مجلس الصحة
لدول مجلس التعاون
Gulf Health Council

GCDC
المركز الخليجي للوقاية من الأمراض ومكافحتها
Gulf Center for Disease Prevention and Control

ANNUAL REPORT

On Public Health Emergency Intelligence

For the year of 2023

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Epidemic Intelligence in the Gulf CDC

One of the Gulf CDC's strategic objectives is to enhance preparedness, early detection, and rapid response to health hazards in the Gulf region, as part of objective 2 – sharing early notifications to countries - of the Public Health Emergencies department. Therefore, Gulf CDC established, in late 2022, an epidemic intelligence (EI) system and rapid risk assessment (RRA) system to scan for, collect, filter, collate, and validate EI signals from a variety of official and non-official sources. These were further enhanced using artificial intelligence and social listening platforms.

The short-listed signals are shared with the GCC member states weekly and discussed with the Public Health Emergency Network, which is technical teams from the departments of communicable disease, IHR, and public health labs from all six GCC member states (MS), in a weekly roundtable meeting for evaluation, input, and discussion. This weekly channel enabled all six countries and the Gulf CDC to further discuss any topic or epidemic signals that are not captured through the systems. Statistics on the EI and RRA systems are shown below.

34	148
Roundtable meetings in 2023	**GCC MS presence in Roundtable meetings**

Throughout 2023, there have been six signals that were considered “events of regional interest” and subsequently were monitored in-depth and discussed for 2 months. These events were included in the RRA system and were covered by in-detail rapid risk assessment reports. The Gulf CDC has engaged subject matter experts as well as the Network from the GCC MS for review and input. The RRAs are produced to include some proposed actions and recommendations for the GCC MS’s further consideration and national assessment.

Finally, the Gulf CDC’s EI and RRA systems have been covered by internal SOPs and implemented in IT solutions and dashboards. The Gulf CDC has produced an RRA Technical Guide for the GCC MS that has been reviewed in collaboration with 9 global or regional public health agencies for international standards. In this annual report, the Gulf CDC reports the diseases that have been assessed in RRAs in 2023 with the most updated and available epidemic information as well as information extracted from the rapid risk assessment reports.

2023 Overview

1028	79	6
Total Signals Detected	**Total Potential Threats**	**Total Events of Regional Interest**

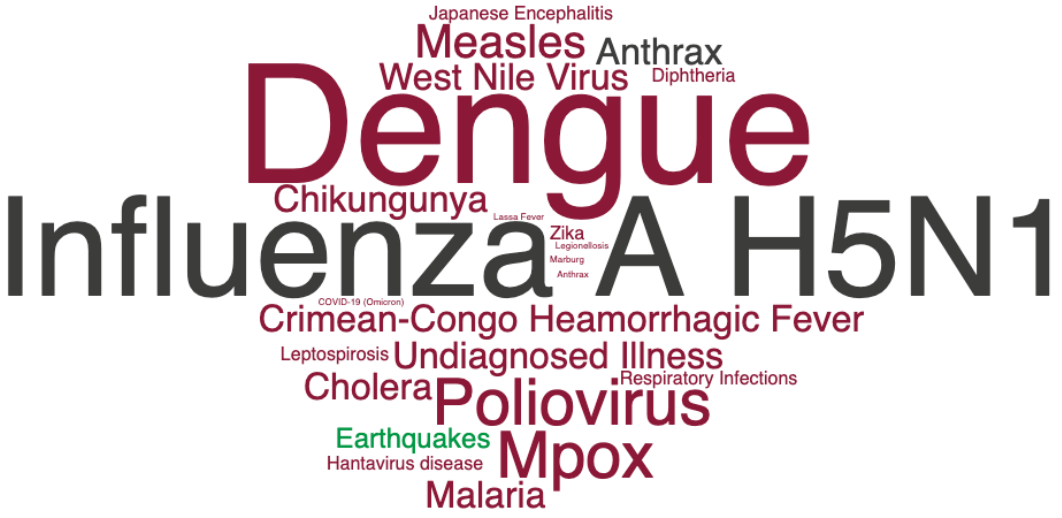
66

Detected signals in GCC countries in 2023

158

Covered locations

The PHE team at the GULF CDC monitors for all hazards that can affect public health, including infectious diseases in humans and animal, environmental hazards, drug or food poisoning, food contamination, chemical hazards, man-made attacks, bioterrorism, infectious environmental samples, and natural disasters.



Types of hazards: Infectious disease in humans | Infectious disease in animals | Environmental

The size of the word corresponds to the counts of hazard, not based on case counts

Figure 1: Word cloud identifying the top 25 all-hazards signals detected by the Gulf CDC's Epidemic Intelligence in 2023

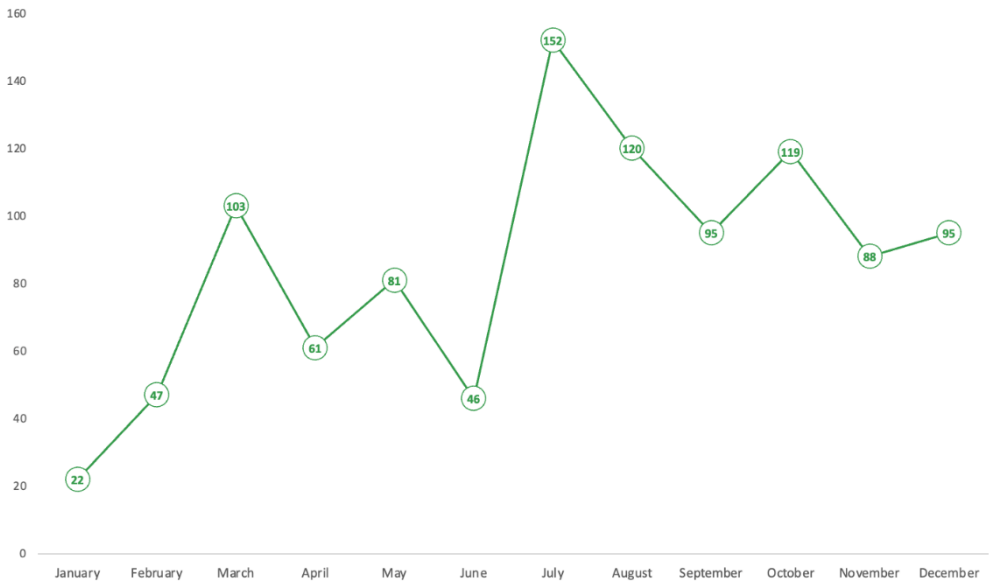


Figure 2: Detected signals by month in 2023

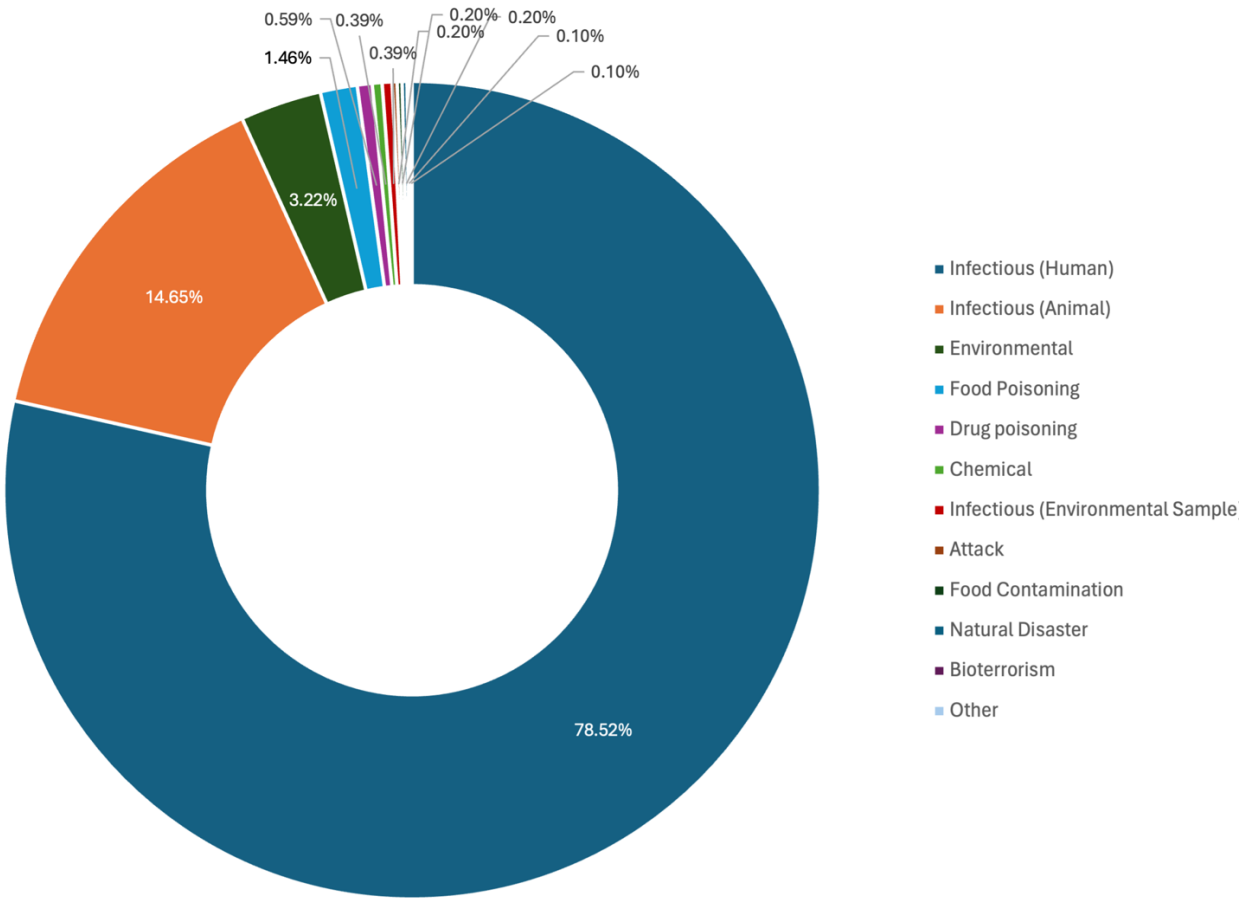


Figure 3: Proportion of detected signals by type of hazard in 2023

The GULF CDC reviews and verifies multiple sources to validate the accuracy of data being collected and shared with GCC member states. In 2023, signals were detected using the following sources.

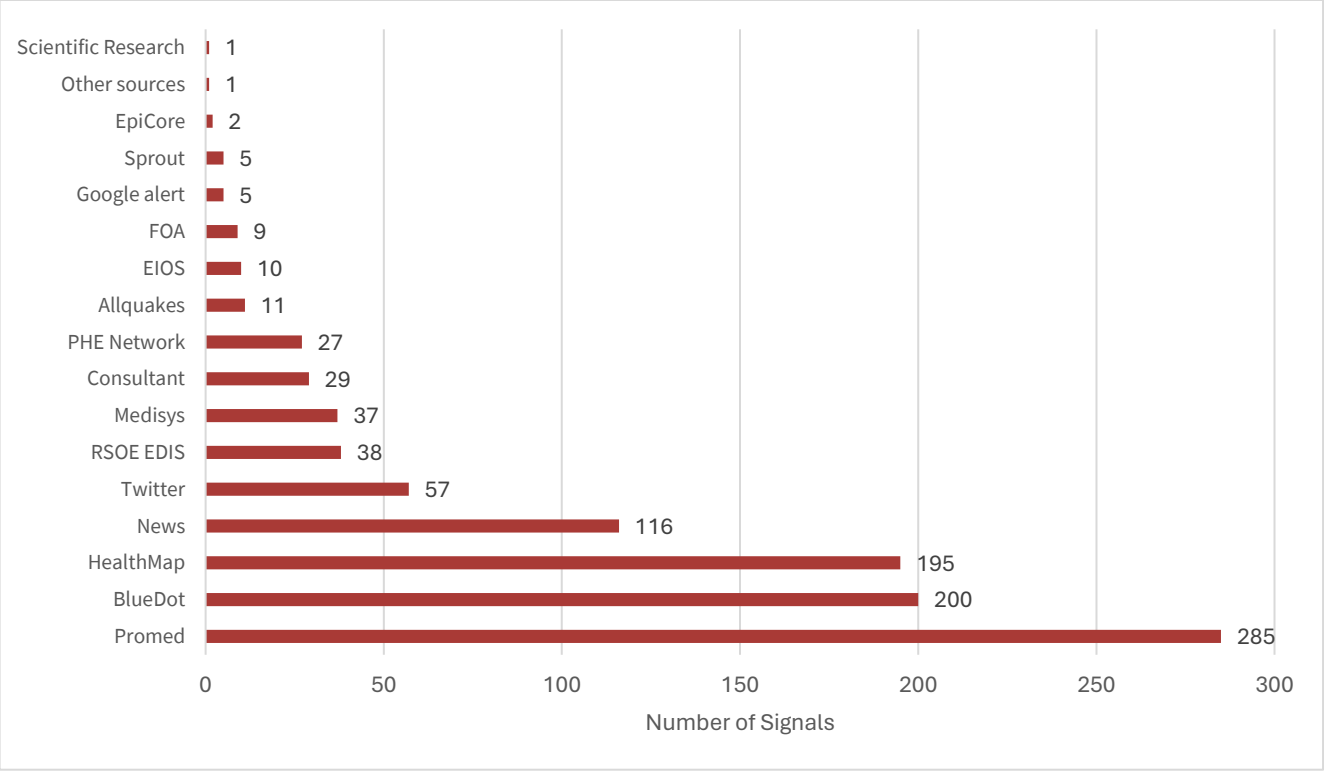


Figure 4: Total detected signals by source in 2023

Definitions

The below is a list of commonly referred to terms and keywords in the annual report.

Gulf Public Health Emergency Network (PHEN)

A group of technical individuals within GCC health authorities, nominated to represent each GCC country. The composition typically includes International Health Regulations Focal Point, Ministry of Health Communicable Disease Directors and National Public Health Laboratory Directors or appointed representatives on their behalf. The Gulf CDC serves as the Network's secretariat with the PHE Department Director chairing the network meetings.

Hazard

A source/incident that has the potential to cause morbidity (including injury) or mortality in an exposed human population.

Signal

An incident/situation involving a hazard that has occurred. Signals are typically news/updates identified through Event-Based Surveillance and Indicator-Based Surveillance, utilizing both official and non-official sources.

Threat

Any signal as assessed by the Gulf CDC PHE Department to have the potential to pose a near-future risk to the GCC countries' populations.

Threat of Regional Interest

Any threat that has been confirmed by the PHEN to have the potential to pose a near-future risk to the GCC countries' populations and could be monitored closely by Gulf CDC for 2 weeks.

Event of Regional Interest

Any threat, inside or outside the GCC, that has been identified by the Public Health Emergency Network to pose a certain type of risk for the GCC countries' public health. For these threats, Gulf CDC produces regular risk assessments and recommendations for their control, as well as enhances daily monitoring of it to provide regular situational updates to the GCC countries.

Rapid Risk Assessment

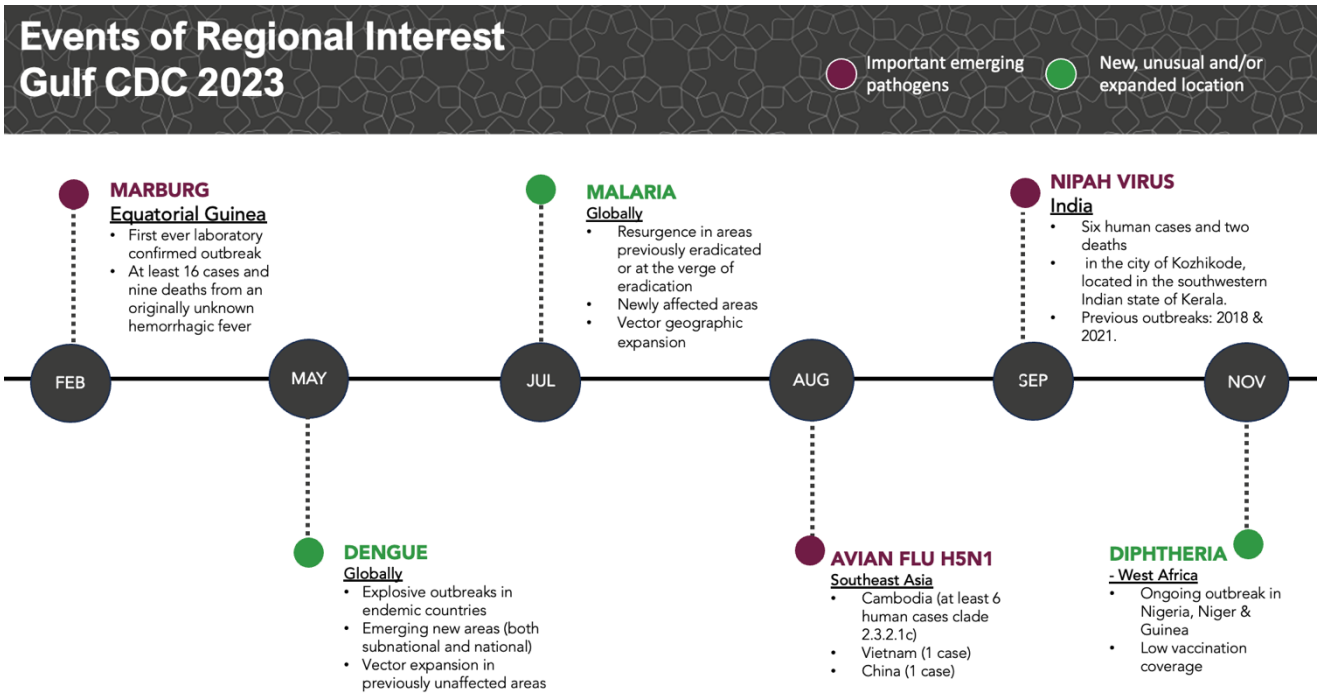
A prompt evaluation of the level of health risk in relation to a verified acute event within a short time frame, mainly for situation update, risk level determination and recommendation to support the GCC countries in risk communication and management.

GULF CDC RISK SCALE					
Negligible	Very Low	Low	Moderate	High	Critical

Events of Regional Interest

In 2023, the Gulf CDC identified 6 global events of interest to the Gulf Region. These were: Marburg in four provinces in Equatorial Guinea and one region in Tanzania, dengue globally, malaria globally, avian influenza H5N1 in Southeast Asia, Nipah virus in Kerala, India, and diphtheria in West Africa.

The below timeline of events outlines when the Gulf CDC triggered an RRA in response to the following important emerging pathogens or unusual activity / expansion of endemic pathogens.



Marburg

4 provinces in Equatorial Guinea and one region in Tanzania

Negligible	Very Low	Low	Moderate	High	Critical

GULF CDC RISK ASSESSMENT OF THIS EVENT

- **Risk Question:** Risk question focused on risk of importation and spread of the disease in the GCC.
- **Impact: Moderate,** GCC countries have high infection prevention and control capabilities, but the unvaccinated population would be at high risk of infection, should a case be reported in the region.
- **Likelihood: Low,** there is a low number of travellers from Equatorial Guinea and Kagera region (Tanzania) to GCC countries, and the probability of an infected traveller travelling while infectious is also low.

Please refer to the GULF CDC Rapid Risk Assessment on Marburg (16 February 2023) for further details.

KEY STATS FOR EQUATORIAL GUINEA

87.5%
Case fatality ratio

40
Reported cases (7 February – 8 June 2023)

KEY STATS FOR TANZANIA

67%
Case fatality ratio

9
Reported cases (21 March – 31 May 2023)

KEY FACTORS OF CONCERN FOR MARBURG	
Disease severity	Marburg virus disease (MVD) is a severe and often fatal human illness. Marburg virus, along with the Ebola virus, is part of the Filoviridae family, that can cause severe haemorrhagic fever in humans. The case fatality ratio can be as high as 88% but can be much lower with timely diagnosis and appropriate patient care.
Global Trends	There have been 13 previously documented Marburg outbreaks (1967-2022). The 2005 outbreak in Angola and the 1998-2000 outbreak in the Democratic Republic of the Congo remain the most expansive and deadly of these (154 cases, 128 deaths and 252 cases, 227 deaths respectively). Most other outbreaks were smaller and better contained, with 1-5 reported cases. *Please refer to the Gulf CDC Rapid Risk Assessment on Marburg (16 February 2023) for further details.*
	No Marburg virus cases have been reported in GCC countries. The species of bats that carries MVD has been identified in the southern parts of the Arabian Peninsula in Yemen,

GCC Regional Information	Saudi Arabia and Oman[1]. While this species is not migratory, it is possible that other migratory bats could transmit the Marburg virus to bats in the GCC and pose a threat of zoonotic spillover.
Connectivity to the Gulf Region	During the time of the outbreak, a total of 693 passengers travelled from Equatorial Guinea to GCC countries, with the highest passenger count arriving in United Arab Emirates (388) and Saudi Arabia (103). Given the limited connectivity (no non-stop passenger flights) and low number of cases, the risk of importation of Marburg from Equatorial Guinea to GCC countries was considered low. While Tanzania has a higher level of connectivity to GCC countries, particularly to United Arab Emirates and Oman, there were no recorded flights from the Kagera region of the outbreak to GCC countries during the time of the outbreak. 94% of passengers travelling to GCC countries from Tanania are from the Dar es Salaam and Tanzania regions.

SITUATIONAL HIGHLIGHTS FOR MARBURG IN EQUATORIAL GUINEA AND TANZANIA

- **Equatorial Guinea:** Between February 7th and June 8th, 2023, there were 40 reported cases[2] (17 laboratory-confirmed) and 35 reported deaths (12 laboratory-confirmed) across 4 provinces in Equatorial Guinea (Bata - Litoral Province, Ebibeyin – Kie Ntem Province, Evinayon – Centro Sur Province, Nsork – Wele-Nzas Province).
    - Many of the reported cases were closely linked, either through social gatherings and networks or geographically.
- World Health Organization (WHO) authorities[3] highlighted that health authorities should maintain most response and surveillance activities for three months after the outbreak ends, due to the risk of re-emerging disease or relapsing infections that can occur in the months following acute illness and potentially cause new outbreaks.
- **Tanzania:** On 21 March 2023, health authorities identified Marburg disease as the cause for an unknown illness associated with five deaths in Kagera region, Tanzania[2]. In total, there were 8 laboratory confirmed cases (including 5 deaths), and 9 total reported cases.
- **Potential future trends:** Including these two, there have been 5 Marburg virus outbreaks[2] since 2017 and 10 Ebola virus outbreaks[4] since 2014. Historical trends point to increasing zoonotic transmission of these viruses from animal reservoirs. Continued human contact and changes in climate patterns that may affect the habitat and migration of carrier fruit bats could lead to more frequent outbreaks of hemorrhagic fever viruses.

RECOMMENDATIONS FOR MARBURG

The GCC countries are encouraged to conduct national risk assessments as well as to consider the following recommended actions for strengthening preparedness according to national risk levels.

- Review and disseminate viral haemorrhagic fever guidance (guidelines, case definitions and investigation forms) to all stakeholders involved in surveillance and contact tracing.
- Disseminate Marburg case definition to relevant surveillance and clinician staff.

- Raise awareness of healthcare workers on standard and transmission-based infection prevention and control precautions when caring for suspected or confirmed Marburg virus disease or other suspected hemorrhagic fever cases.
- Raise awareness of travellers to regions in Africa with recent history of Marburg virus disease cases and/or Ebola virus disease cases on the risk factors, symptoms, and protective measures against hemorrhagic fevers to reduce exposure.
- To reduce the risk of zoonotic transmissions, collaborate with the Ministry of Agriculture in investigating serological evidence of Marburg infection, particularly where the bats have been previously identified, and in assessing likelihood of exposure of populations living, working and/or visiting these areas.

Dengue

Globally

Negligible	Very Low	Low	Moderate	High	Critical

GULF CDC RISK ASSESSMENT OF THIS EVENT

- **Risk question:** What is the risk to GCC populations of the introduction of dengue cases into the region and subsequent local transmission in the next 6 months?
- **Impact: Minor**, based on current capacities of the GCC countries; if cases of dengue are imported or local transmission occurs, the impact would be manageable due to the robust public health systems and infrastructure of GCC countries.
- **Likelihood: Almost certain,** based on widespread distribution of dengue virus vectors in several Gulf countries and in neighbouring countries, as well as the likelihood of travel-related cases being imported to the region.

Please refer to the Gulf CDC Rapid Risk Assessment on Dengue (22 August 2023) for further details.

TRIGGER DATE	18 May 2023
REASON FOR TRIGGER	The Gulf CDC detected a global increase in dengue reports over the first months of 2023, with a notable signal detected in Sri Lanka on 17 May 2023.

KEY STATS

50%
Of the world population is at risk of dengue (WHO)

5+ million
Dengue cases reported in 2023 globally

KEY FACTORS OF CONCERN FOR DENGUE

Disease severity	Dengue is a mosquito-borne disease considered to have a moderate pathogen severity. It is the most ubiquitous arbovirus that affects humans. There is limited vaccine availability and no specific treatment for dengue.
Global Trends	Growing number of dengue cases reported globally for both endemic countries and non-endemic countries.

GCC Regional Information	Except in some areas in Saudi Arabia and some outbreaks in Oman, almost all recorded cases of dengue in the GCC region have been imported. GCC countries have robust public health systems and infrastructure that can detect and respond to outbreaks of infectious diseases. All GCC countries have established and implemented vector control management programs to prevent and control the spread of dengue fever. *Please refer to the GULF CDC Rapid Risk Assessment on Dengue (22 August 2023) for further details.*
Connectivity to the Gulf Region	Connectivity and importation risk is high for some affected countries. Some Gulf countries have a high degree of connectivity with countries in Southeast Asia, where dengue is endemic with a significant burden such as Philippines, Indonesia, Malaysia, and India.

SITUATIONAL HIGHLIGHTS FOR DENGUE

- **GCC and neighbouring countries:** there are 9 countries in the GCC and surrounding region that are endemic for dengue (Afghanistan, Djibouti, Egypt, Oman, Pakistan, Saudi Arabia, Somalia, Sudan, and Yemen).
    - The outbreaks are exacerbated due to disruption of health services (Sudan), fragile health systems (Afghanistan, Somalia, Sudan, Pakistan, and Yemen), mass population movements, poor water, and sanitation infrastructure, and recurring natural disasters such as floods affecting Somalia, Sudan, Pakistan, and Yemen, along with earthquakes in Afghanistan. Outbreaks are also reported in middle- and high-income countries such as Egypt, Oman, and Saudi Arabia due to climate change leading to unusual rainfalls.
- **Southeast Asia:** an unusual dengue surge[5] (in terms of seasonality and early sharp increase in comparison to previous years) in Bangladesh, high case activity in Thailand and Sri Lanka
- **Central and South America:** Many countries in Central and South America are seeing significant increases[5] in comparison with previous seasons.
- **Africa:** The burden of dengue in Africa[5] is not well understood due to i) similarity of common, non-specific clinical symptoms of the disease with malaria and other tropical febrile illnesses; ii) limited laboratory capacity for timely detection and confirmation of dengue, which is crucial for detecting and reporting cases and preventing its spread; and iii) inadequate surveillance and limited case reporting, especially for dengue.
- **Non-endemic countries where the vector is present and have confirmed local cases:** Sporadic autochthonous cases have been reported recently in the United States, France, Spain, and Italy, where historically most of the cases are imported.
- **Presence of the vector *Aedes aegypti* recently confirmed, no evidence of local transmission:** Bahrain, Iran, Qatar, Madeira in Portugal and Cyprus have reported the presence of *Ae. aegypti* recently, although no local transmission of dengue has been documented.

- **Spatial and temporal shifts[5] in dengue patterns were observed in 2022 and continued in the last quarter of 2023**: Cases in Nepal shifted from the Kathmandu Valley in 2022 to the southeast Terai region and hill districts in Gandaki province in 2023. India, in 2023, experienced an increase in cases in Kerala and northeastern States bordering Bangladesh compared to the previous year.
- **Potential future trends:** Given El Nino (warmer-than-usual) weather patterns likely to continue until mid-2024, ongoing disruptions to healthcare in regions of conflict, expanding vector distributions, and high dengue activity in some endemic countries in 2024 to date (e.g., Brazil, Paraguay) there is a continued risk of dengue importation and local transmission in the GCC region in the months ahead. The anticipated transition from El Nino to La Nina[6] (cooler-than-usual period) by late 2024 may bring heightened risk of tropical storm/hurricane activity in the Atlantic Ocean region, bringing increased flooding events and suitable conditions for mosquito vectors in affected coastal areas.

RECOMMENDATIONS FOR DENGUE

The GCC countries are encouraged to conduct national risk assessments as well as to consider the following recommended actions for strengthening preparedness according to national risk levels.

- Raise awareness among healthcare professionals, particularly in dengue-endemic areas, on the differential diagnosis of febrile and sub-febrile patients with a rash, especially for patients returning from affected regions.
- Establish rapid and routine reporting to health authorities for greater cooperation across GCC countries.
- Support the strengthening of laboratory-capacity to enable timely and accurate diagnosis and case detection in affected and at-risk countries.
- Support country adoption of a multisectoral One health strategy while preparing for and responding to dengue outbreaks as well as other arboviral diseases.
- Invest further in entomological surveillance, including but not limited to:
    - Conduct surveys and surveillance in all areas with a history of *Ae. aegypti* in the Gulf region, assess the local mosquito susceptibility to control measures.
- Increase knowledge and awareness of the increasing risks of dengue and other vector-borne diseases because of climate conditions changing through public health communication campaigns targeted to local populations.

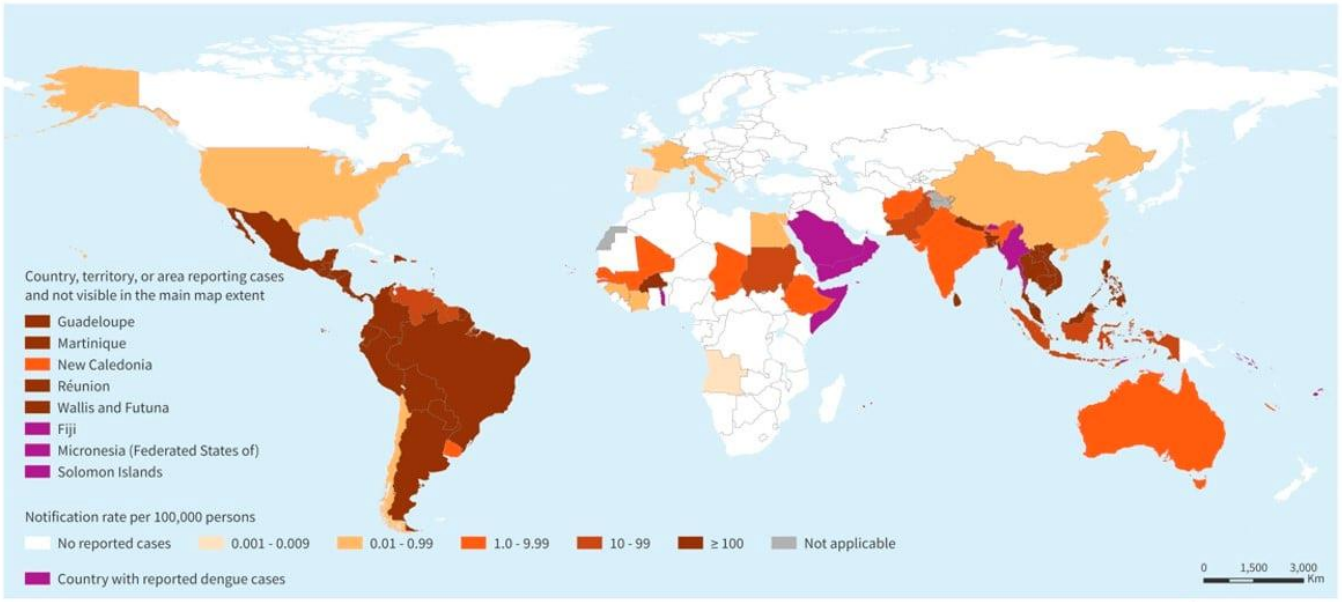


Figure 5: Countries, territories, and areas reporting autochthonous dengue cases (November 2022-November 2023).[5]

Malaria

Globally

Negligible	Very Low	Low	Moderate	High	Critical

GULF CDC RISK ASSESSMENT OF THIS EVENT

- **Risk Question:** What is the likelihood of malaria cases introduction into the GCC countries and the impact of this introduction on the susceptible population for the next 3 months?
- **Impact: Moderate,** given current capacities of the GCC countries, impact would be manageable
- **Likelihood: Unlikely,** travel related cases are most likely from some Southeast Asian countries and Ethiopia in particular. However, expats from affected countries who are travelling to work in the GCC are requested to test negative for malaria, and therefore the importation estimate should be lower.

Please refer to the GULF CDC Rapid Risk Assessment on Malaria (21 November 2023, updated 15 January 2024) for further details.

TRIGGER DATE	13 July 2023
REASON FOR TRIGGER	The Gulf CDC detected unusual or unexpected events representing a risk to public health, specific to reports of locally acquired cases of malaria in the United States, and reports of malaria in Israel, whereby the country had not reported cases since 2012.

KEY STATS

13
Malaria endemic countries reporting upward trends

95%
Malaria deaths are on the African continent

KEY FACTORS OF CONCERN FOR MALARIA

Disease severity	Malaria is a mosquito-borne disease considered to have a high severity. A case of malaria is considered a medical emergency due to its capacity to rapidly progress to severe malaria and death without prompt and appropriate treatment. Specific treatment for malaria is widely available in endemic locations.
Global Trends	Growing number of malaria cases over the last quarter of 2023 (and throughout 2023) in countries where malaria is endemic, countries that had previously made great progress towards malaria elimination and locally transmitted cases in malaria-free countries.

GCC Regional Information	GCC countries have adopted Artemisinin-based Combination Therapy (ACT) for malaria treatment, as it is the most effective treatment to date. Bahrain, Qatar and Kuwait are classified by the WHO as 'countries where malaria has never existed or disappeared without specific measures', and the UAE is classified as a 'malaria-free country' (2012). Oman has remained largely malaria free in recent years and Saudi Arabia is striving for malaria elimination. Locally acquired cases have been detected recently in Saudi Arabia's southwestern regions, near the border with Yemen. GCC countries continue to support a Gulf initiative for malaria control in Yemen, which could reduce imported malaria cases to GCC countries. *Please refer to the GULF CDC Rapid Risk Assessment on Malaria (21 November 2023, updated 15 January 2024) for further details.*
Connectivity to the Gulf Region	Connectivity and importation risk is high for some affected countries, particularly neighbouring Gulf countries such as Yemen, Ethiopia, and Pakistan.

SITUATIONAL HIGHLIGHTS FOR MALARIA

- **Endemic countries with upward trends:** Sudan, Angola, Pakistan, DRC, Zimbabwe, Senegal, and Burkina Faso. The impact of climate change and extreme weather events on malaria transmission continues to be dramatically demonstrated with the recent floods in Pakistan, resulting in a five-fold increase in malaria cases since mid-2022.
- **Imported cases in malaria-free countries:** Imported cases often highlight that the burden of the disease from the origin country is likely larger than official case counts indicate. This is also a reminder that there are further risks of re-emergence in non-endemic regions, specifically with climate change and where favourable conditions for Aedes vector mosquitoes exist.
- **Effects of climate change:** Mosquito breeding sites are changing[7] (e.g., slight warming in cooler, malaria-free zones could lead to new malaria cases), requiring countries to make better use of data to predict malaria seasons and geographies at risk, and plan seasonal malaria chemoprevention (SMC) campaigns. Indirectly, climate change can weaken healthcare systems, disrupt medical supply chains, and increase migration, thereby exposing new populations.
- **Emerging research:**
  - Researchers in Saudi Arabia[8], in collaboration with King Abdullah University of Science and Technology, identified the gene PfAP2-MRP responsible for the reproduction of *Plasmodium falciparum,* the most dangerous strain of malaria. This discovery paves the way for developing more effective drugs to treat *Plasmodium falciparum* malaria.
  - Research in the United States[9] on an experimental antimalarial drug called TDI-8304 revealed that mutations in P. *falciparum* reduce sensitivity to TDI-8304 increase sensitivity to other proteasome-targeting compounds. Understanding how TDI-8304 interacts with the parasite and how resistance mutations affect sensitivity could help researchers design improved therapies.

- **Preparedness measures:**
  - Thailand introduced an anomaly detection system[10] as an early warning mechanism for potential malaria outbreaks in countries with similar malaria profiles as Thailand. The anomaly detection algorithms developed can be optimized to ingrate with existing malaria surveillance infrastructure, which can enhance identification process for sub-regions at risk of outbreaks.
  - The World Health Organization recommended a new vaccine[11] (R21/matrix-M) for the prevention of malaria in children. It is the second malaria vaccine recommended by the WHO (the first being RTS, S). Both vaccines are shown to be effective in preventing malaria in children, and when implemented broadly, are expected to have high public health impact.
  - The WHO recommended RTS,S vaccine completed pilot campaigns in Kenya, Ghana and Malawi. In 2023, Cameroon received 330,000 doses of the vaccine. Immunizations will be given at the same time as other routine childhood vaccinations.

RECOMMENDATIONS FOR MALARIA

The GCC countries are encouraged to conduct national risk assessments as well as to consider the following recommended actions for strengthening preparedness according to national risk levels.

- Review and update national malaria guidelines and contingency plans, including plans for rapid scale-up of vector control interventions.
- Establish rapid and routine reporting to health authorities for greater cooperation across GCC countries.
- Support the strengthening of laboratory-capacity to enable timely and accurate diagnosis and case detection in affected and at-risk countries.
- Support country adoption of a multisectoral One health strategy while preparing for and responding to malaria cases and outbreaks.
- Increase knowledge and awareness of the increasing risks vector-borne diseases because of climate conditions changing through public health communication campaigns targeted to local populations.

Avian Influenza H5N1

Globally

Negligible	Very Low	Low	Moderate	High	Critical

GULF CDC RISK ASSESSMENT OF THIS EVENT

- **Risk Question:** What is the likelihood of HPAI H5N1 human-to-human transmission occurring in the GCC countries and what is the impact of such transmission?
- **Impact: Low,** zoonosis programs are available or being established. Case management capacities in GCC countries for influenza infections are generally high.
- **Likelihood: Unlikely,** as there is currently no global evidence of sustained human-to-human transmission

Please refer to the GULF CDC Rapid Risk Assessment on Avian Influenza H5N1 (15 October 2023) for further details.

TRIGGER DATE	03 August 2023
REASON FOR TRIGGER	New emerging or re-emerging disease, possible zoonoses. Avian influenza outbreaks across bird populations have increased, indicating wider spread of the virus. Continued spread, particularly among wild or domestic mammals, could increases the risk that the virus mutates to more efficiently spread from person-to-person.

KEY STATS

12
Human infection cases of H5N1 in 2023

50%
Of reported human cases in 2023 were laboratory confirmed in Cambodia

KEY FACTORS OF CONCERN FOR H5N1

Disease severity	Avian Influenza H5N1 with a severe pathogen severity level. The mortality rate for this infection can be as high as 60%. Infection is mainly through contact with infected poultry, however there are growing concerns that this virus could mutate and cause more efficient person-to-person transmission.
Global Trends	In 2023, there were 12 reported human infection cases of H5N1[12] across 4 countries (Cambodia, China, Chile, United Kingdom). In years prior, there have been small

	numbers of sporadic reported human infection cases of H5N1 across several countries.
GCC Regional Information	All GCC countries have set up infectious disease programs or services for zoonosis, but lack strategic plans or programs needed to control and prevent the spread of avian influenza. While recent clades of the H5N1 virus have not been detected in Gulf countries, the connectivity to other countries through agricultural trade and bird migration increases the likelihood of importation of the virus, and the possibility of spillover to humans (particularly those in close contact with poultry). *Please refer to the GULF CDC Rapid Risk Assessment on Avian Influenza H5N1 (15 October 2023) for further details.*

SITUATIONAL HIGHLIGHTS FOR H5N1

- In 2023, there were 12 reported human infection cases of H5N1 across 4 countries. Cambodia accounted for 6 of these, between October and November. Chile and China accounted for 1 reported case each, and the United Kingdom reported 4 cases.[12]
  - All cases involved individuals living and/or working near infected poultry.
- Measures taken in Cambodia include standard protocols such as outbreak investigation, administration of oseltamivir (Tamiflu), monitoring and public education. In some situations, authorities culled wild birds suspected of infecting domesticated birds.
- Animal outbreaks of H5N1 clade 2.4.4.b were documented in South America[13] (including Peru, Chile, Argentina, Uruguay and Brazil) and the Antarctic region.
  - In Brazil[14], an unprecedented almost 1,000 marine mammals (seals and sea lions) died due to this strain of influenza. Mass mortality events in wild mammals are notable as they indicate a possibility for mammal-to-mammal transmission in addition to multiple exposure events.
  - In Chile and Peru, an estimated 20,000 sea mammals died of Avian Influenza in 2023.
- In a December 2023 policy brief[15], the World Organization for Animal Health (WOAH) said the epidemiology of avian influenza is evolving – the disease is gradually losing its seasonal nature, and high pathogenicity strains are circulating in wild birds. This intensified circulation increases the likelihood of virus evolution and spillover to new species, posing a risk to animal and human health.
- The same report encourages avian influenza vaccination as part of a broader disease prevention and control strategy.
- **Potential future trends:** While it is not possible to predict whether current H5N1 or other non-human influenzas will mutate or recombine to more efficiently spread between people, the continued circulation of H5N1 clade 2.2.4.b globally in wild birds makes it likely that there will be continued sporadic outbreaks in domestic poultry and wild scavenger bird and mammal species. The major migratory flyway shared with the European region poses the most likely source for importation of H5N1 to domestic poultry flocks in the GCC region.

RECOMMENDATIONS FOR H5N1

The GCC countries are encouraged to conduct national risk assessments as well as to consider the following recommended actions for strengthening preparedness according to national risk levels.

- Reviewing national implementation status of activities agreed within the joint GCC meeting in AIV in 2005.
- Establishing mechanisms to ensure cooperation and transparent communication between relevant stakeholders, including ministries, Veterinary Authorities and poultry producers when engaging in international trade.
- Support country adoption of a multisectoral One health strategy including surveillance in birds, mammals and the environment, and enhanced severe acute respiratory syndrome (SARI) surveillance in humans.
- Increase awareness and risk communication for populations at risk (e.g. poultry workers, animal market visitors, bird hunters) for the appropriate use of PPE when in contact with birds and prompt reporting of suspected disease activity.

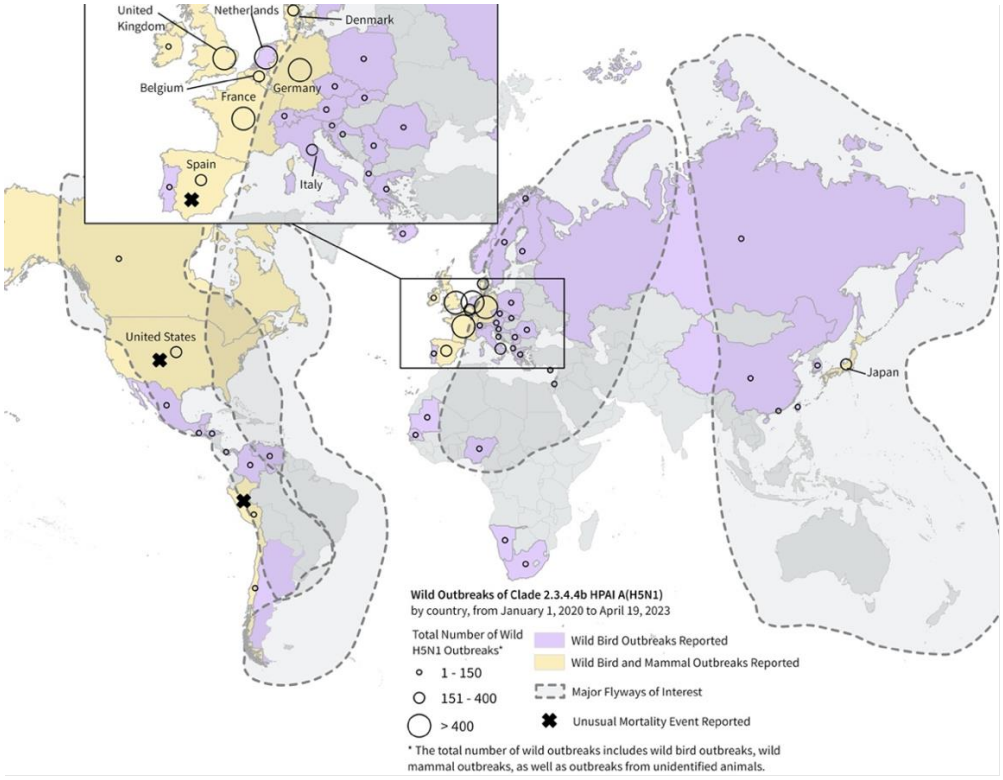


Figure 6: A world map showing wild bird and mammal HPAI A(H5N1), clade 2.3.4.4b outbreaks reported between January 1, 2020, and April 19, 2023.*

**Dotted lines represent major bird migration flyways with expected high activity over the next four months and are known to be used by species currently experiencing a high number of infections and deaths. The data represented is limited to countries which reported HPAI A(H5N1), clade 2.3.4.4b cases and deaths either to WOAH, WHO, and/or through peer-reviewed journal articles. The number of outbreaks is limited to countries that perform whole genome sequencing and phylogenetic analysis. Countries such as Uruguay (only confirmed H5 cases) and Bolivia (reported H5N1 cases of an unknown clade) have been omitted from this map.*

Nipah Virus

Kerala, India

Negligible	Very Low	Low	Moderate	High	Critical

GULF CDC RISK ASSESSMENT OF THIS EVENT

- **Risk Question:** What is the risk of the introduction of the Nipah virus into the GCC countries?
- **Impact: Minor;** given the GCC's high reporting capacities for detecting and responding to epidemic-prone viruses.
- **Likelihood: Unlikely;** while there were 2 identified high-risk contacts who travelled to the region, containment measures at the source of outbreak limited the spread and response measures were implemented by UAE health authorities for the potential contacts.

Please refer to the GULF CDC Rapid Risk Assessment on Nipah virus (21 September 2023) for further details.

TRIGGER DATE	21 September 2023
REASON FOR TRIGGER	The Gulf CDC detected unusual or unexpected events representing a risk to public health, including six suspected human cases and two deaths of Nipah virus. Two high-risk contacts travelled from India to UAE in the week following the outbreak.

KEY STATS

6
Suspected human cases in Kerala, India

33%
Case fatality ratio

KEY FACTORS OF CONCERN FOR NIPAH VIRUS

Disease severity	Nipah virus (NiV) is an emerging zoonotic infectious disease, transmitted from animals to humans. Symptoms range from asymptomatic to severe disease with acute respiratory failure and encephalitis, with death having been reported to occur among a high proportion of those confirmed to be infected in outbreaks (historically ranging from 40% to 75%).
Global Trends	NiV outbreaks have been reported in Asia, with initial detection occurring in Malaysia and Singapore, and later outbreaks occurring in Bangladesh, India, and the Philippines. Outbreaks have historically occurred in endemic regions and

	have been of spillover nature from animals. However, human-to-human transmission has resulted in relatively small case clusters.
GCC Regional Information	There are no known species of Pteropus bats in any of the Gulf countries, or neighbouring countries. GCC countries have high capacities for detecting and responding to epidemic-prone diseases. The countries also have strong infection prevention and control capacities in healthcare facilities, reducing the potential impact of virus transmission in those settings. *Please refer to the GULF CDC Rapid Risk Assessment on Nipah virus (21 September 2023) for further details.*
Connectivity to the Gulf Region	India has a high level of connectivity to the Gulf region, with hundreds of thousands of passengers travelling every month (monthly averages: India – Saudi Arabia - 230,000 passengers, India – UAE – 520,000 passengers). Border screening measures should be in place to be quickly implemented, in the event of another Nipah virus outbreak.

SITUATIONAL HIGHLIGHTS FOR NIPAH VIRUS

- In September 2023, an outbreak of Nipah virus occurred in Kerala, India. There were 6 laboratory confirmed cases, including 2 deaths.
- Health authorities responded quickly with contact tracing (1,288 contacts identified, including 211 high risk contacts), sample testing (365 samples tested).
    - Two high-risk contacts travelled from the region to Dubai International Airport, while being asymptomatic in India. Authorities in the UAE were able to monitor those contacts who subsequently completed the incubation period without showing symptoms.
- India had previously experienced five Nipah virus outbreaks[16] in Jan.-Feb. 2001, April 2007, May 2018, June 2019, and August 2021. Three of these outbreaks also occurred in the state of Kerala.
- While cases of NiV infection among humans have not been detected outside of Malaysia, Singapore, Bangladesh, India, and the Philippines, evidence of NiV among bat species has been reported.
    - Anti-NiV antibodies have been detected among fruit bats[17] from Bangladesh, Cambodia, China, Indonesia, India, Madagascar, Malaysia, New Caledonia, Papua New Guinea, Thailand, and Vietnam.
    - NiV RNA has been detected in bats in Timor-Leste, Bangladesh, India, and Thailand.
    - Moreover, henipavirus RNA (closely related viral DNA from within the same viral genus) has been detected in bats in Ghana.
    - Another species of bat within the family Pteropodidae, known as African fruit bats of the genus Eidolon, have been found positive for antibodies against NiV, indicating that the virus may also be present within the geographic distribution of Pteropodidae bats in Africa.
- Although there are several candidates in the research and development pipeline for countermeasures against this virus, currently, there is no specific treatment or vaccine available in the market for either

people or animals. The primary treatment for humans is supportive care. This highlights the urgent need for accelerated research and development for medical countermeasures to prevent and/or treat NiV infections.

- Due to the potential for aerosolization of the virus and its high severity and mortality rate, it has been categorized as a potential agent of bioterrorism.
- **Potential future trends**: Factors supporting the continued sporadic emergence/re-emergence of NiV[18] in endemic locations include wildlife habitat pressures, increased activities at the human-animal interface and increased urbanization, all of which are expected to continue for the foreseeable future. Nipah is considered a likely future pandemic agent[19], although whether and when this may occur is unpredictable. NiV has been estimated to have a low reproductive value under previous outbreak conditions which has fortunately led to relatively limited outbreaks in the past.

RECOMMENDATIONS FOR NIPAH VIRUS

The GCC countries are encouraged to conduct national risk assessments as well as to consider the following recommended actions for strengthening preparedness according to national risk levels.

- Reviewing and disseminating Nipah guidelines to all stakeholders involved in surveillance and contact tracing.
- Disseminating Nipah case definition based on previous known outbreaks to relevant surveillance and clinician staff, highlighting vigilance for patients with a travel history to affected regions.
- Developing border screening measures that can be implemented in short notice for incoming flights from India or other regions prone to Nipah virus outbreaks, should another outbreak occur.
- Coordinating with One Health partners to review risk of importation of potential sources of virus importation into the country, including food authorities.
- Coordination with global partners to prioritize research and development for the NiV, given its potential to be used as a disruptive bioagent.
- Examination and evaluation of currently not approved NiV therapeutic options, vaccines and antibodies.

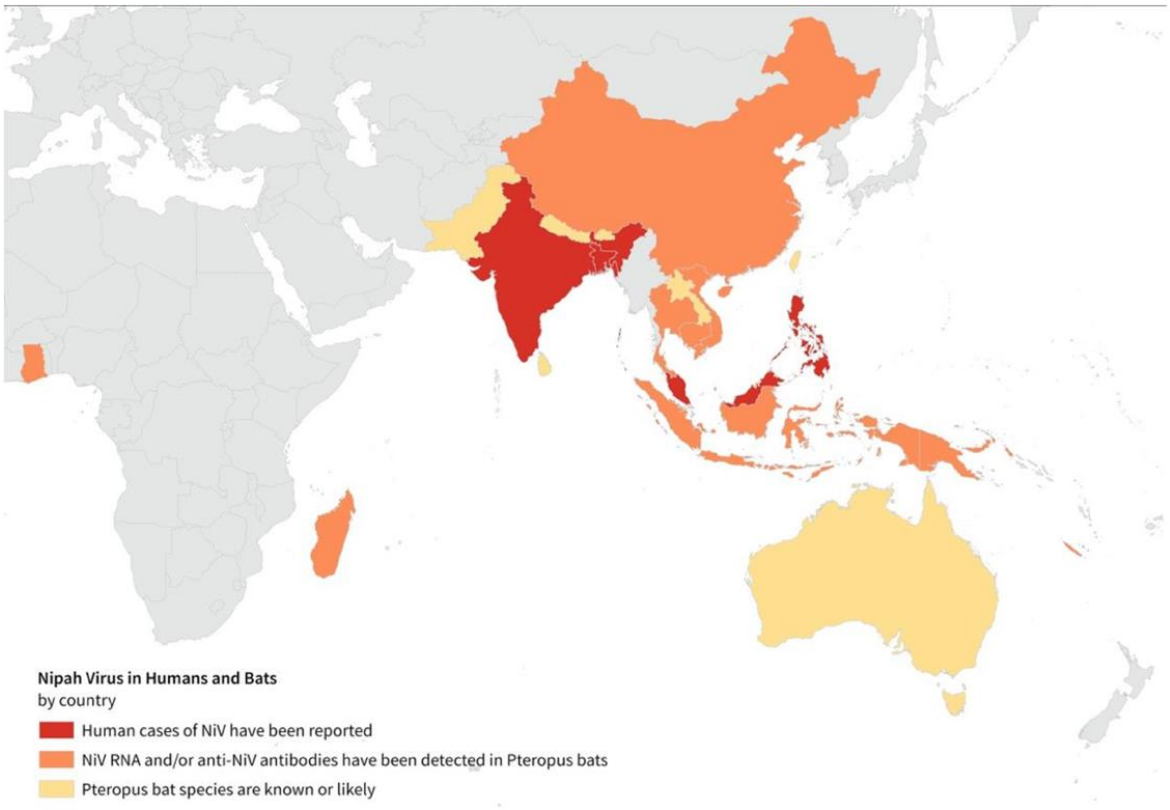


Figure 7: Nipah virus in humans and bats by country.[16,17]

Diphtheria

Globally

Negligible	Very Low	Low	Moderate	High	Critical

GULF CDC RISK ASSESSMENT OF THIS EVENT

- **Risk Question:** What is the risk of a significant number of diphtheria cases being imported into the GCC region in the upcoming 6 months, in terms of the likelihood and impact of importation?
- **Impact: Minor**, rare disease in the Gulf Region and immunization coverage estimates for diphtheria, tetanus toxoid, and pertussis (DTP) in 2022 are high but vary across GCC countries
- **Likelihood: Likely,** due to significant population movement between GCC countries and regions where high diphtheria activity is reported.

Please refer to the GULF CDC Rapid Risk Assessment on diphtheria (10 December 2023, updates 31 January 2024) for further details.

TRIGGER DATE	23 November 2023
REASON FOR TRIGGER	The Gulf CDC detected a significant increase in diphtheria cases on 24 October 2023 in Nigeria, making the outbreak the largest documented on the African continent.

KEY STATS

27,991
Reported Cases in Africa (May 2022 to 14 Jan 2024)[20]

34%
Case importation into Europe

KEY FACTORS OF CONCERN FOR DIPHTHERIA

Disease severity	Diphtheria is a vaccine preventable disease considered to have a moderate pathogen severity. The case fatality rate for diphtheria can be up to 10%.
Global Trends	An outbreak has been ongoing in West Africa since December 2022 (Nigeria- December 2022, Niger – July 2023, Guinea – July 2023). The ongoing outbreak in Nigeria is the largest reported since 1989 when over 5,000 people were infected. As of 31 December 2023, Nigeria surpassed 22,000 reported cases.[20] In 2022, Europe saw a sudden spike in the number of reported cases, which has lowered in 2023.

GCC Regional Information	Diphtheria is a rare disease in the Gulf region. Based on data available to the Gulf CDC, immunization coverage estimates for diphtheria, tetanus toxoid and pertussis (DTP) in 2022 are high but vary across the region. The response capacity for diphtheria is generally advanced across the region. Despite the global shortage, some countries have secured sufficient antitoxins and vaccines. Also, some countries have begun the administration of diphtheria booster vaccines as per national recommendations. *Please refer to the GULF CDC Rapid Risk Assessment on diphtheria (10 December 2023, updates 31 January 2024) for further details*
Connectivity to the Gulf Region	Connectivity and importation risk from the affected countries in West Africa to the Gulf region is generally low. However, Nigeria is the most affected country and has the highest number of passengers to GCC countries. Importation from Europe is highly unlikely, given the lowered number of cases in 2023.

SITUATIONAL HIGHLIGHTS FOR DIPHTHERIA

- **Africa:** In 2023, there were 5 diphtheria outbreaks across the African continent[20] – the 3 most sizeable ones were in Nigeria, Niger and Guinea, while smaller outbreaks were reported in Mauritania and South Africa
- According to the WHO African region, Nigeria is the most severely affected country, making up 80% of cases and 72% of deaths across the African region as of January 14, 2024.
- Suspected cases:
  - Nigeria (May 16 – December 31, 2023) – 22,417
  - Guinea (July 4, 2023 – January 14, 2024) – 2,754
  - Niger (July – December 24, 2023) – 2,721
- The WHO African region highlights that of the cases reported, children make up the most affected age groups, with children between five and nine years of age making up 31% of those affected, 10 to 14 years of age making up 27%, and children four years and younger making up 12%.
  - Additionally, 44% of the affected individuals are known to be unvaccinated, making them more likely to experience severe infection and require diphtheria antitoxin.
- An antitoxin is in limited supply[21] as few companies globally manufacture it, while other countries had halted production due to previously reduced demand.
- This means that 93% of confirmed cases were considered positive if the affected individual presented with diphtheria symptoms and had recent travel history to a location that is known to be endemic for diphtheria or currently affected by the disease.
  - Multiple affected African countries have highlighted that in addition to low vaccination coverage, surveillance and response initiatives face challenges such as a lack of laboratory reagents for the testing of patient samples, regional insecurity leading to delays in medical care-seeking and data reporting, supply chain and response difficulties, and impeded healthcare seeking of affected individuals.

- **Europe:** The European Union/European Economic Area (EU/EEA) and United Kingdom (UK) saw a sudden spike in the number of diphtheria cases reported in 2022, with reported cases jumping from 71 in 2021 to 446 in 2022 - a 528% increase. Reported cases of diphtheria dropped to 170 in 2023[22], with Germany carrying the highest number of cases (107) (Figure #). Three fatal cases were reported, one each in Belgium, Germany, and Latvia.
- **Potential future trends:** Despite gains in global vaccination coverage for diphtheria over the past year following pandemic disruptions, most countries globally have not recovered[23] to previous levels of coverage achieved before the pandemic. Diphtheria outbreaks are thus likely to continue occurring in locations with high connectivity to known outbreaks and where coverage gaps exist. This may place continued importation pressure on the GCC member states over the year ahead, while vaccine programs continue to try to recover previous gains in diphtheria vaccine coverage.

RECOMMENDATIONS FOR DIPHTHERIA

The GCC countries are encouraged to conduct national risk assessments as well as to consider the following recommended actions for strengthening preparedness according to national risk levels.

- Raise awareness among healthcare professionals about the current global diphtheria situation, in addition to developments regarding the emergence of antibiotic resistance, and the possible effects of the global vaccine shortage. This is particularly important for ensuring detection, as diphtheria may not be commonly suspected in the GCC due to its limited incidence and high national vaccine rates.
- Raise awareness of travel clinics and encourage informing travelers to regions experiencing diphtheria outbreaks to ensure they receive the necessary vaccinations or booster dose based on national regulations.
- Consider evaluating a recommendation for diphtheria booster vaccine dose prior to entry into GCC, for travelers from affected countries.
- Ensure readiness of equipment and consumables for early case confirmation of cases of antibiotic resistance.

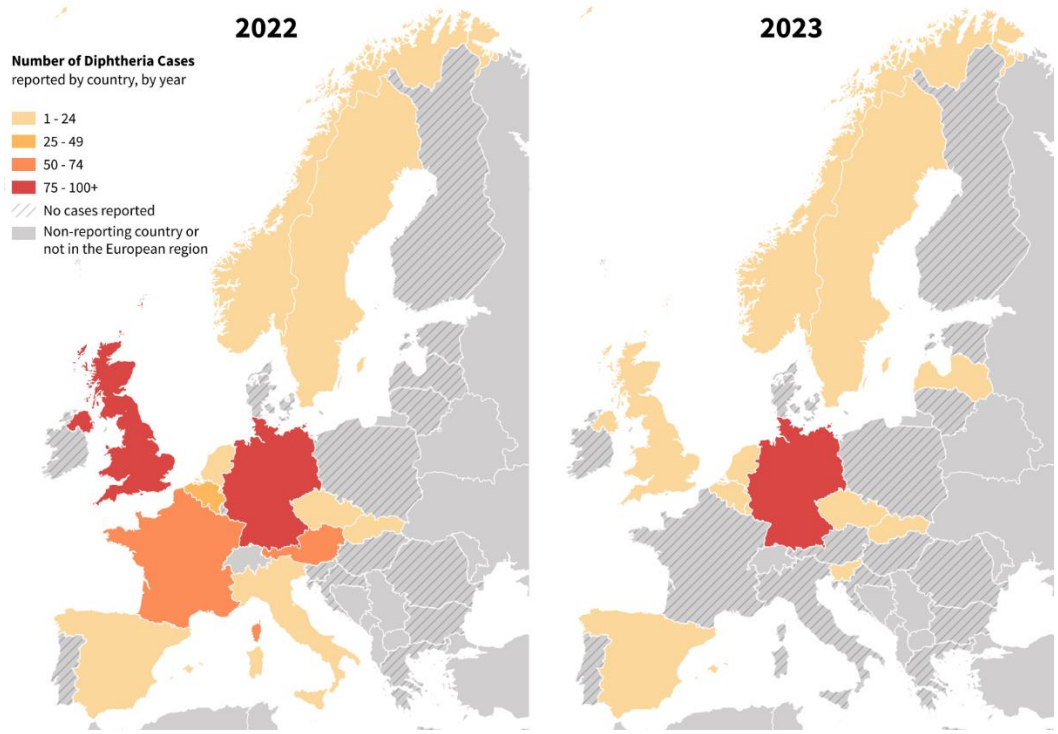


Figure 8: The number of diphtheria cases reported in the WHO European region in 2022 (left) and 2023 (right). With data from the ECDC and UKHSA. Data last refreshed on January 31, 2024.

Global Notable Disease Trends

Other notable disease trends were reported globally. These include vaccine-preventable diseases, influenza-like-illnesses and vector-borne diseases. Responses to outbreaks that have been noted do not portray the Gulf CDC's position on specific recommendations and are instead meant to highlight global reactions, recommendations, and changes to health policies.

Sustained drop in childhood vaccination resulting in an uptick of VPDs

According to a joint report from UNICEF and the WHO[24], between 2019 and 2021, the world experienced the largest sustained decline in childhood vaccinations in approximately 30 years, therefore since the end of 2022 upward trends of vaccine-preventable diseases (VPD) are being reported all around the globe. This report outlines 4 notable global VPD trends – measles, pertussis, poliovirus, and cholera.

ILI burden is on the rise

Changes in influenza-like-illnesses, including COVID-19, influenza, RSV and *Mycoplasma pneumoniae* are also being observed. As seasonality patterns return to pre-pandemic levels, a high circulation of viruses is being observed compared to pre-pandemic levels. The burden of influenza-like-illnesses is further exacerbated by low vaccine access, promotion and uptake and diminished healthcare capacity.

Climate change continues to exacerbate vector-borne disease occurrence

As previously noted with dengue and malaria, vector-borne diseases are expanding geographically as a result climactic change. This has led to unusual or expanded events of other mosquito-borne diseases, like zika and chikungunya, as well as tick-borne diseases, like West Nile virus and Lyme disease.

Vaccine Preventable Disease Trends in 2023

Despite being a highly successful public health intervention, immunization coverage has remained stagnant over the past decade. The challenges posed by the COVID-19 pandemic, disruptions associated with it, and the extensive efforts to vaccinate against COVID-19 strained health systems throughout 2020 and 2021, leading to setbacks. However, by 2022, the coverage of DTP (diphtheria, tetanus toxoid, and pertussis-containing vaccine) immunization almost recovered to 2019 levels[25].

In 2023, a significant transformation occurred in the realm of global immunization. The landscape saw widespread vaccination campaigns at the national level, commitments to routine immunization, and the distribution of new vaccines to areas with the greatest need. However, 2023 was also substantially characterized by large outbreaks of VPD and/or resurgence of some in areas where the disease has been absent after decades.

Measles

Disease Trends & Situational Highlights

According to official data available, there was a worldwide measles increase of 79%[26] when compared to cases in 2022, with large measles outbreaks being reported across the globe. In just the first three months of 2023 the Africa region had reported over 400% increase in measles cases when compared to the same period in 2022. Furthermore, outbreaks of the virus also begun to crop up in larger numbers across Europe, as well as in the United States and many outbreaks triggered by initially imported cases from travelers to areas where measles was highly circulating. The WHO[27] has highlighted measles and as a high health risk in the occupied Palestinian territory. Data available from 2022 demonstrated a high vaccination coverage against measles (~100%), however recent escalations have disrupted routine vaccinations, disease surveillance systems, and health sector services to respond to potential cases.

As of 14 December 2023, the WHO European Region[28] reported an over 30-fold increase in measles cases in 2023 (over 30,000 cases) when compared with 971 cases in 2022. As of February 2024, an increase in the total number of measles cases reported globally in 2023 (306,291) compared to 2022 (171,156).[26] In 2023, measles cases have increased in the Eastern Mediterranean Region, European Region, South-East Asia Region, and Western Pacific Region. While there appears to be a decrease in measles cases in all of 2023 compared to 2022 in the African Region, this may be attributable to a delay in reporting. Official data from the WHO will be available in July 2024. The proximity of Europe and Africa to the Gulf region presents as well as neighboring countries to the Gulf region that reported high increases in measles cases (Yemen, India) are of particular concern to GCC countries, given the high contagion and mortality of measles.

Response to Outbreaks

Countries that have eliminated measles as an endemic disease are at risk of measles outbreaks following importation of the measles virus from other countries if high rates of routine childhood vaccinations are not sustained across communities. The increasing trend in the number of measles cases is expected to continue and rise further due to gaps in immunity and increasing vaccine hesitancy. It is imperative that countries achieve and maintain over 95% coverage with two doses of measles-containing vaccine.

The United States had declared measles an eliminated disease in 2000, but outbreaks have been increasing from unvaccinated individuals due to immigration, disrupted vaccine schedules because of the COVID-19 pandemic and growing vaccine hesitancy. Health officials recommend that individuals with measles or those that have been exposed to measles follow strict isolation measures. Globally, 89 countries have mandatory vaccination for childhood vaccines[29], while 20 enforce the mandate for school entry, and 33 have them as recommended policies. However, in countries like the United States, Canada Australia and India, immunization is regulated at the subnational level, so there can be discrepancies in vaccination coverage rates. Battling vaccine hesitancy while simultaneously closing the gap in childhood immunization caused by the COVID-19 pandemic will continue to be obstacles in reaching and maintaining high levels of vaccination coverage.

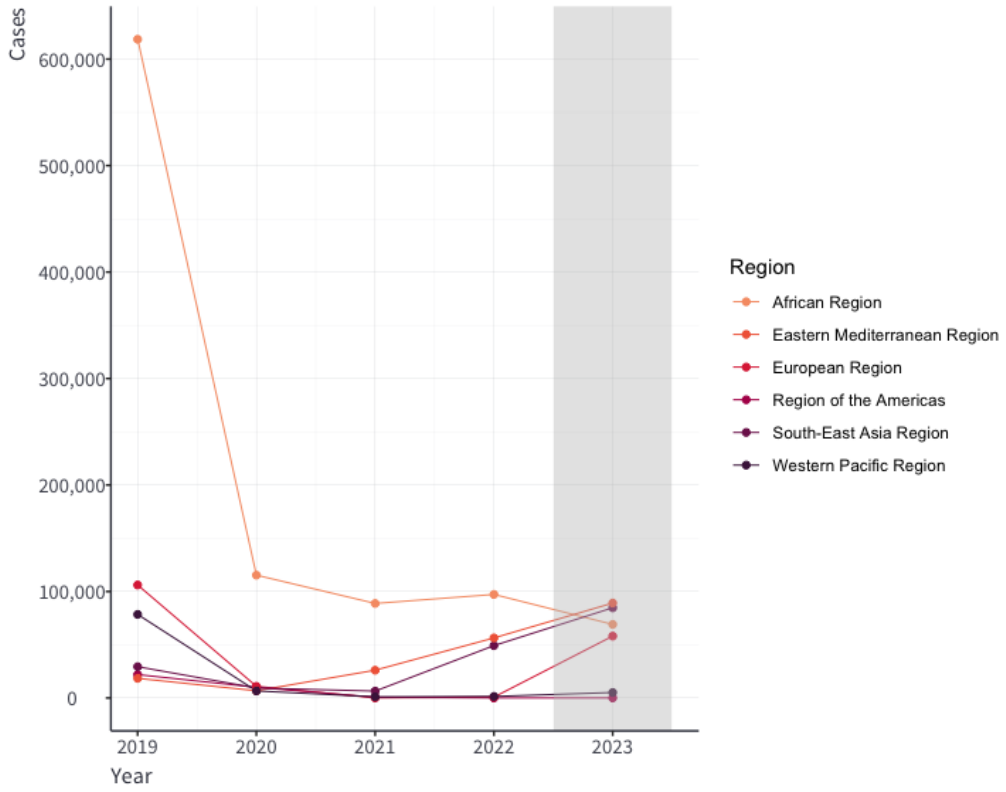


Figure 9: Annual reported measles cases by WHO region, 2019-2023[26]

Data for 2019-2022 is official data from the WHO Immunization Data portal accessed in mid-December 2023. Grey bar indicates data for 2023 are provisional, based on monthly reports to WHO as of 12 February 2024.

Pertussis

Disease Trends and Situational Highlights

Since early 2022, increasing trends of pertussis[30] (also known as whooping cough) have been reported in several countries. Declining vaccine confidence and rates of pertussis coverage in some countries indicates a risk of future increases in activity in additional locations. Pertussis surveillance is challenging, and the reported cases are influenced by factors including healthcare access, testing availability, asymptomatic/mildly symptomatic cases; hence disease burden is largely underestimated. Many regions are reporting a resurgence of pertussis cases compared to the minimal activity observed during the first three years of the ongoing COVID-19 pandemic. News media reported outbreaks at several subnational locations throughout 2023. Of highlight, the highest burden in the European Region is held by Russia, which reported roughly 3,000 cases in 2022, whereas 27,800 cases were reported in 2023. This is a nine-fold increase.

Response to Outbreaks

As with measles, pertussis is best prevented via immunization, and is included in routine childhood immunizations. Pertussis outbreaks are likely a result of the same factors fueling the measles outbreaks described above – lag in childhood immunization coverage because of the COVID-19 pandemic and vaccine hesitancy. In an immunization catch up campaign in Indonesia, the WHO outlines that despite some vaccine hesitancy being present in catch-up immunization[31], largely because of concerns of multiple immunizations at one time for children, parents accept multiple injections once provided with clear explanations from immunization officers regarding the vaccines and their benefits. They emphasize consistent communication with parents, community leaders and local, trusted healthcare professionals to increase community engagement and acceptance rates.

Poliovirus

Disease Trends and Situational Highlights

Although Wild poliovirus type 1 (WPV1) cases appear to be decreasing since 2020, cases continue to be reported in Afghanistan and Pakistan[32], where WPV1 remains endemic.

- Afghanistan reported a 200% increase, with cases rising from two in 2022 to six in 2023.
- While Pakistan reported a 70% decrease, with cases dropping from 20 cases in 2022 to six in 2023.
- According to the WHO, both Afghanistan and Pakistan reported an increase of WPV1 positive samples from environmental sources when compared to those reported in 2022, with 182% and 186% increases reported, respectively.

Additionally, there continues to be instances of circulating vaccine derived poliovirus[33] (cVDP). In 2023, there were 133 cases of vaccine derived poliovirus (126 cVDP type 2, 7 cVDP type 1). All cVDP cases were reported across the African continent and in Indonesia (visualized in figure X). The reported cases in 2022 and 2023 are substantially lower than those reported in 2020 and 2021, indicating a decline in cVDP type 2. This has been mainly attributed to

the increased administration of the novel oral polio vaccine type 2 (nOPV2). In 2023, there were 4 reported cases of vaccine-derived polio in Yemen, which has continued surveillance efforts after two concurrent vaccine-derived poliovirus outbreaks (cVDP type 1 in 2020, cVDP type 2 in 2021).

Response to Outbreaks

Both Afghanistan and Pakistan continue to roll out vaccination campaigns with the aim of reducing the number of zero-dose and under-vaccinated children. Over the course of 2023, however, it was reported that there were ongoing challenges with vaccine rollouts including violent attacks against healthcare workers and high rates of vaccine hesitancy within high-risk populations. Overall, in 2023, health workers successfully administered polio vaccinations to over 400 million children[34], averting an estimated 650,000 cases of polio-related paralysis and preserving the lives of up to 600,000 children.

In response to the outbreaks in Yemen[35], the Polio Eradication Initiative worked with the Ministry of Public Health to carry out nationwide polio campaigns using the trivalent oral polio vaccine (tOPV), particularly focused in the northern governorates. As mentioned above, global decline in circulating vaccine-derived poliovirus is attributed to the administration of the novel oral polio vaccine type 2. Where mono- and bivalent- oral polio vaccine (mOPV2/bOPV) experience genetic reversion and lead to human cases of cVDP2, nOPV2, a next-generation version of mOPV2, has proven to be more genetically stable, providing a safe and effective vaccine for children.

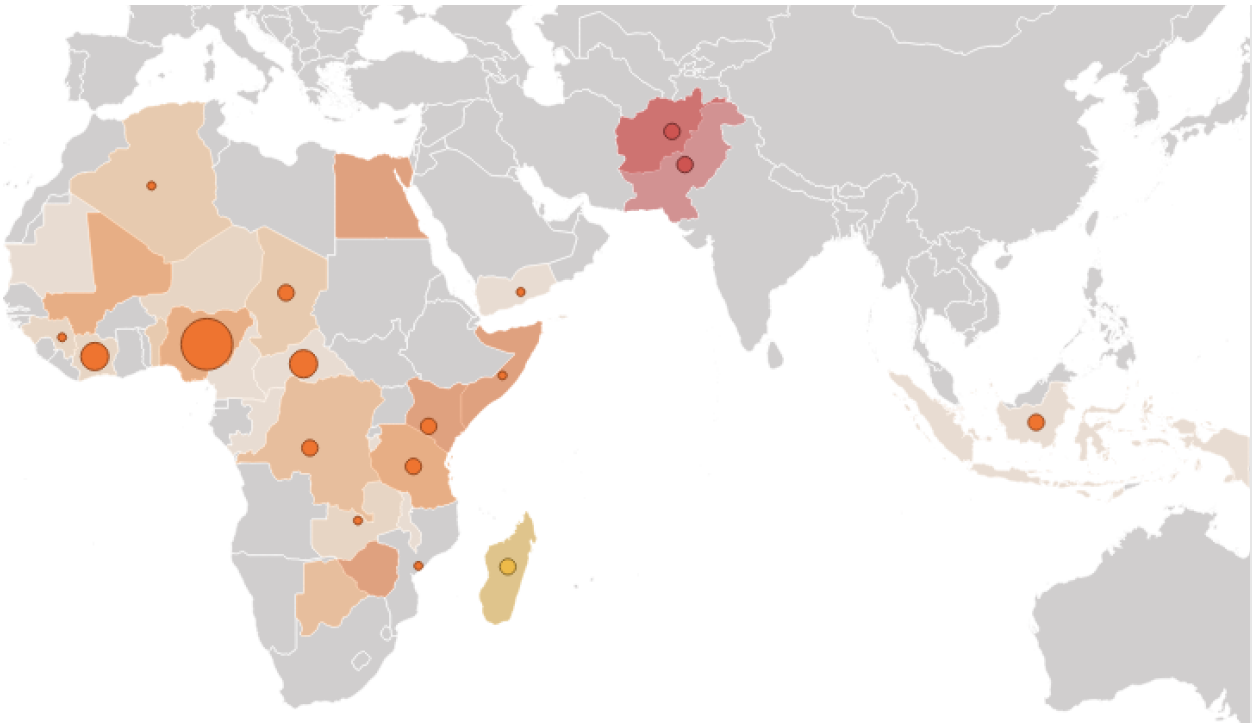


Figure 10: Reported wild poliovirus cases and circulating vaccine-derived poliovirus cases in 2023.

Data from Jan 1, 2023, to Dec 27, 2023 from GPEI and WHO, red circles = WPV, yellow circles = cVDPV1, orange circles = cVDPV2, light green shading = env vdp1, tan shading = env vdp2

Cholera

Disease Trends and Situational Highlights

Globally, there has been a significant surge in cholera cases[36], totaling over 610,000 with 3,500 fatalities across 29 countries in 2023 (as of mid-November 2023). According to the WHO, preliminary data indicate that the number of reported cholera cases as of December 2023 are much higher than that of 2022. In addition, the WHO has classified this global resurgence of cholera as a grade 3 emergency, which is the highest internal level, emphasizes the critical need for a comprehensive response. Eastern and southern African nations[37] bear the brunt, constituting approximately 75% of the fatalities and a third of the cases, as reported by UNICEF. As the outbreaks rapidly spread, these regions are grappling with inadequate clean water and sanitation issues and face heightened vulnerability, particularly among children. In the most recent report from the WHO[36], Malawi in southern Africa and Haiti in the Caribbean experienced the deadliest outbreaks with 1,769 and 922 reported deaths respectively as of 15 November 2023. In Africa, the Democratic Republic of the Congo (DRC) reports close to 1,000 cases weekly, while Zimbabwe and Mozambique witness a surge in cases and outbreak spread. Afghanistan and Syrian Arab Republic report the highest numbers of suspected and/or confirmed cases with 203,911 and 161,620 cases respectively. Médecins Sans Frontières has warned for has warned[38] of a potential cholera outbreak in the occupied Palestinian territory because of the ongoing conflict.

Response to Outbreaks

As a result of sustained classification of cholera as a grade 3 emergency by the WHO, the WHO stated in a December 2023 report[36] that it would be reviewing its response to cholera globally to make evidence-based adjustments where needed to better coordinate activities across all levels of response. In response to acute needs, experts were deployed to Malawi, Mozambique Kenya, Lebanon and Haiti through the Global Outbreak Alert and Response Network to support the cholera response in the functions of health operations, case management and epidemiological surveillance. In 2023, the Global Task Force on Cholera Control revised guidance on public health surveillance for cholera[39], including technical recommendations on standard data sets and data management for cholera reporting, recommendations for cholera testing, and laboratory guidance. According to the same report, 65 million Oral Cholera Vaccine (OCV) doses have been requested, with 45% being approved and allocated to 12 countries.

Influenza-like-Illnesses Trends in 2023

The containment and non-pharmacological interventions enacted during the COVID-19 pandemic had a secondary result in lowering the incidence of other influenza-like-illnesses. Since these measures have been lifted, changes in multiple respiratory disease trends are occurring. There is an observed higher level of influenza-like illness (ILI) activity due to multiple pathogens circulating, which is coinciding with waning immunity against COVID-19 alongside low immunization uptake of vaccines targeting newer strains of SARS-CoV-2.

A January 2024 report by the WHO[26] highlighted influenza-like-illnesses as very high health risks in the conflict situation in the occupied Palestinian territory. As of January 10, 2024, over 164,000 cases of upper respiratory infection have been reported. COVID-19 vaccination data is available to October 2022, when the occupied Palestinian territories reached 58% of target vaccination coverage. Considering the high level of displacement and overcrowding at shelters and hospitals, incidences of respiratory illnesses are likely to rise rapidly. The Palestinian Ministry of Health has also reported more than 133,000 cases of upper respiratory tract infection (URTI).

COVID-19

In the last 3 months of 2023, there were two SARS-CoV-2 variants of XBB sublineage[40] (HV.1 and HK.3) that were increasing in prevalence in most regions globally. There were also two other SARS-CoV-2 variants of non-XBB sublineage (JN.1 – sublineage of BA.2.86, and DV.7.1 – sublineage of CH.1.1) that were lower in prevalence in September and October 2023, but had demonstrated mutations associated with an evolutionary advantage over their parental lineages. In late 2023, COVID-19 activity was not being driven by a single variant, but rather a combination of multiple emerging variants.

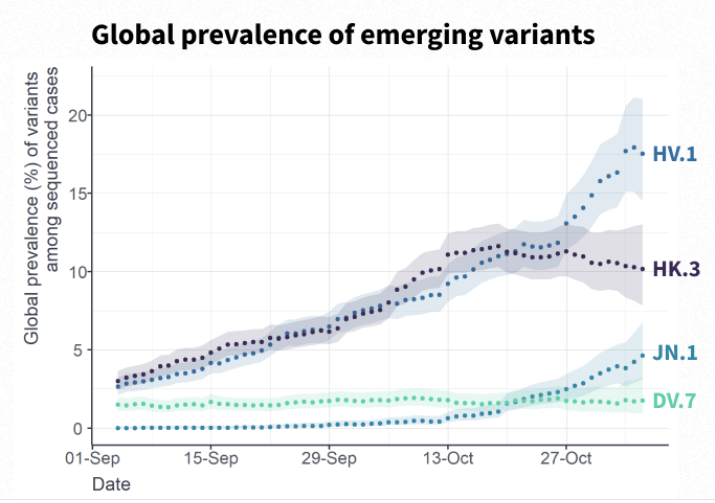


Figure 11: Global prevalence of COVID-19 variants, 01 September – 09 November 2023[40]

JN.1 Variant

By the end of 2023, the JN.1 variant became dominant globally[40] due to having an estimated 67% growth advantage over other currently circulating variants. It is the first variant since early Omicron that has gained global dominance so quickly. It was designated a variant of interest by the WHO on December 18, 2023. By the end of 2023, it was accounting for over 70% of global sequenced cases. According to early studies, the JN.1 variant appears to have increased immune evasion characteristics, relative to its parent lineages (BA.2.86.1 and EG.5). Differential impacts were observed in different locations[41] – for example, it is responsible for a new COVID-19 wave of infections and hospitalizations in Singapore and for prolonging the COVID-19 wave that was underway in Canada, leading to some of the highest levels of hospitalizations since the initial Omicron BA.1/BA.2 epidemic waves in both countries. Other countries like the United States have not experienced as great an impact of the JN.1 variant as it became dominant. Given the variations across countries in terms of recent vaccinations, previous infections, duration between epidemic waves, policy and behavioral differences, it is increasingly challenging to anticipate the impact of each new variant.

Neighboring countries to the GCC region reporting high prevalence of JN.1 include Pakistan (89%), Israel (90%), and India (98%). Countries with a high degree of connectivity to the GCC countries are also reporting high prevalence, including United Kingdom (79%), United States (78%), and France (72%). These trends are expected to continue into 2024[42]. Several regions in both northern and southern hemispheres saw an increase in COVID-19 hospitalizations in late 2023. Thus, it is increasingly necessary to improve access and uptake of the new XBB.1.5-targeted vaccines to limit COVID-19-associated severe disease. Vaccine uptake of this targeted vaccine has remained low, globally, despite positive results in real-world efficacy studies[43].

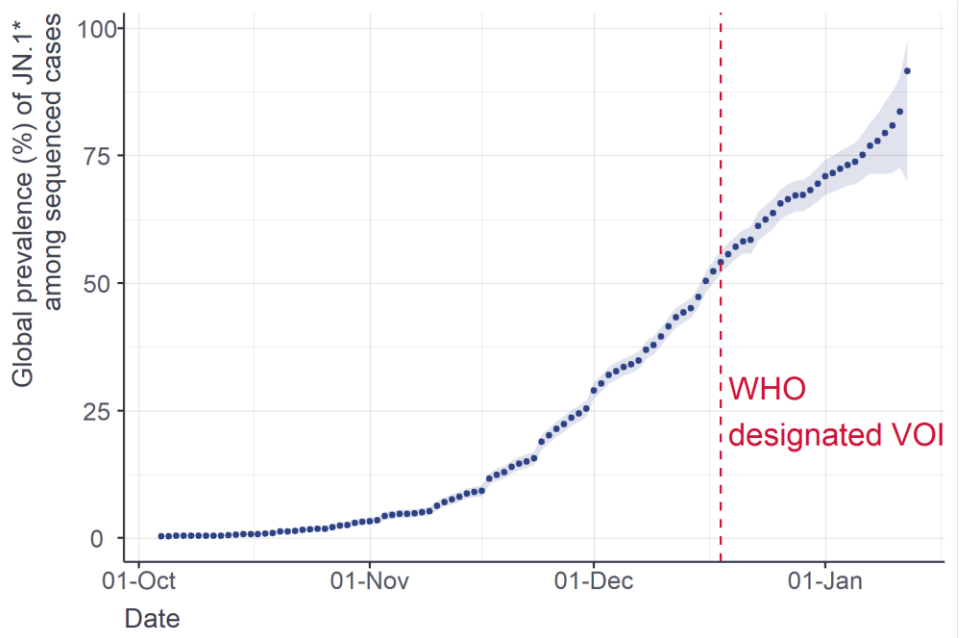


Figure 12: Global prevalence (%) of COVID-19 variant JN.1 among sequenced cases between October 1, 2023, and January 12, 2024[40]

Influenza

Influenza patterns and seasonal dynamics continue to evolve since the implementation and removal of non-pharmaceutical interventions during the acute phase of the COVID-19 pandemic. Epidemic patterns in seasonal influenza still differ from pre-COVID-19-pandemic trends. Many countries have displayed shorter cycles of seasonal influenza activity, although countries in the southern and northern hemispheres are observing a return to a more typical influenza seasonal timing and activity levels. For example, the onset of 2023-2024 influenza season in the United States was slightly earlier than the average of the pre-pandemic influenza seasons, and the magnitude of cases is in line with pre-pandemic trends. In the EU, the onset of influenza season this year has been more in line with pre-pandemic timing and activity levels in a number of countries. There has also been a more balanced mix of influenza A and B, compared to 2022 which saw relatively low influenza B circulating.

Other Respiratory Pathogens

Increasing trends of several other respiratory pathogens were documented in late 2023 across the northern hemisphere. The continued added burden of the ongoing COVID-19 pandemic has placed ongoing strain on hospitals for the 2023-2024 respiratory season in the northern hemisphere, substantially above pre-pandemic levels of ILI-related hospitalizations. Additionally, the United States observed a modest increase in childhood pneumonia cases, due to a range of respiratory pathogens, including *Mycoplasma pneumoniae* (MP) and respiratory syncytial respiratory virus (RSV). However, rates of pneumonia are largely consistent with pre-pandemic years. In early November, China reported a nationwide increase[44] in the incidence of respiratory diseases, primarily affecting children and attributed to co-circulation of known pathogens, particularly *MP.* The resurgence of MP[45] can be attributed to the multi-year epidemic cycles of MP that have previously been noted across countries in Europe and Asia, greater susceptibility of young children born during the last few years to respiratory pathogens as they were suppressed during the early stages of the pandemic, and increased rates of antibiotic usage since the onset of the pandemic which may contribute to increased antimicrobial resistance[46] of MP. In 2023, China reported high rates of macrolide resistance among MP isolate, warranting further monitoring and awareness for the potential to spread globally. Finally, the potential impact of previous SARS-CoV-2 infections, and resurgence of seasonal influenza and respiratory syncytial virus (RSV) on susceptibility to secondary bacterial infections warrants consideration for measures to reduce transmission of all pathogens that spread through respiratory modes more broadly.

Immunization and Therapeutics

Updated vaccines for COVID-19 are effective against currently circulating SARS-CoV-2 strains, but coverage is relatively low. Vaccine effectiveness studies show that the updated COVID-19 XBB-targeted vaccine[43] has a vaccine effectiveness of 63%, and that it is effective against circulating variants, including JN.1. The seasonal flu vaccine is overall well matched this season[47] (61% for Influenza A H1N1, 49% for influenza A H3N2, and 75% for influenza B

against infection). Data from RSV vaccine clinical trials[48] are showing an effectiveness of 82% among older adults and infants against severe illness. Overall uptake to respiratory disease immunizations is low in North America[49] and Europe[50], and as has been demonstrated with recent COVID-19 waves, necessary to continue to curb spread of the disease. Population groups with low coverage include young children, who have represented an outsized share of hospital burden. Other risk groups including those living in congregate settings and pregnant individuals are particular demographics to continue prioritizing. A new monoclonal antibody called nirsevimab was unanimously recommended by the United States Food and Drug Administration (FDA) panel[51] for the prevention of RSV in infants and young children. Historically, macrolides have been recommended to treat MP, however the use of macrolides has begun to subside due to a high rate of macrolide resistance exhibited by MP globally.

Vector-Borne Disease Trends in 2023

Vector-borne diseases (VBDs) are highly climate-sensitive, and the risk from these infections is changing worldwide in the context of climate change. Weather and climate are well-recognized drivers of tick and mosquito (vector) presence, distribution, and seasonality. Warmer temperatures are leading to expansion of the geographical range and seasonal duration of vector activity of public health importance. Throughout the report we have highlighted the most important events and a summary for dengue and malaria (vector-borne) in 2023.

Mosquito-borne Diseases

Other mosquito-borne disease events, such as zika and chikungunya, were also reported in 2023. One notable example, there was a geographic expansion of the zika virus (ZIKV) in India, with first historical cases confirmed in several states since 2021. A 2021 zika outbreak in the Trivandrum district, Kerala was at least 400km away from the cluster of cases reported in 2023 in the costal municipality of Thalassery[52] (Tellicherry), also in Kerala. Asymptomatic or subclinical cases of Zika virus can account for up to 80% of the cases, so it's likely under-diagnosed across countries with other vector-borne diseases (such as dengue and chikungunya) due to the overlapping symptoms and laboratory challenges across many under-resourced areas. An example of under-reporting in 2023 was highlighted likely undergoing in Indonesia, since an imported case with a history of travel to that country was reported in South Korea. This is likely representative of a larger outbreak in Indonesia. Furthermore, although the Zika virus is not endemic to South Korea, the vector that transmits the virus is present. This could allow for further disease transmission in the country if conditions are met. This is also a valuable insight into how diseases further spread.

High Prevalence of Chikungunya in the Americas

As of 31 December 2023, approximately 500,000 chikungunya cases and over 400 deaths had been reported worldwide. At least 26 countries reported confirmed cases from the Americas (16), Africa (5) and Asia (5).
The largest number of cases have been reported from the Americas, in South and Central America[53].
Chikungunya can spread to unaffected areas by infected travelers and wherever the vector is present with the potential of epidemics among naive populations. In Asia, India reported the highest number of chikungunya cases (93,465). While many countries in the Americas continued to report high case numbers, there were two unusual events related to chikungunya worth noting. The first was that Paraguay[54] reported an unprecedented number of cases and held the largest burden of deaths due to chikungunya in the region in 2023. Also, the first autochthonous chikungunya outbreak was documented in Uruguay[55]. These events support a growing concern that vector-borne diseases will continue to expand geographically.

Tick-borne Diseases

While not unexpected, aberration West Nile events occurred for the first time in areas that have not previously reported transmission was also reported in 2023. One example was highlighted in Pakistan[56] where the first lab-confirmed case of West Nile was reported in November 2023. In Pakistan, previous cases of WNv have been poorly documented, however, serological evidence in humans and vector competence for WNV in Pakistan has been reported as early as 1982. In recent years, WNv has been identified in horses and humans in Pakistan and its neighboring countries, Iran, Afghanistan, and India as a cause of human encephalitic disease. Like most of the world, Pakistan has seen an increase in mosquito-transmitted diseases (such as dengue, chikungunya, CCHF) in recent years, however the magnitude and distribution of these diseases are poorly understood as Pakistan lacks a nation-wide system for reporting disease.

Geographic expansion of ticks worldwide

The survival, distribution and density of ticks is determined by three key elements: microclimate, habitat, and hosts, all of which can be impacted by climate change. The public health risk from ticks is further influenced by human behavior (including precautionary behaviors) and how we access and manage the environment where ticks or key tick hosts are found. Like mosquito-borne diseases, there are continued trends of geographical expansion of ticks worldwide. There is likely under-surveillance of many tick-borne diseases, such as Lyme disease, however upward trends were seen in the USA when 2,406 cases[57] were reported which doubled 2021 at 1,132 cases. Other countries with high incidence reported in 2023 include Poland, Russia, Czech Republic, Lithuania, and Estonia.

Infectious Disease Mentions in Global Media

Media Mentions

Top 12 infectious diseases most mentioned in global media in 2023

Asia	Europe	Africa	Americas	Oceania
Influenza	**Influenza**	**Cholera**	**Influenza**	**Influenza**
Tuberculosis	Measles	Dengue	Cholera	Rabies
Mpox	Mpox	Marburg Virus	Chikungunya	Unknown Illness
Malaria	**Tuberculosis**	**Malaria**	**Rabies**	**Malaria**
Poliomyelitis	Dengue	Poliomyelitis	Tuberculosis	Cholera
Measles	**COVID-19**	Rabies	**COVID-19**	**Dengue**
Dengue	West Nile	**COVID-19**	Poliomyelitis	Pneumococcus
Nipah	Pneumococcus	Diphtheria	Malaria	Avian Influenza
COVID-19	**Rabies**	**Measles**	**Avian Influenza**	**COVID-19**
Cholera	Malaria	Tuberculosis	West Nile	Unknown Encephalitis
Pneumococcus	**Avian Influenza**	Ebola	Mpox	**Measles**
Rabies	Cholera	**Influenza**	**Dengue**	Tuberculosis

Event-based surveillance allows us to understand what diseases are being most discussed around the world and can give us clues to what infectious diseases are most concerning to the media and public. The above insights are provided by BlueDot, after analyzing 5,489,669 infectious disease name mentions from BlueDot's internal disease dataset of processed event-based surveillance articles between January 1 and December 31, 2023 (does not include social media mentions of infectious diseases).

Notably, influenza represented the highest media mentions in four of five regions, followed by COVID-19 and mosquito-borne diseases. Influenza-like-illnesses continued to represent a significant threat worldwide with co-circulation and the highly concerning scenario of continued pressure on health services that have yet to recover from the onset of the COVID-19 pandemic. There are also a high number of mentions regarding avian influenza, despite a small number of cases in humans in select countries being reported. This highlights the impact this

disease has had on animal populations and the potential for this zoonotic disease to become disruptive as it could lead human-to-human transmission, thus creating risks for greater outbreaks.

In addition, vector-borne disease mentions like malaria and dengue are being represented across the globe, highlight the changes in climate that are leading to vectors moving into northern regions, and causing local transmission cases to be seen for the first time in some places. In particular, the COVID-19 pandemic significantly disrupted malaria services, leading to a surge in both incidence and mortality rates, exacerbating already stalled progress against the disease, This, along with increasing changes in climate, continue to pose a substantial risk, particularly in vulnerable regions.

Finally, there are also relatively high numbers of mentions of vaccine-preventable diseases (poliomyelitis, diphtheria, measles, cholera) across the globe. These continue to have a high burden on many countries, particularly as reluctance to vaccines grows in some regions and others are still working to catch up to immunization regiments following the pandemic.

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