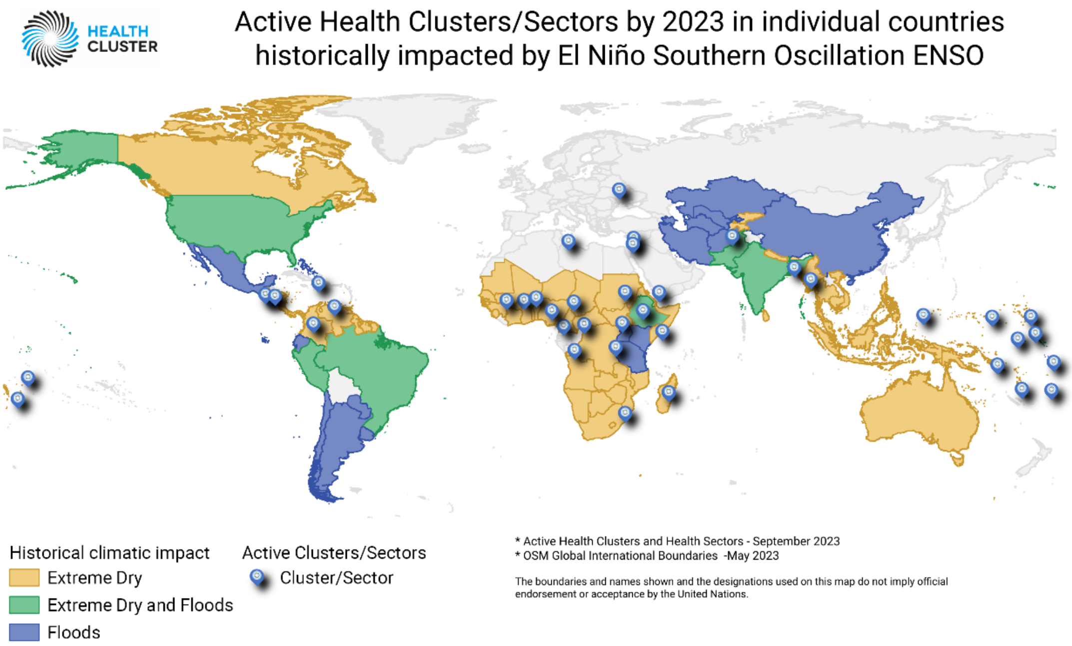
- **Global spillover price/economic effects**

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, inflation and economic performance. Concerns about effects of the ongoing El Niño on agricultural production prompted the Government of India to ban non-basmati white rice exports from 20 July 2023, following earlier bans on exports of broken rice from 8 September 2022 and of wheat from 13 May 2022. India is a major rice exporter accounting for about 40 percent of global trade, and recent rice bans have had significant implications on international prices, with surges to multi-year highs registered in main exporters Thailand and Viet Nam, as well as in most rice import-dependent countries. Strong demand for rice in south-east Asian countries, historically affected by El Niño, also added to the upward pressure on prices. Rice is a vital global food source, and India's export ban raises substantial food security concerns for large numbers of people in many countries already affected by the negative impacts of high domestic food prices and inflation. The most vulnerable people who spend a significant portion of their income on food are the most affected. Many countries are already struggling to afford rice imports due to rising international prices, currency devaluations against the US dollar, and increased trade financing costs. This situation could further limit access to rice, for large rice importers in Asia (e.g., Afghanistan, Nepal) and possibly beyond (e.g., Yemen, Somalia), affecting food security. Even before India's export restrictions, the Food and Agriculture Organization of the United Nations (FAO) predicted a 5% annual decline in global rice in 2023.

Likewise, the El Niño event is anticipated to disrupt food production in Central America's Dry Corridor and northern South America, which could have adverse effects on both economic performance and broader food security and commodity prices in the region.

- **Exacerbation of existing humanitarian crises**

ENSO's climatic impacts are expected to further exacerbate existing hardships in health cluster/sector-supported countries already grappling with a range of challenges, including disasters, violence and fragile healthcare systems. In these countries, home to significant numbers of very vulnerable populations including refugees and internally displaced persons (IDPs), the further aggravation of already prominent health risks due to El Niño climatic impacts makes the role of existing humanitarian health clusters/sectors of paramount importance. This is because they offer a crucial coordination platform to ensure preparedness for and rapid scale-up of delivery of life-saving medical assistance, especially to the most vulnerable populations and/or those that will be most significantly affected by El Niño's climatic impacts. At present, it is disconcerting that the majority of the clusters/sectors grapple with funding shortages and operational risks, hindering their capacity to effectively respond to existing crises that are likely to be further exacerbated by the El Niño event.



Health risks

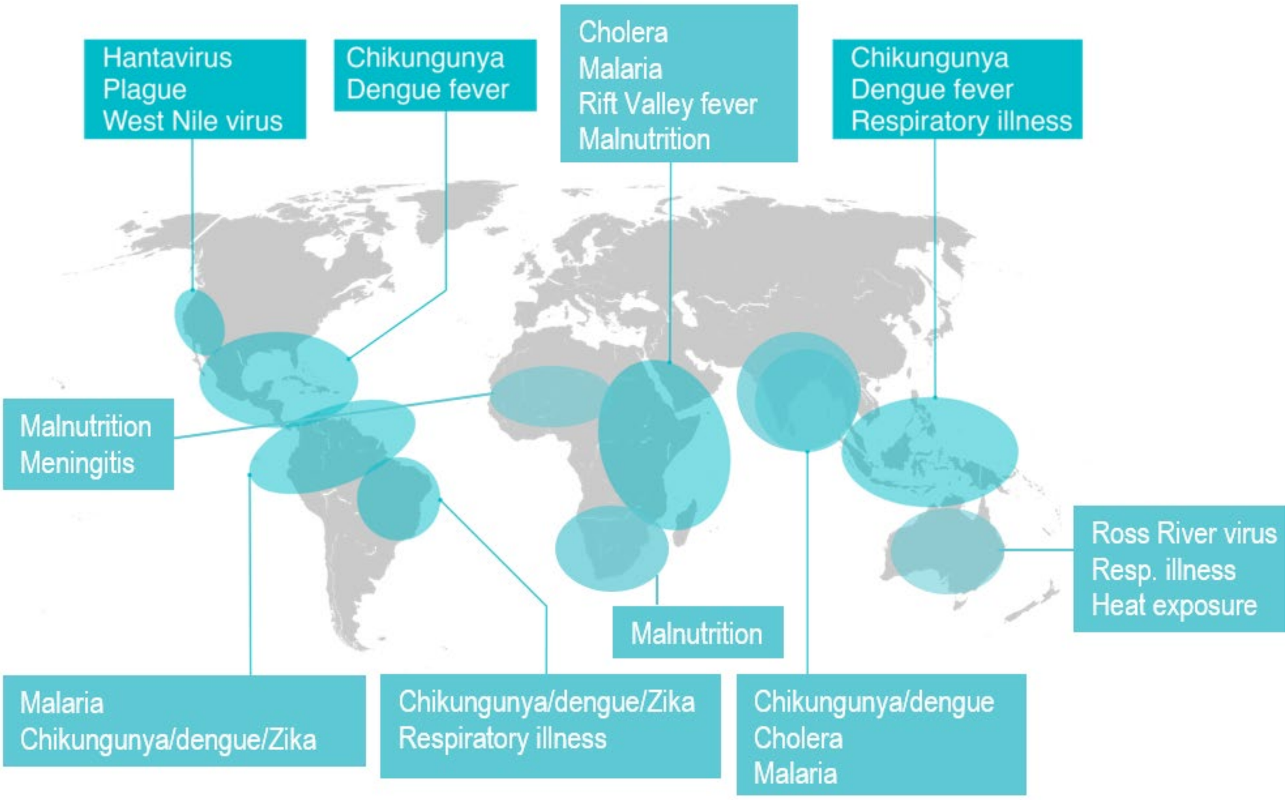
(Image from World Health Organization[4])

◉ Summary of 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, tropical cyclones, and heatwaves, all of which are detrimental to human health (it should be noted, however, that in some settings, increased rainfall associated with El Niño may actually be beneficial). 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, damage and associated economic loss, also impacting mental health. Damage or closure of health care facilities reduces access to healthcare during the emergency and well beyond the event;
- Droughts, flooding and intense rainfall can increase water- and vector-borne diseases;
- 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 drinking-water and/or sanitation infrastructure may lead to waterborne diseases, including through compromised hygiene practices in the absence of sufficient water supply;
- 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.

Potential exacerbations of specific disease risks related to El Niño events[6]



◉Immediate health risks

The primary immediate health risks related to El Niño over the next three months (Oct-Dec 2023) are summarized in Tables 2a and 2b. These tables 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 2a: Key health risks associated with DRY CONDITIONS in the context of El Niño, October-December 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 waterborne diseases	Highly likely	Severe	Very High Risk	Water contamination and worsening hygiene often occur due to water scarcity in the event of droughts.
Malaria	Likely	Moderate	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.
Arboviral diseases like dengue, Zika, chikungunya	Likely	Moderate	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 in late 2023.
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 primarily in late 2023.

Vaccine-preventable diseases	Likely	Moderate	High Risk	Increased crowding due to displacement. Some effects of decreased hygiene. 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 Niño warrant further study, but some association has been observed in Caribbean and Pacific islands.
Heat stress and air pollution	Almost certain	Major	Very 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, Australia and South America.
Worsening maternal and child health	Likely	Moderate	High Risk	Decreased access to health services, displacement, others.
Direct injuries	Likely	Moderate	High Risk	Mostly from fires.
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

Table 2b: Key health risks associated with WET CONDITIONS in the context of El Niño, October-December 2023

Public health risk	Likelihood	Public health consequences	Level of risk*	Rationale
Malnutrition	Highly likely	Severe	Very High Risk	Increased food insecurity, including due to crop inundation and livestock losses, and diarrhoea, result in malnutrition. This may further contribute to population displacement.
Cholera and other waterborne diseases	Highly likely	Severe	Very High Risk	Water contamination due to flooding; deteriorations in hygiene and sanitation. Highest risk for cholera in affected countries in east Africa.
Malaria	Highly likely	Major	Very 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.
Arboviral diseases like dengue, Zika, chikungunya	Highly Likely	Major	Very 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.
Other vector-borne diseases	Likely	Moderate	High Risk	Increased vector breeding, exposure to vectors and movement of animals.
Rodent-borne diseases	Highly 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 Niño warrant further study, but some association has been observed in Caribbean and Pacific islands.
Worsening maternal and child health	Likely	Moderate	High Risk	Decreased access to health services, displacement, others.

Direct injuries	Highly Likely	Moderate	High Risk	Flooding, storms.
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

◉ 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."[7] 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 waterborne diseases

Outbreaks of cholera and other waterborne diseases (such as typhoid fever, shigellosis, and hepatitis A and E) can occur after flooding, for example through human contact with floodwaters contaminated with human or animal waste (e.g., from sanitation systems), or due to contaminated drinking-water supply. Drought conditions may reduce the water available for hygiene and sanitation purposes, and thus also increases the risk of disease. Drought also leads to increased concentration of pathogens in surface water. Higher temperatures are also associated with an increase in gastro-intestinal infections. Food preparation practices may be similarly impacted.[8]

Rising water temperatures can boost the proliferation of *Vibrio cholerae* in environmental reservoirs where the bacteria is known to be present (esturaries, sea coasts)[9,10]. In existing reservoirs such as the Black Sea, increased temperature can have two effects: increasing the proliferation of algae, mollusks and other substrates where *V. cholerae* is found; and extending the season during which *V. cholerae* is a risk. In environments not previously favorable for the presence of *V. cholerae*, increased water temperatures can make them favorable for its proliferation, if introduced anthropogenically.

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 the 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.[11]

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.[12]

◉ 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 influence 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 the mosquito vector and the *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.[13]

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, Zika, yellow fever and Rift Valley fever (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, especially in urban centres, 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.[14]

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. It is endemic in over 100 countries. 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. Changes in serotypes are also associated with outbreaks and weather changes can further worsen the situation. Many countries in the South-East Asia region, including Bangladesh, India, Thailand and Sri Lanka, have already noted a high dengue burden this year. While Thailand and Sri Lanka have passed the peak, Bangladesh still continues to report a higher number of cases and the dengue season is just starting in India.

Chikungunya

Chikungunya transmission is well established to be linked to El Niño events.[15] 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.[15,16]

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.[16]

Zika virus disease

After emerging in the Pacific/Americas in 2015, Zika virus rapidly spread, 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.[17]

Japanese encephalitis

There is some evidence of association between transmission of Japanese encephalitis and El Niño events.[18] 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: these are Murray Valley (Australian) encephalitis and Ross River Virus disease.[16]

◉ Other vector-borne diseases

Plague

Madagascar has the highest incidence 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.[19] 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.[20] However, this does not appear to be universally true – the geospatial dynamics of transmission are likely complex and dependent on local environments.[21]

Tick borne diseases

There is some evidence for association between tick borne illnesses and El Niño events.[22] These diseases 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 could provide favorable conditions for rodent breeding.[16]

◉ 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: *Prorocentrum lima* and *hoffmannianum* (causing diarrheal shellfish poisoning),[23] *Ostreopsis spp*. (responsible for irritant aerosols)[24] and *Gambierdiscus* spp. (causing ciguatera) increase during El Niño;[25] recent blooms have been observed in Chile and Peru.

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.

Warming waters and algal blooms may also have an effect on marine life, which may in turn affect fisheries and associated livelihoods.

◉ Effects of heat stress and air pollution

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. Indonesia has already noted an increase in wildfires and associated air pollution this year. Australia has experienced record heat in September 2023 and is already experiencing an increase in wildfires despite not yet entering into its summer season.

◉ 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.[26] High levels of heat can have adverse effects on rates of preterm birth, stillbirths, and low birth weight.[27]

◉ 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.[28] Recent catastrophic flooding in Libya has not been directly linked to El Niño, although climate change in general was reported to be a major contributing factor.[29]

◉ 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.[30] 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, flooding and reduced access to health services. Further, during heatwaves, suicide rates, hospitalizations for psychiatric disorders, and emergency psychiatric visits have been shown to increase.[31]

◉ Determinants of health

Displacement

Droughts, flooding, fires and intense rainfall (including cyclones) may cause 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, hygiene 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 pathogens to places where a vector is present but the 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 higher risk of conditions 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 internally displaced persons.

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 internally displaced and refugee contexts must take into account vaccination coverage in both the displaced 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 a possible association with 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.[32] 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.

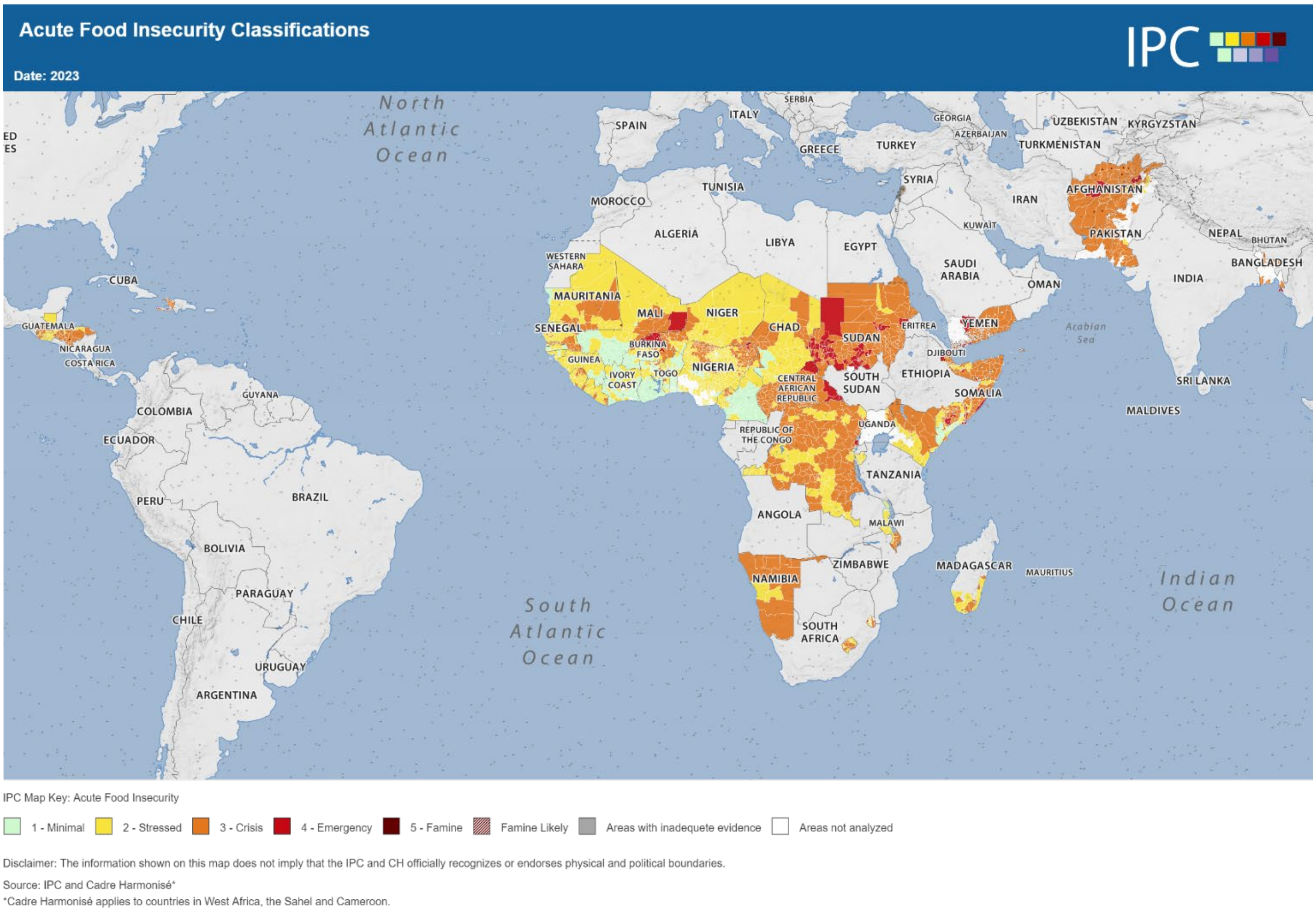
Conflict-affected settings are likely to further exacerbate the negative impact of El Niño on the affected populations, with internally displaced people and refugee populations especially vulnerable to consequences such as malnutrition, infectious diseases, and limited access to health services further 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.[33] In 1991–1992, El Niño triggered the drought in southern Africa, affecting nearly 100 million people. Droughts in Brazil, north-eastern China, Indonesia, the 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.

Despite earlier projections of increased rainfall as a result of El Niño, in some countries such as Sri Lanka, drought conditions have already significantly decreased the yield of harvests.[34]



Map source: IPC. Higher-resolution data and updated country-level forecasts are available from ipcinfo.org. Accessed 27-9-23.

Water, sanitation, and hygiene

Droughts, flooding and intense rainfall may significantly contaminate water resources, restrict access to safe water, sanitation and hygiene (WASH) services, and disrupt infrastructure. Damaged or flooded sanitation and water supply infrastructure may lead to water-borne diseases, including by compromised hygiene practices due to the lack of sufficient amounts of water. Some of these threats can be prepared for and mitigated by emergency contingencies, such as reservoir management and emergency treatment, to prevent water-related diseases and the increase of arbovirus vectors. Dry conditions will decrease water availability and may thus have similar effects. In Indonesia, for example, increased challenges in access to clear water have already been observed since the start of El Niño.

Lack of access to safe water, public drinking-water supply as a result of water scarcity or shortages, is likely to increase the consumption of single-use bottled water. The restriction of access to fresh food due to drought increases the consumption of packaged food, which leads to an increase in the consumption of packaging that increases the generation of waste.

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[35] and to feed into the development of risk communication and communications strategies and plans.

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 ultimate impact of El Niño on health can be characterized according to the intersection of the likelihood of its severe effects (as per the risk tables above) versus the consequences in 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 vulnerability, using the INFORM Risk Index to characterize the context.[36] 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. Another risk categorization, related to epidemic risk, is provided by the WHO Dynamic Preparedness Metric (DPM) Index, a composite measure similar to INFORM Risk but specifically developed to determine risk for five epidemic-prone syndromes (respiratory, diarrhoeal, haemorrhagic, neurological, and acute febrile illness).[37] Epidemic risks for each syndrome are presented as a single metric which summarizes more than 90 country-level, frequently updated indicators from open-source domains; these are determined across three main conceptual dimensions of hazard, vulnerability, and capacity. 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. *Lighter gray italicized* countries are being monitored but appear to be at lower risk. Other countries likely to be affected by El Niño, according to FAO[38], are also listed below in plain text. Countries with asterisks[*] have been identified as high or very high risk for epidemics (aggregated across the five syndromes) by the DPM Index.

Table 3: El Niño affected countries grouped by INFORM Risk Class 2024

Low or Very Low INFORM	Medium INFORM
Argentina	Azerbaijan
Armenia	Bolivia (Plurinational State of)
Australia	*Brazil*
Bhutan	Cambodia
Botswana	Costa Rica
Fiji	Côte d'Ivoire
Kyrgyzstan	Dominican Republic
Malaysia	*Ecuador*
Nauru	*El Salvador*
Palau	Eswatini
Paraguay	Gabon
Samoa	**Guyana**
Sri Lanka	*Honduras*
Suriname	**Indonesia**
Trinidad and Tobago	Kazakhstan
Turkmenistan	*Kiribati*
Uruguay	*Lao People's Democratic Republic*
Viet Nam	*Lesotho Malawi*
	Marshall Islands
	Mauritania
	Micronesia (Federated States of)
	Namibia
	Nicaragua
	Panama
	Peru (eastern region)
	Rwanda
	Senegal
	Solomon Islands
	South Africa
	Tajikistan
	Thailand
	Timor-Leste
	Tonga
	Türkiye
	Tuvalu
	United States of America
	Uzbekistan
	Vanuatu
	Venezuela (Bolivarian Republic of) (northern region)
	Zambia
	Zimbabwe

High INFORM	Very High INFORM
Angola[*] *Bangladesh* *Burundi*[*] **Colombia (north)** Djibouti Eritrea[*] *Guatemala* Iraq Iran (Islamic Republic of) **Kenya (southwest)** *Madagascar* Mexico *Mozambique* *Pakistan* **Papua New Guinea**[*] **Philippines** *United Republic of Tanzania*	*Afghanistan*[*] Burkina Faso[*] Chad[*] *Democratic Republic of the Congo*[*] **Ethiopia (north, west)**[*] Mali[*] *Myanmar* Niger[*] Nigeria[*] **Somalia**[*] *South Sudan*[*] Sudan[*] Syrian Arab Republic *Uganda*

Feature: HeRAMS in El Niño-affected countries

The Health Resources and Services Availability Monitoring System (HeRAMS) is a system developed by WHO and the Global Health Cluster which ensures that core information on essential health resources and services is readily available to decision-makers at country, regional and global levels. HeRAMS facilitates the mapping of which specific health services are available, and identification of health system gaps and inequalities, both geographically and in terms of the package of health services provided.[39] Its mission is to support countries with the standardization and continuous collection, analysis and dissemination of information on the availability of essential health services and resources down to the point of service delivery and to strengthen health information systems, particularly through the compilation, maintenance, regular update and continuous dissemination of an authoritative master list of health facilities.[40] Rapidly deployable and scalable to support emergency response and fragile states, HeRAMS can be expanded to or directly implemented as an essential component of routine health information systems. Its modularity and scalability constitute an essential component of emergency preparedness and response, health systems strengthening, universal health coverage and the humanitarian-development nexus.

In HeRAMS, all modalities through which health services are provided are defined as Health Service Delivery Units (HSDUs), and they include mobile clinics. As of September 2023, HeRAMS has been implemented in 25 countries, covering over 74 000 HSDUs. There is an overlap between El Niño-affected countries and countries implementing HeRAMS. Among “very high” (INFORM index) countries, HeRAMS is operationalized in ten countries, covering over 30 000 HSDUs. HeRAMS covers the entire nation in seven countries (Afghanistan, Burkina Faso, Chad, Mali, Niger, Somalia and Sudan); the remaining countries have implemented HeRAMS at the regional or sub-national levels: Democratic Republic of the Congo (Ituri), Ethiopia (Northern) and Nigeria (North East). Among countries with “high” risk (INFORM index), HeRAMS data are available only in Iraq. In other countries, HeRAMS data are available in specific regions in the country: Bangladesh (Cox's Bazar), Mozambique (Cabo Delgado, Nampula, Zambezia), Pakistan (Balochistan), and the Philippines (National Capital Region, Mindanao), with over 37 000 HSDUs registered.

Based on only the available HeRAMS data, over 27 000 operational HSDUs, which can at least partially provide some health services, could be affected by El Niño, including through flooding, storms, droughts which affect water availability in the facilities, and increased demand for health services due to the health consequences of El Niño described above. This number needs to be carefully interpreted as these calculations do not take into account different variables within the country and regions (for example, according to the WHO Country Office in Somalia, of the total health facilities, 13 are anticipated to be directly affected in 26 districts, affecting 1.6 million people); however, the total number of affected health facilities globally could actually be higher, as HeRAMS remain unavailable for many of the countries projected to be affected by El Niño. Facilitating the implementation of HeRAMS in settings where not currently available would be crucial to appropriately understand the available healthcare resources, measure the potential impact of El Niño on healthcare systems, and consider appropriate mitigation and adaptation measures.

Table 4: Number of operational health service delivery units (HSDUs) in El Niño-affected countries ("Very High" or "High" by INFORM risk class)

Very High		High	
Country	**Number of operational HSDUs**	**Country**	**Number of operational HSDUs**
Afghanistan	4 328	Angola	NA
Burkina Faso	2 848	Bangladesh (Cox's Bazar)*	142
Chad	1 634	Burundi	NA
Democratic Republic of the Congo (Ituri)*	818	Colombia	NA
Ethiopia (Northern)*	1 205	Djibouti	NA
Mali	2 978	Eritrea	NA
Myanmar		Guatemala	NA
Niger	3 294	Iraq	4 579
Nigeria (North East)*	2 032	Iran (Islamic Republic of)	NA
Somalia	349	Kenya	NA
South Sudan		Mexico	NA
Sudan	585	Mozambique (Cabo Delgado, Nampula, Zambezia)*	561
Syrian Arab Republic		Pakistan (Balochistan)*	1 381
Uganda		Papua New Guinea	NA
		Philippines (National Capital Region, Mindanao)*	1 237
		United Republic of Tanzania	NA

Source: WHO. The Health Resources and Services Availability Monitoring System (HeRAMS). Data extracted from: HeRAMS
Note: Countries with * indicate that HeRAMS data are available in specific regions or sub-national levels within the country. Operational indicates that health services are provided, at least partially. NA: Not available

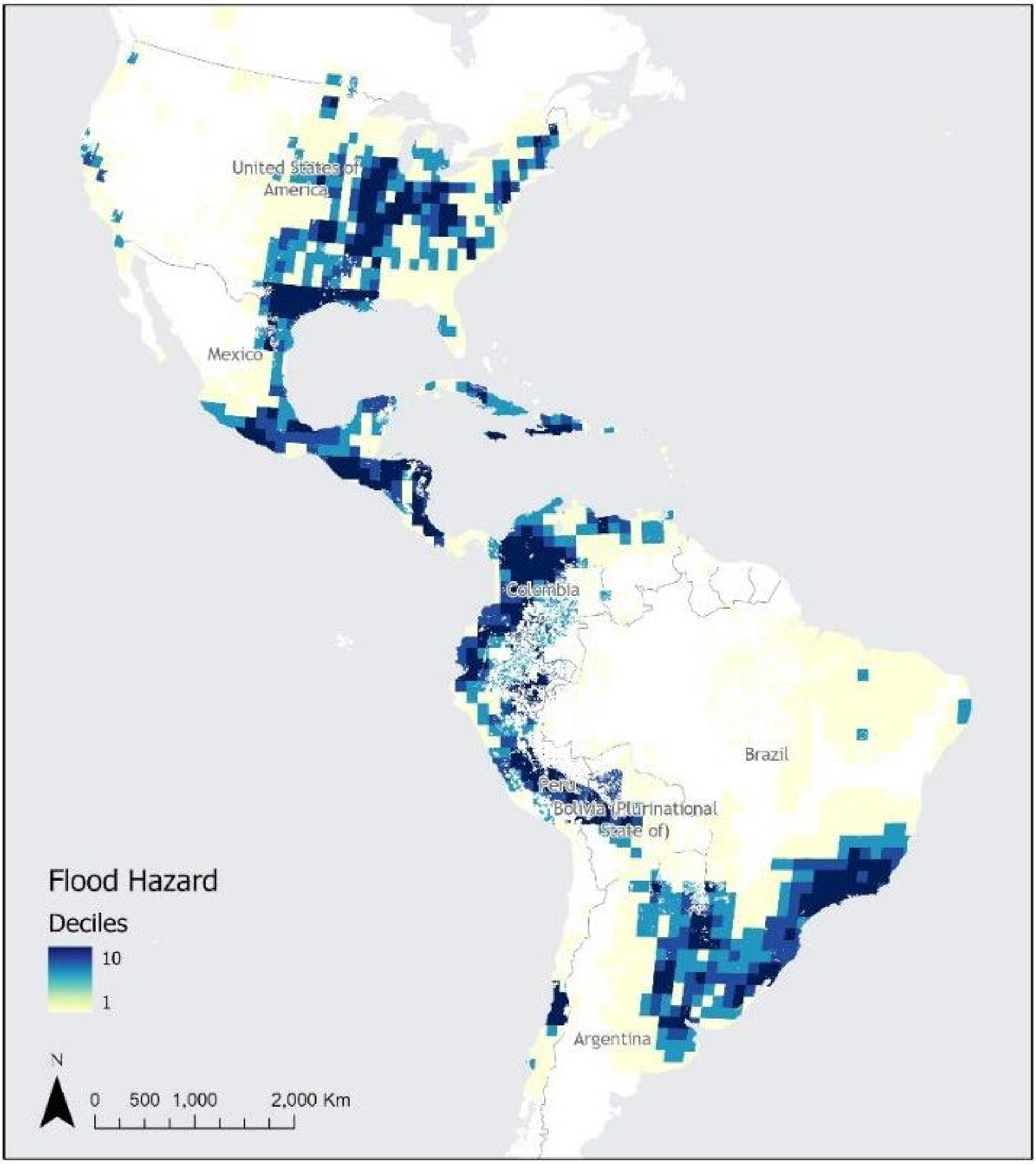
Feature: Challenges to health infrastructure in the Americas

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[41] 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 the 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 5: 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)

Feature: Challenges to health infrastructure in the Western Pacific Region

Health Systems in the Western Pacific Region vary, with highly-developed and well-resourced health systems in some countries, and weaker health systems in others, with less capacity to adapt to shocks. While all health systems have some level of vulnerability to the extreme weather events, those in Pacific Island Countries and Areas (PICs) with key infrastructure in coastal and low-laying areas are particularly vulnerable. In some areas of the Western Pacific, such as countries in the Mekong delta, flooding already causes interruptions to health service delivery, and more significant events attributed to El Niño effects could lead to more expansive and severe health and humanitarian consequences. Countries across the Region are vulnerable to cyclones and typhoons, which frequently affect health infrastructure, cause injuries and deaths, and interrupt routine health service delivery. Because of the frequency of these events, many countries have taken action to strengthen health system resiliency and readiness. At the same time, high-intensity storms or back-to-back events in recent years have in some cases overwhelmed local capacity to respond and ensure continuity of care, requiring short-term engagement of external partners, such as Emergency Medical Teams, to meet the needs of effected populations.

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, preparedness communications, health and hygiene promotion focused on the behaviours to adapt during flooding, drought, etc.
- Emergency health supplies
- Vaccination
- Prevention of sexual exploitation and abuse
- 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. WHO has previously issued guidance[42] on creating climate-resilient and environmentally sustainable health care facilities. WHO also works closely with UNICEF through the WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (JMP)[43] which provides country, regional and global estimates of progress on drinking water, sanitation and hygiene.

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 a weather impact from El Niño 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 projected to 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 are projected to be affected by the 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. WHO is also providing risk communication and community engagement (RCCE) support and technical resources, including indicators, question banks and on-demand services to responding partners through the Collective Service partnership and regional WHO RCCE teams.

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.[38] 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 WHO Regions: African Region

The African Region is actively preparing itself to detect, mitigate, and respond to potential hazards stemming from the El Niño effect throughout the latter part of 2023 and beyond. It is important to note that many of the El Niño-affected countries are already grappling with ongoing humanitarian crises and disease outbreaks, for instance about twelve countries In the African Region have ongoing cholera; measles outbreak response is ongoing in South Sudan, Chad, the Democratic Republic of the Congo, the Central African Republic, Kenya, Ethiopia, Zimbabwe and Uganda; there are outbreaks of dengue fever in Chad and the Democratic Republic of the Congo; exacerbations of malnutrition in Chad, the Central African Republic, Ethiopia, Madagascar and South Sudan; a surge in malaria cases in Ethiopia and Uganda; and mpox, plague, meningitis, and a recent landslide in the Democratic Republic of the Congo.

Disease surveillance systems are being reinforced to promptly detect public health events and trigger responses. Health workers are trained to recognize and report early signs of health conditions related to El Niño. Many of the African countries have implemented the 3rd edition of the Integrated Disease Surveillance and Response Technical Guidelines. In addition, they are utilizing the District Health Information System 2 to track and report health-related data. These critical activities are being carried out with the guidance and support of WHO. Ethiopia, Mozambique, and the Democratic Republic of the Congo have implemented HeRAMS (see above) to assess the availability of health services in their regions. Furthermore, Epidemic Intelligence from Open Sources (EIOS) has been deployed to thirty-one countries in the African Region. EIOS is instrumental in the early detection of disease outbreaks or humanitarian signals, facilitating early response activities.

Governments and international organizations work together to assess the potential health risks associated with El Niño, such as waterborne diseases, malnutrition, and vector-borne diseases. Based on these assessments, contingency plans are developed to guide response efforts. Additionally, the Readiness Intelligence Tool (RIT) has undergone pilot testing in South Sudan and Chad. This tool is a web-based solution that serves as a centralized repository for reports, assessments, plans, and actions aimed at enhancing operational readiness and response capacities within these countries. The RIT will empower countries to map hazards effectively and identify top-priority actions to enhance their readiness for potential challenges.

Efforts are being made to improve food security and nutrition, as El Niño can lead to food shortages. This includes interventions like food distribution, nutritional support, and agricultural assistance to affected communities.

By adopting these proactive measures and leveraging tools such as EIOS and RIT, the African region is taking significant strides toward bolstering its ability to respond to emerging hazards and safeguard the health and well-being of its populations.

◉ Response in the WHO Regions: Region of the Americas – with updates

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 tropical cyclones 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.

The global EWARS in a Box team and PAHO continue to support Nicaragua, El Salvador, Honduras, Panama and Guatemala to strengthen disease surveillance and outbreak response with WHO's electronic early warning system EWARS in a box. In Central America, the response is focused on two main concerns:

Population migratory movements: the first five months of 2023 recorded six times more migrants across the region compared to the same period in 2022, and countries often lack sufficient capacity to provide temporary shelter, adequate medical care and security to migrants in transit.

Ongoing and expected future outbreaks of communicable diseases: the region is currently seeing an outbreak of dengue, which occurs cyclically every three to five years. In the northern hemisphere, the influenza season is also ramping up, which will likely lead to a pronounced increase of influenza and other respiratory viruses, including SARS-CoV-2, which has already substantially increased in many areas.

Use of EWARS in a Box technology enables rapid disease detection 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. In this context, over 18 public health officers from these countries, three from each affected-country, will be trained through October 2023 to implement and oversee the rolling-out of EWARS in a Box in their national contexts, including through cascade trainings at field level. The WHO Global EWARS team will continue to remote-support operations throughout the El Niño response.[1]

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 WHO Regions: Eastern Mediterranean Region – focus on Somalia

The WHO Country Office in Somalia has been actively engaged in supporting the El Niño response in Somalia, particularly in the following areas:

Coordination

WHO Somalia has engaged health partners on the impact of El Niño to review the risks and possible impact in prioritised districts. WHO is working with partners to review contingency requirements (medical supplies, human resource, etc.) and current stock levels.

Through the Health Cluster, WHO is working with other Clusters to identify evacuation locations on higher ground to preposition medical supplies and essential health services at designated locations for integrated response.

WHO and the Ministry of health have conducted a readiness assessment at the district level to identify gaps and are working together to bridge the gaps.

[1] More information can be found in WHO's Operational Update on Health Emergencies - September 2023

The Country Office has an active Incident Management Team currently responding to adverse climatic events, with 76 staff deployed at national and subnational levels within the five operational states.

Resource mobilization is ongoing to support preparedness and response actions to address significant gaps that exist within the already vulnerable populations, which will be compounded by the impacts of El Niño.

Disease surveillance and outbreak preparedness

WHO has mapped health facilities by levels of risk of flooding, and is engaging government and partners on mitigation measures. Thirteen health facilities have been identified to be at high risk of flooding and causing interruption of health services.

Estimations of disease burden for acute watery diarrhoea/cholera, malaria, Rift Valley fever, dengue and others have been mapped to priority districts to inform preparedness actions. WHO has prepositioned cholera supplies in high-risk locations

WHO has engaged with animal health partners through the one health platform to enhance early warning for zoonotic diseases

Community-based surveillance is active in priority districts.

Continuity of Essential Health Services

WHO has supported outreach teams and community health workers that can be readily deployed in collaboration with the Ministry of Health to support uninterrupted essential health service delivery.

Interagency Emergency Health Kits have been prepositioned in selected locations; however, significant gaps persist. WHO has also prepositioned emergency kits for the management of severe acute malnutrition with complications in stabilization centres.

◉ Response in the WHO Regions: European Region – with updates

Using data gathered through country assessments using the Strategic Tool for Assessing Risks (STAR), it is possible to identify risks that may be 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, including outside the context of El Niño. The data provided valuable insights into the risk levels and coping capacities associated with the following relevant risks:

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.

Cold wave: Three SP conducted assessments for cold weather-related events, with the risk of low assessed by one SP and moderate by two. Coping capacity was evaluated as partial by one, high by one and very high by one. Vulnerability was assessed as low by two SP and partial by one.

Floods: The assessment encompassed 12 SP, with the risk of floods assessed as low by two SP, moderate by five SP, high by four SP, and very high by one SP. Coping capacity evaluations revealed that four SP had a low capacity, five SP had a partial capacity, and three SP had a high capacity to cope with floods.

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.

Urban/wild fires: This risk was assessed by 10 SP. Among these, one SP classified risk as very low, two SP considered the risk to be low, 6 SP assessed it as moderate, and one classified it as high. Coping capacity assessments indicated that one SP had a low capacity, 5 SP had a partial capacity to respond and three reported high capacity to respond and one did not report.

The European Extreme Weather coordination cell was established in the summer of 2023, focusing on ongoing monitoring of various events in the Region through enhanced event-based surveillance by using Epidemic Intelligence from Open Sources (EIOS), monitoring of trends in EU/EEA and outside, keeping track of health impacts and needs in the affected areas, and following up on any support requested by Member States from WHO or partners.

There is a new WHO Regional Office for Europe emergency "Climate crisis: extreme weather" webpage: https://www.who.int/europe/emergencies/situations/climate-crisis-extreme-weather. This page is currently focused on heat, but will be adapted to wildfires, flooding, and other extreme weather events as required. It includes public health advice about wildfires, floods, and heat. WHO has also developed related social media content including a #keepcool campaign, multilingual social media tiles optimized for Instagram and X (formerly Twitter), and short (<40s) informational videos on YouTube and shared via social media (X, Facebook, and Instagram)

Internal briefings have been held on El Niño with relevant staff of WHO, and a plan for emergency communications and Risk Communication, Community Engagement, and Infodemic Management (RCCE-IM) has been developed and implementation has started.

◉ Response in the WHO Regions: South-East Asia Region

The Environmental Health Unit of the WHO Regional Office for South-East Asia has been working with WHO Member States to enhance the climate resilience and environmental sustainability of health care facilities. Key areas of support are in the development of policies and guidelines, assessment frameworks and training of the health workforce. This includes supporting countries such as Bangladesh, Nepal, Myanmar and Timor-Leste in developing climate-informed surveillance and early warning systems using the Climate-sensitive Disease Surveillance Tool (EWARS and EWARS+); and ongoing capacity building programs for surveillance authorities, medical recorders and others on the use of the tool. WHO has also been providing guidance and training on conducting national or subnational assessment of vulnerability to the health risks of climate variability and change, and supporting countries in the development of policies, programmes, and capacities of health systems that could increase resilience, taking into account the multiple determinants of climate-sensitive health outcomes.

The Regional Office's Health Emergencies Programme, in coordination with the Communicable Disease and Surveillance (CDS) Division, is supporting Member States in epidemiological analysis and forecasting using mathematical models of dengue to inform assessment and stratification of dengue-associated risks, and to inform dengue control activities in Nepal and Sri Lanka. This takes into account environmental and climatic variables, including El Niño-related weather patterns. In view of the changing epidemiology and increasing risk of outbreaks of dengue and other arboviral diseases, WHO has facilitated synthesis and dissemination of publicly-available dengue data; these data have been published in a biweekly epidemiological bulletin since May 2023.

El Niño appears to be associated with increasing frequency and occurrence of major natural hazards. One of the examples was the Cyclone Mocha, one of the largest cyclones affecting Myanmar, in May 2023, which may have been influenced by early effects of El Niño. The WHO Country Office in Myanmar and the Regional Office supported the relief efforts.

The WHO Country Office in Nepal is establishing enhanced surveillance on six climate-sensitive epidemic-prone diseases/conditions, namely dengue, malaria, kala-azar, cholera, severe acute respiratory infection (SARI) and acute gastroenteritis, under the Health National Adaptation plan. This surveillance system is currently being piloted in four sites. It can correlate climatic changes and routine surveillance data for advanced analytics (climate-informed disease surveillance) for early warning generation. This surveillance system will be a complementary arm in the wider multi-source disease surveillance network. A plan has been made to expand the system to 30 sites within the next five years. With regard to safe WASH services, the preparedness and response activities are carried out under the WASH Cluster, led by water supply and sanitation-related ministries at the federal and provincial levels, supported by the UN and other partners. The Cluster maintains stockpiles of WASH items, including water purification and mobile toilets, to mobilize in an emergency. They have central and some provincial stockpiling mechanisms established. The Cluster also maintains human resource mapping for easy human resource mobilization in an emergency. Emergency supplies including WHO standard Medical Kit – Interagency Emergency Health Kit (IEHK), Cholera Kit – Central Module, and Trauma and Emergency Surgery kit, community water filters and autoclave, Medical Camp Kits (MCK) are being provided. To ensure provincial level support, two Emergency Medical Logistics Warehouses (EMLWs) were established, one each in the western and eastern parts of the country. The Hospital Disaster Preparedness and Response Plan (HDPRP) has recently been updated and developed for all 25 hub hospitals of the country to ensure effective and efficient response to disaster and continued health service delivery.

The WHO Country Office in Timor-Leste actively participates and contributes to National El Niño Preparedness activities. Health sector Specific Early Actions, Preparedness, Response and the Long-term Development and Programming Opportunities have previously been developed, and include an 'El Niño Emergency Action Plan, Timor-Leste (2016 & 2017)'; and 'Public Health Emergency Preparedness and Contingency Plans, Timor-Leste, 2021' for droughts. Some of the key highlights of the early action mitigation measures include conducting HeRAMS assessments; strengthening promotion, prevention, and control of diseases and essential public health programs; conducting outbreak preparedness training and mobile phone surveillance rollout in affected areas; monitoring water quality; and investing in community preparedness and health promotion messages around prevention of diseases triggered by drought.

◉ Response in the WHO Regions: Western Pacific Region

All countries and areas in the Western Pacific Region have committed to strengthening preparedness and readiness for extreme weather events, and many have also taken significant action in recent years to strengthen resiliency and response capacity.

In the Pacific, with support from WHO and partners, nearly all countries have established national Emergency Medical Teams (EMTs) capable of self-sufficient response to disasters, and the Region is home to 12 of 38 internationally classified EMTs, creating a strong regional network for clinical and public health response. EMTs have now been established from Mongolia in the north - prepared to respond in extreme winter conditions - to small highly-mobile EMTs in the Pacific, capable of reaching outer islands and providing self-sufficient clinical services in the most remote and austere conditions. Similarly, the Global Outbreak Alert and Response Network has expanded in the Western Pacific in recent years, with the ability to deploy experts within the region to support response efforts at the national or sub-national level.

The Western Pacific Region also has a strong foundation for sectoral coordination in health, and across sectors, both at the national and sub-regional level. The Association of Southeast Asian Nations (ASEAN)'s Member States within the Western Pacific Region have agreed upon common Standard Operating Procedures for humanitarian response, including adopting WHO coordination guidance for health sector response. The Pacific Humanitarian Team (PHT) Cluster Support System mobilizes UN agencies, NGOs and other partners in support of nationally-led emergency coordination across the PICs, with collective and coordinated action on preparedness, readiness and response – all under national government leadership. National Health Clusters or sectoral working groups are standing mechanisms in many countries across the Region. Strong regional solidarity and collaboration are core elements of regional health emergency response capabilities in the Western Pacific.

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 6: Potential monitoring indicators for use in monitoring 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. Difficult to disentangle from other concurrent contributors to excess 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 individually]	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 individually]	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 districts with active Rapid Response Teams	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	Consult WASH Cluster for standards
Percentage of health facilities with sufficient quantities of safe running water	Marker of infection prevention and control functionality of health facilities	May vary according to level of health facility (e.g., community health posts may not be expected to have running water)
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
Risk Communication and Community Engagement coordination mechanism is activated	Process indicator to assess coordination for readiness and response to El Niño-related health threats.	Research findings from communities are relevant across response pillars; countries may wish to have a mechanism that ensures integration of evidence from the RCCE pillar across other pillars.
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 exist.
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

Information Gaps

The following are identified as major areas with gaps in available information, along with proposed methods to obtain additional information.

Table 7: Information Gaps

Domain	Gap	Potential methods to obtain additional information
Health status and threats	Many health conditions lack an evidence base linking them to climate-related phenomena, including El Niño	Additional primary research is encouraged
Health status and threats	Sub-national risks are largely beyond the scope of this global overview	National or even sub-national PHSAs or other risk assessment frameworks
Health system capacity	Many countries do not have readily available information about the capacities of health facilities in areas projected to be impacted by El Niño	Health Resources and Services Availability Monitoring System (HeRAMS); other health facility assessment tools
Health facility vulnerability	Most countries do not have readily available information on vulnerability of health facilities to the effects of El Niño (e.g., facility flooding risk)	Local physical assessments; HeRAMS also provides locations of facilities and level of dependence on other shared infrastructure such as water and power; Geographic information systems (GIS) – e.g., facility locations overlaid with e.g., flood risk
Response operations	Little information is available about local preparedness, readiness and response needs and activities to mitigate the effects of El Niño	Local assessments; HeRAMS
Response operations	Socio-behavioural data to guide RCCE readiness and response is either not up-to-date or not systematically compiled.	Local behavioural insights studies; community listening; channels analysis

Annex 1: Risks for El Niño-affected countries[2]

Location		El Niño related climate patterns						Expected health risks (evidence from literature)				Country vulnerabilities									Response
WHO Region	Country	Historically, when ENSO shifts rainfall patterns (months)	Historical ENSO impacts on rainfall (dry/wet)	Historical tempera-ture changes	Sep-Nov Seasonal Forecast [WMO]	Dec-Feb Seasonal forecast [WMO]	Oct-Dec seasonal forecast (temperature) [WMO]	Q4 2023	Q1 2024	Q2 2024	Q3, Q4 2024	Risk Level (DPM aggregated epidemic risk Q1 2023)*	Risk Class (INFORM Risk 2023)	Projected proportion population IPC classification >3	Internally displaced persons (UNHCR 2022)	Refugees (UNHCR 2022)	Current outbreak of cholera or other water-borne disease	Current outbreak of arboviral disease	Current outbreak of vaccine-preventable disease	Current outbreak of other vector-borne disease	Existing Humanitarian Response Capacity
Africa	Angola	Nov to Mar	Dry	warmer	Below-normal SE	*Above-normal (N), below-normal (S)*	Above-normal					High	Medium		-	25 514					
Africa	Benin	Jul to Sep	Dry		Above-normal	*Normal*	Above-normal					Moderate	Medium			1 779					
Africa	Botswana	Nov to Mar	Dry	warmer	Below-normal	*Below-normal*	Above-normal					Low	Low			733					
Africa	Burkina Faso	Jul to Sep	Dry		Above-normal	*Normal*	Above-normal		*meningitis*		meningitis	High	Very High		1 882 391	34 375					Cluster or Sector
Africa	Burundi	Oct to Jan	Wet		Equal chances	*Above-normal*	Above-normal					High	High	9%	8 495	84 636	cholera		cVDPV2		Cluster or Sector
Africa	Cameroon	Jul to Sep	Dry		Above-normal	*Above-normal*	Above-normal					High	Very High		989 079	473 887	cholera				Cluster or Sector
Africa	Central African Republic	Jul to Sep	Dry		Above-normal	*Normal*	Above-normal					High	Very High	39%	515 665	11 213			measles		Cluster or Sector
Africa	Chad	Jul to Sep	Dry		Above-normal	*Normal*	Above-normal	*increased refugees from Sudan*			meningitis	High	Very High		381 289	592 764					Cluster or Sector
Africa	Cote d'Ivoire	Jul to Sep	Dry	warmer	Above-normal	*Normal*	Above-normal					Moderate	Medium			5 636					
Africa	Democratic Republic of the Congo (extreme south)	Nov to Mar	Dry	warmer	Above-normal	*Above-normal*	Above-normal	*(food insecurity)*				High	Very High	25%	5 541 021	520 544	cholera		measles		Cluster or Sector
Africa	Eritrea	Jul to Sep	Dry		Above-normal	*Above-normal*	Above-normal					High	High			119					
Africa	Eswatini	Nov to Mar	Dry	warmer	Equal chances	*Below-normal*	Above-normal					Moderate	Low								
Africa	Ethiopia (north)	Jul to Sep	Dry		Equal chances	*Above-normal*	Above-normal	*increased refugees from Sudan*			meningitis	High	Very High		2 730 000	879 598	cholera (Gondar)		measles	malaria	Cluster or Sector
Africa	Ethiopia (southeast)	Oct to Jan	Wet		Below-normal	*Above-normal*	Above-normal	*flooding cholera Rift Valley fever malaria*				High	Very High		2 730 000	879 598	cholera		measles		Cluster or Sector
Africa	Gambia, the	Jul to Sep	Dry	warmer	Above-normal	*Normal*	Above-normal					Moderate	Medium			3 685					
Africa	Ghana	Jul to Sep	Dry	warmer	Above-normal	*Normal*	Above-normal					Moderate	Medium			8 531					
Africa	Guinea	Jul to Sep	Dry	warmer	Above-normal	*Normal*	Above-normal					Moderate	Medium			2 199			Diptheria		
Africa	Guinea-Bissau	Jul to Sep	Dry	warmer	Above-normal	*Normal*	Above-normal					Moderate	Medium			24					

[2] Countries highlighted below in pink have been identified as "***high priority for potential humanitarian challenges***" through March 2024 by the IASC ENSO Analysis Cell in October 2023.

Location		El Niño related climate patterns						Expected health risks (evidence from literature)				Country vulnerabilities									Response
WHO Region	**Country**	**Historically, when ENSO shifts rainfall patterns (months)**	**Historical ENSO impacts on rainfall (dry/wet)**	**Historical tempera-ture changes**	**Sep-Nov Seasonal Forecast [WMO]**	**Dec-Feb Seasonal forecast [WMO]**	**Oct-Dec seasonal forecast (temperature) [WMO]**	**Q4 2023**	**Q1 2024**	**Q2 2024**	**Q3, Q4 2024**	**Risk Level (DPM aggregated epidemic risk Q1 2023)***	**Risk Class (INFORM Risk 2023)**	**Projected proportion population IPC classification >3**	**Internally displaced persons (UNHCR 2022)**	**Refugees (UNHCR 2022)**	**Current outbreak of cholera or other water-borne disease**	**Current outbreak of arboviral disease**	**Current outbreak of vaccine-preventable disease**	**Current outbreak of other vector-borne disease**	**Existing Humanitarian Response Capacity**
Africa	Kenya	Oct to Jan	Wet		Above-normal	*Above-normal*	Above-normal (south) Near-normal (north)	*flooding cholera Rift Valley fever malaria*				Moderate	Very High	11%		504 473	cholera				
Africa	Lesotho	Nov to Mar	Dry	warmer	Equal chances	*Below-normal*	Above-normal					Moderate	Medium	15%		251					
Africa	Madagascar	Nov to Mar	Dry		Equal chances	*Above-normal*	Above-normal	*plague*		flood disasters	*flood disasters*	High	High	5%		119					Cluster or Sector
Africa	Malawi	Nov to Mar	Dry	warmer	Equal chances	*Above-normal*	Above-normal	*Food insecurity (drought related)*	*Food insecurity (drought related)*	*Food insecurity (drought related)*	*Food insecurity (drought related)*	Moderate	Medium	20%		35 162	cholera				
Africa	Mali	Jul to Sep	Dry		Above-normal	*Normal*	Above-normal		*meningitis*			High	Very High		379 932	60 637			diptheria		Cluster or Sector
Africa	Mauritania	Jul to Sep	Dry		Above-normal	*Normal*	Above-normal					Moderate	Medium			100 981					
Africa	Mozambique (far north)	Oct to Jan	Wet	warmer	Equal-chances	*Above-normal (N)*	Above-normal	*cholera*				Moderate	Very High	10%	1 028 743	4 992	cholera				Cluster or Sector
Africa	Mozambique (south)	Nov to Mar	Dry	warmer	Equal-chances	*n/a*	Above-normal	*food insecurity (south)*				Moderate	Very High	10%	1 028 743	4 992	cholera				Cluster or Sector
Africa	Namibia	Nov to Mar	Dry	warmer	Equal chances	*Below-normal*	Above-normal			food insecurity (drought related)	food insecurity (drought related)	Moderate	Medium	9%	-	4 685					
Africa	Niger	Jul to Sep	Dry		Above-normal	*Normal*	Above-normal		*meningitis*			High	Very High		376 809	255 307			Meningitis Diphtheria		Cluster or Sector
Africa	Nigeria	Jul to Sep	Dry		Above-normal	*Above-normal*	Above-normal		*meningitis*			High	High		3 286 881	91 275	cholera		Diphtheria Yellow fever meningitis		Cluster or Sector
Africa	Rwanda	Oct to Jan	Wet		Equal chances	*Above-normal*	Above-normal	*flooding cholera Rift Valley fever malaria*				Moderate	Medium			120 753					
Africa	Senegal	Jul to Sep	Dry		Above-normal	*Normal*	Above-normal					Moderate	Medium			11 802					
Africa	Sierra Leone	Jul to Sep	Dry	warmer	Above-normal	*Normal*	Above-normal					High	Medium								
Africa	South Africa	Nov to Mar	Dry	warmer	Equal chances	*Below-normal*	Above-normal			food insecurity (drought related)	food insecurity (drought related)	Moderate	High		-	66 596			measles		
Africa	South Sudan	Jul to Sep	Dry		Above-normal	*Above-normal*	Above-normal	*increased refugees from Sudan, flooding*		food insecurity (drought related)	food insecurity (drought related)	High	Very High	63%	1 474 679	308 369			measles		Cluster or Sector

Location		El Niño related climate patterns						Expected health risks (evidence from literature)				Country vulnerabilities									Response
WHO Region	Country	Historically, when ENSO shifts rainfall patterns (months)	Historical ENSO impacts on rainfall (dry/wet)	Historical tempera-ture changes	Sep-Nov Seasonal Forecast [WMO]	Dec-Feb Seasonal forecast [WMO]	Oct-Dec seasonal forecast (temperature) [WMO]	Q4 2023	Q1 2024	Q2 2024	Q3, Q4 2024	Risk Level (DPM aggregated epidemic risk Q1 2023)*	Risk Class (INFORM Risk 2023)	Projected proportion population IPC classification >3	Internally displaced persons (UNHCR 2022)	Refugees (UNHCR 2022)	Current outbreak of cholera or other water-borne disease	Current outbreak of arboviral disease	Current outbreak of vaccine-preventable disease	Current outbreak of other vector-borne disease	Existing Humanitarian Response Capacity
Africa	Tanzania, United Republic of	Oct to Jan	Wet		Above-normal E	*Above-normal*	Above-normal	*flooding cholera Rift Valley fever malaria*				Moderate	High	2%		206 229	Cholera				
Africa	Togo	Jul to Sep	Dry		Above-normal	*Normal*	Above-normal					Moderate	Medium			9 300					
Africa	Uganda	Oct to Jan	Wet		Above-normal	*Above-normal*	Above-normal	*flooding cholera Rift Valley fever malaria*				Moderate	Very High	1%	-	1 463 523					
Africa	Zambia	Nov to Mar	Dry	warmer	Below-normal	*Above-normal (N), below-normal (S)*	Above-normal			food insecurity (drought related)	food insecurity (drought related)	Moderate	Medium	10%		61 159	cholera				
Africa	Zimbabwe	Nov to Mar	Dry	warmer	Below-normal	*Below-normal*	Above-normal			food insecurity (drought related)	food insecurity (drought related)	Moderate	Medium			10 475	cholera				
Americas	Argentina	Jun to Jan	Wet	warmer	Below-normal N; Above-normal S; equal chances C	*Above-normal*	Near-normal Above-normal (far NW tip)					Moderate	Low		-	4 094		dengue			
Americas	Aruba	Jul to Dec	Dry		Below-normal	*Below-normal*	Above-normal					-	-								
Americas	Bahamas	Nov to Apr	Wet	warmer	Above-normal	*Above-normal*	Above-normal					Low	Low			10					
Americas	Brazil (extreme south)	Sep to Jan	Wet	warmer	Above-normal	*Above-normal*	Above-normal			(increased arbovirus transmission)		Moderate	Medium			67 522		dengue			
Americas	Brazil (north)	Apr to Mar	Dry	warmer	Below-normal	*Below-normal*	Above-normal	smoke inhalation from wildfires food insecurity	food insecurity (increased arbovirus transmis-sion)	(increased arbovirus transmission)		Moderate	Medium			67 522		dengue			
Americas	Canada (West coast)	Nov to Mar	Dry	warmer	Above-normal	*Below-normal*	Near-normal					Low	Low								
Americas	Chile	Jun to Sep	Wet	warmer	Above-normal C; Below-normal S	*Below-normal*	Above-normal (north) Near normal (south)			smoke inhalation due to wildfires		Low	Low		-	2 133					
Americas	Colombia	Jun to Mar	Dry	warmer	Below-normal	*Mixed-conditions*	Above-normal			malaria dengue	malaria dengue	Moderate	High		6 834 492	1 607		dengue			Cluster or Sector
Americas	Costa Rica	Jul to Dec	Dry	warmer	Mixed (transition area)	*Below-normal*	Above-normal			(dengue)	(dengue)	Low	Medium			14 088		dengue			
Americas	Curacao	Jul to Dec	Dry		Below-normal	*Below-normal*	Above-normal					-	-								

Location		El Niño related climate patterns						Expected health risks (evidence from literature)				Country vulnerabilities									Response
WHO Region	Country	Historically, when ENSO shifts rainfall patterns (months)	Historical ENSO impacts on rainfall (dry/wet)	Historical tempera-ture changes	Sep-Nov Seasonal Forecast [WMO]	Dec-Feb Seasonal forecast [WMO]	Oct-Dec seasonal forecast (temperature) [WMO]	Q4 2023	Q1 2024	Q2 2024	Q3, Q4 2024	Risk Level (DPM aggregated epidemic risk Q1 2023)*	Risk Class (INFORM Risk 2023)	Projected proportion population IPC classification >3	Internally displaced persons (UNHCR 2022)	Refugees (UNHCR 2022)	Current outbreak of cholera or other water-borne disease	Current outbreak of arboviral disease	Current outbreak of vaccine-preventable disease	Current outbreak of other vector-borne disease	Existing Humanitarian Response Capacity
Americas	Ecuador (northwest)	Jan to May	Wet	warmer	Above-normal W	*Above-normal*	Above-normal		*(leptospi-rosis) (cholera)*	*(leptospirosis) (cholera) (dengue)*		Moderate	Medium			60 125		dengue			
Americas	El Salvador	Jul to Dec	Dry	warmer	Equal chances	*Below-normal*	Above-normal					Low	Medium		71 500	104					Cluster or Sector
Americas	French Guiana	Jun to Mar	Dry	warmer	Below-normal	*Below-normal*	Above-normal						-								
Americas	Grenada	Jun to Mar	Dry		Below-normal	*Below-normal*	Above-normal					Low	Very Low								
Americas	Guatemala	Jul to Dec	Dry	Warmer	Below-normal N	*Below-normal*	Above-normal		*flood disasters*			Moderate	High	24%		701		dengue			Cluster or Sector
Americas	Guyana	Jun to Mar	Dry	warmer	Below-normal	*Below-normal*	Above-normal	*food insecurity*	*food insecurity*	(dengue)	(dengue)	Moderate	Medium			12					
Americas	Honduras	Jul to Dec	Dry	warmer	Below-normal	*Below-normal*	Above-normal					Moderate	High	25%	247 090	165		dengue			Cluster or Sector
Americas	Mexico (north)	Jan to Apr	Wet	cooler	Below-normal NW	*Above-normal*	Above-normal					Moderate	High		262 411	95 579		dengue			
Americas	Nicaragua	Jul to Dec	Dry	warmer	Below-normal	*Below-normal*	Above-normal		*(dengue)*			Moderate	Medium		-	312		dengue			
Americas	Panama	Jul to Dec	Dry	warmer	Below-normal	*Below-normal*	Above-normal					Low	High			2 576		dengue			
Americas	Paraguay	Sept to Jan	Wet	warmer	Above-normal S	*Equal-chances*	Above-normal					Moderate	Low			5 420		dengue	measles		
Americas	Peru (northeast)	Jun to Mar	Dry	warmer	Below-normal	*Equal-chances*	Above-normal					Moderate	Medium			6 543		dengue			
Americas	Peru (northwest)	Jan to May	Wet	warmer	Below-normal	*Above-normal*	Above-normal		(cholera) (flood related disasters) (malaria)	(cholera) (flood related disasters) (malaria)	(dengue)	Moderate	Medium			6 543					
Americas	Suriname	Jun to Mar	Dry	warmer	Below-normal	*Below-normal*	Above-normal	*food insecurity*	*food insecurity*	dengue	dengue	Moderate	Low		-	25					
Americas	Trinidad and Tobago	Jun to Mar	Dry		Below-normal	*Below-normal*	Above-normal					Low	Low			3 424					
Americas	Uruguay	Sep to Jan	Wet	warmer	Above-normal	*Above-normal*	Above-normal					Low	Low			1 115					
Americas	USA (Hawaii)	July to Apr	Dry		Below-normal	*Below-normal*	Near-normal	*(smoke inhalation due to wildfires)*	*(smoke inhalation due to wildfires)*			Low	Low								
Americas	USA (Ohio River Valley)	Dec to Mar	Dry	cooler	Equal-chances	*Below-normal*	Near-normal					Low	Low			363 059					
Americas	USA (south)	Nov to Apr	Wet	cooler	Below-normal SW	*Above-normal*	Above-normal			(hantavirus)		Low	Low			363 059					
Americas	Venezuela (Bolivarian Republic of)	Jun to Mar	Dry	warmer	Below-normal	*Below-normal*	Above-normal	*food insecurity*	*food insecurity*	Malaria	Malaria	Moderate	High			29 341		dengue			Cluster or Sector
Eastern Med.	Afghanistan	Jan to Apr	Wet		Above-normal N	*Above-normal*	Above-normal		*flood disasters, landslides*	flood disasters, landslides, cholera	malaria	High	Very High	35%	3 254 002	52 159	cholera	CCHF			Cluster or Sector
Eastern Med.	Djibouti	Jul to Sep	Dry		Above-normal	*Above-normal*	Above-normal	*cholera*	*cholera*			Moderate	Medium	24%		20 383					

Location		El Niño related climate patterns						Expected health risks (evidence from literature)				Country vulnerabilities									Response
WHO Region	**Country**	**Historically, when ENSO shifts rainfall patterns (months)**	**Historical ENSO impacts on rainfall (dry/wet)**	**Historical tempera-ture changes**	**Sep-Nov Seasonal Forecast [WMO]**	**Dec-Feb Seasonal forecast [WMO]**	**Oct-Dec seasonal forecast (temperature) [WMO]**	**Q4 2023**	**Q1 2024**	**Q2 2024**	**Q3, Q4 2024**	**Risk Level (DPM aggregated epidemic risk Q1 2023)***	**Risk Class (INFORM Risk 2023)**	**Projected proportion population IPC classification >3**	**Internally displaced persons (UNHCR 2022)**	**Refugees (UNHCR 2022)**	**Current outbreak of cholera or other water-borne disease**	**Current outbreak of arboviral disease**	**Current outbreak of vaccine-preventable disease**	**Current outbreak of other vector-borne disease**	**Existing Humanitarian Response Capacity**
Eastern Med.	Iran (Islamic Republic of)	Jan to Apr	Wet		Above-normal	*Above-normal*	Above-normal					**Moderate**	**High**			3 425 091					
Eastern Med.	Pakistan (north)	Jan to Apr	Wet		Equal chances	*Above-normal*	Above-normal				malaria (highland fringes)	**Moderate**	**High**	**5%**	-	1 743 785	cholera		XDR Typhoid	malaria	
Eastern Med.	Pakistan (southeast)	Jun to Sep	Dry		Near-normal	*Above-normal*	Above-normal					**Moderate**	**High**	**5%**	-	1 743 785	cholera		XDR Typhoid		
Eastern Med.	Somalia	Oct to Jan	Wet		Above-normal	*Above-normal*	Above-normal (north) Near normal (south)	*population displacement flooding malaria cholera Rift Valley fever*	*Population displace-ment*	*population displacement*		**High**	**Very High**	**39%**	2 967 500	16 023	cholera				Cluster or Sector
Eastern Med.	Sudan	Jul to Sep	Dry		Above-normal	*Normal*	Above-normal		*meningitis*	food insecurity (drought related)	food insecurity (drought related)	**High**	**Very High**	**16%**	3 552 717	1 097 128	acute watery diarrhoea (Gedaref, N Khar-toum)	Dengue	measles cVDPV2		Cluster or Sector
Europe	Azerbaijan	Jan to Apr	Wet		Above-normal	*Above-normal*	Near-normal					**Low**	**High**		658 793	6 414					
Europe	Kazakhstan	Jan to Apr	Wet		Above-normal SE	*Above-normal*	Near-normal					**Low**	**Very Low**			308					
Europe	Kyrgyzstan	Jan to Apr	Wet		Above-normal	*Above-normal*	Above-normal					**Low**	**Low**			274					
Europe	Tajikistan	Jan to Apr	Wet		Above-normal	*Above-normal*	Above-normal					**Moderate**	**Medium**			8 608					
Europe	Turkmenistan	Jan to Apr	Wet		Above-normal	*Above-normal*	Slightly above normal					**Low**	**Low**			14					
Europe	Uzbekistan	Jan to Apr	Wet		Above-normal	*Above-normal*	Slightly above normal	*(flooding)*	*(flooding)*			**Moderate**	**Low**			13 026					
S.E. Asia	Bangladesh	Jun to Sep	Dry		Equal chances	*Above-normal*	Above-normal		*(cholera)*			**Moderate**	**High**	**31%**	-	952 384	cholera	dengue			Cluster or Sector
S.E. Asia	Bhutan	Jun to Sep	Dry		Equal chances	*Above-normal*	Above-normal					**Low**	**Low**								

Location		El Niño related climate patterns						Expected health risks (evidence from literature)				Country vulnerabilities									Response
WHO Region	Country	Historically, when ENSO shifts rainfall patterns (months)	Historical ENSO impacts on rainfall (dry/wet)	Historical tempera-ture changes	Sep-Nov Seasonal Forecast [WMO]	Dec-Feb Seasonal forecast [WMO]	Oct-Dec seasonal forecast (temperature) [WMO]	Q4 2023	Q1 2024	Q2 2024	Q3, Q4 2024	Risk Level (DPM aggregated epidemic risk Q1 2023)*	Risk Class (INFORM Risk 2023)	Projected proportion population IPC classification >3	Internally displaced persons (UNHCR 2022)	Refugees (UNHCR 2022)	Current outbreak of cholera or other water-borne disease	Current outbreak of arboviral disease	Current outbreak of vaccine-preventable disease	Current outbreak of other vector-borne disease	Existing Humanitarian Response Capacity
S.E. Asia	India	Jun to Sep	Dry	warmer	Below-normal	*Above-normal*	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)	Moderate	High			242 835					
S.E. Asia	India (south)	Oct to Dec	Wet		Below-normal	*Below-normal*	Above-normal					Moderate	High			242 835					
S.E. Asia	Indonesia	Jun to Jan	Dry	warmer; in West Papua warmer daytime temperatures but night frosts in highland areas	Below-normal	*Mixed conditions*	Above-normal	*smoke inhalation from wildfires*	*Food insecurity (drought, wildfire and frost related)*	food insecurity (drought related) malaria (eastern highlands, highland fringes)	food insecurity (drought related) malaria (eastern highland fringes)	Moderate	Medium			9 785			measles cVDPV2		
S.E. Asia	Myanmar	Jun to Sept	Dry	warmer (south)	Mixed conditions (dry)	*Above-normal (N)*	Above-normal					Moderate	Very High		1 504 848	-					Cluster or Sector
S.E. Asia	Nepal	Jun to Sep	Dry		Below-normal	*Above-normal*	Above-normal					Moderate	Medium		-	19 560			measles		
S.E. Asia	Sri Lanka	Oct to Dec	Wet		Above-normal	*Below-normal*	Above-normal	*malaria (southwest)*	*malaria (southwest)*	food insecurity (drought related)	food insecurity (drought related)	Moderate	Low		8 540	504		Dengue			
S.E. Asia	Thailand	Jun to Jan	Dry	warmer	Equal chances	*Equal-chances*	Above-normal					Low	Medium			94 472		Dengue			
S.E. Asia	Timor-Leste	July to March	Dry	cooler	Below-normal	*Below-normal*	Above-normal					Moderate	Medium	20%							
W. Pacific	Australia	July to March	Dry	warmer (east and south) cooler (north)	Below-normal	*Below-normal*	Above-normal		increased arbovirus transmission (MVE, RRV)	smoke inhalation due to wildfires	smoke inhalation due to wildfires	Low	Low		-	54 430					
W. Pacific	Brunei	Jun to Jan	Dry	warmer	Below-normal	*Below-normal*	Above-normal					Low	Very Low								
W. Pacific	Cambodia	Jun to Jan	Dry	warmer	Equal chances	*Below-normal*	Above-normal					Moderate	Medium			24					
W. Pacific	China (west)	Jan to Apr	Wet		Above-normal	*Above-normal*	Above-normal					Low	Medium		-	320					

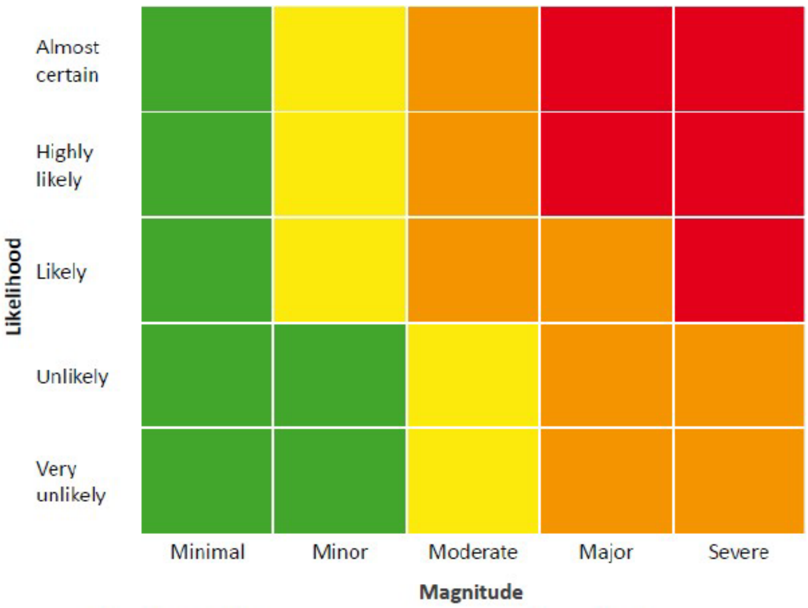
Location		El Niño related climate patterns						Expected health risks (evidence from literature)				Country vulnerabilities									Response
WHO Region	**Country**	**Historically, when ENSO shifts rainfall patterns (months)**	**Historical ENSO impacts on rainfall (dry/wet)**	**Historical tempera-ture changes**	**Sep-Nov Seasonal Forecast [WMO]**	**Dec-Feb Seasonal forecast [WMO]**	**Oct-Dec seasonal forecast (temperature) [WMO]**	**Q4 2023**	**Q1 2024**	**Q2 2024**	**Q3, Q4 2024**	**Risk Level (DPM aggregated epidemic risk Q1 2023)***	**Risk Class (INFORM Risk 2023)**	**Projected proportion population IPC classification >3**	**Internally displaced persons (UNHCR 2022)**	**Refugees (UNHCR 2022)**	**Current outbreak of cholera or other water-borne disease**	**Current outbreak of arboviral disease**	**Current outbreak of vaccine-preventable disease**	**Current outbreak of other vector-borne disease**	**Existing Humanitarian Response Capacity**
W. Pacific	Fiji	Sep to Mar	Dry		Below-normal	*Below-normal*	Near-normal					**Low**	**Low**			5					Cluster or Sector
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					**Moderate**	**Low**								Cluster or Sector
W. Pacific	Malaysia	Jun to Jan	Dry	warmer	Mixed	*Below-normal*	Above-normal					**Low**	**Low**			134 554					
W. Pacific	Marshall Islands	July to April	Dry		Below-normal	*Below-normal*	Above-normal					**Moderate**	**Medium**								Cluster or Sector
W. Pacific	Micronesia (Federated States of)	July to April	Dry		Below-normal	*Below-normal*	Above-normal					**Moderate**	**Medium**								Cluster or Sector
W. Pacific	Nauru	June to April	Wet		Above-normal	*Above-normal*	Above-normal					**Low**	**Low**		-	45					Cluster or Sector
W. Pacific	Palau	June to Jan	Dry		Below-normal	*Below-normal*	Above-normal					**Low**	**Medium**								Cluster or Sector
W. Pacific	Papua New Guinea	June to Jan	Dry	higher daytime tempera-ture, frost at night in highlands	Below-normal	*Below-normal (Above-normal extreme N)*	Above-normal	*Food insecurity (drought, wildfire and frost related)*	*Food insecurity (drought, wildfire and frost related)*	malaria (highlands and highland fringes)	flood disasters	**High**	**Low**		90 634	10 524					
W. Pacific	Philippines	Jun to Jan	Dry		Below-normal	*Below-normal*	Above-normal			food insecurity (drought related)	food insecurity (drought related)	**Moderate**	**High**		98 094	856	cholera				
W. Pacific	Samoa	Sep to Mar	Dry (but also has an above-average cyclone forecast)		Below-normal	*Below-normal*	Near-normal					**Moderate**	**Low**								Cluster or Sector
W. Pacific	Singapore	Jun to Jan	Dry	warmer	Below-normal	*Below-normal*	Above-normal					**Low**	**Very Low**								
W. Pacific	Solomon Islands	Jun to Jan	Dry		Below-normal	Above-normal	Above-normal					**Moderate**	**Medium**		1 000						Cluster or Sector
W. Pacific	Tonga	Sep to Mar	Dry		Below-normal	*Below-normal*	Near-normal					**Moderate**	**Medium**								Cluster or Sector
W. Pacific	Tuvalu	June to April	Wet		Above-normal	*Above-normal*	Above-normal					**Moderate**	**Medium**								Cluster or Sector
W. Pacific	Vanuatu	Sep to Mar	Dry		Below-normal	*Below-normal*	Near-normal					**Moderate**	**Medium**								Cluster or Sector
W. Pacific	Viet Nam	Jun to Jan	Dry	warmer	Below normal (central regions)	*Below normal (S)*	Above-normal					**Moderate**	**Low**					Diptheria			

Note that the above table may not be fully representative of all potential health threats in coming months.

*Risk class for Dynamic Preparedness Metric (DPM) shown in table is aggregated across five syndromes. More details on DPM Index including dashboard access with syndrome specific risk levels are available at https://extranet.who.int/sph/dpm

Risk assessment methodology[44]

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.

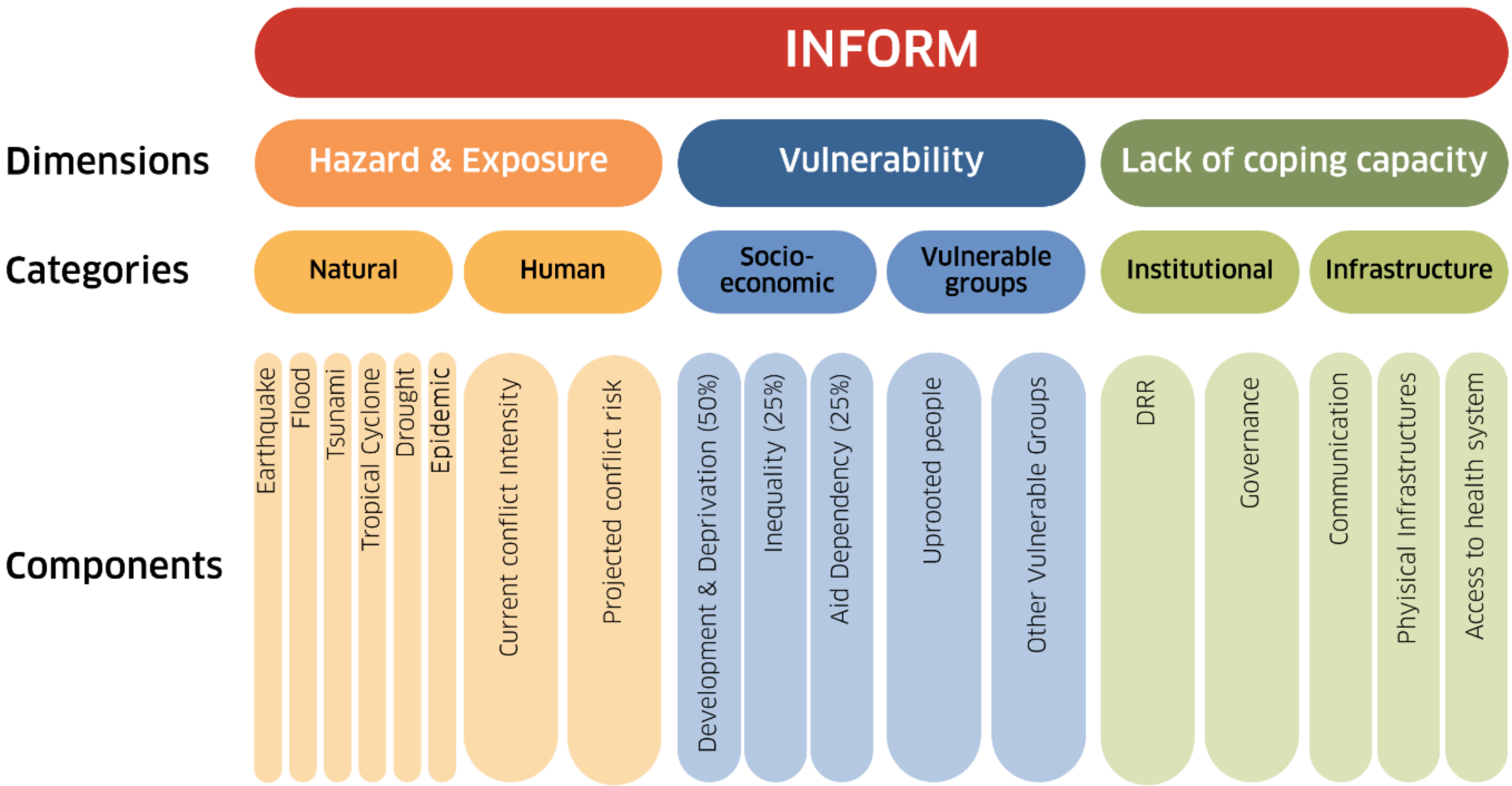
Yellow: **Moderate risk.** Could make a minor contribution to excess mortality/morbidity.

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

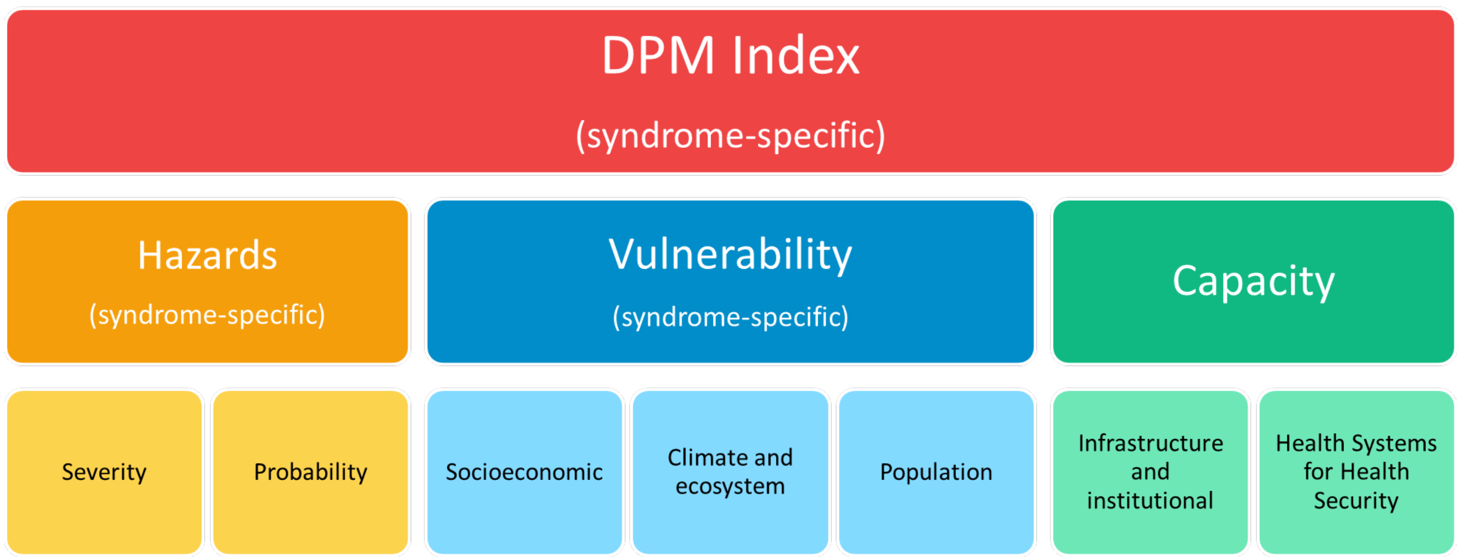
Grey: No plausible assessment can be made at this time.

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[36]



DPM Index methodology[37]



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