

Public Health Situation Analysis of Hurricanes Oscar, Rafael & Earthquakes in Cuba

Type of Emergency



Hurricane



Earthquake

Main Health Risks

- ✓ Water and foodborne diseases
- ✓ Respiratory diseases
- ✓ Vector-borne diseases
- ✓ Maternal and Neonatal health
- ✓ Immunization and Vaccine-preventable diseases
- ✓ Leptospirosis
- ✓ Non-communicable diseases
- ✓ Mental Health and Psychosocial (MHPS) conditions
- ✓ Trauma

Context

In less than a month, between 20 October and 10 November 2024, Cuba was impacted by two hurricanes — Oscar and Rafael — and two major earthquakes, causing widespread disruption to essential services and infrastructure.

On October 20, 2024, Hurricane Oscar, a Category 1 storm, made landfall near Baracoa in the province of Guantánamo, bringing extensive flooding and affecting over 1.4 million people, amid an unprecedented energy emergency marked by repeated disconnections of the national electrical system and widespread blackouts across the country (1). On 6 November, the powerful Category 3 Hurricane Rafael made landfall near Playa Mejana, in the province of Artemisa, exposing 3.5 million people to intense winds, cutting off electricity, disrupting water and health services, and leaving a trail of destruction across western Cuba including the capital Havana (2).

Shortly after, on 10 November, two earthquakes (magnitudes 5.9 and 6.8) struck near Granma province, compounding infrastructure damage and leaving thousands without access to electricity. Additionally, numerous healthcare facilities and 338 schools have been damaged, further complicating the situation (3). These consecutive events have created significant challenges for emergency response and recovery efforts across the most affected regions. Authorities are prioritizing the restoration of electricity and telecommunications, as well as the recovery of water supply and sanitation in the affected areas.

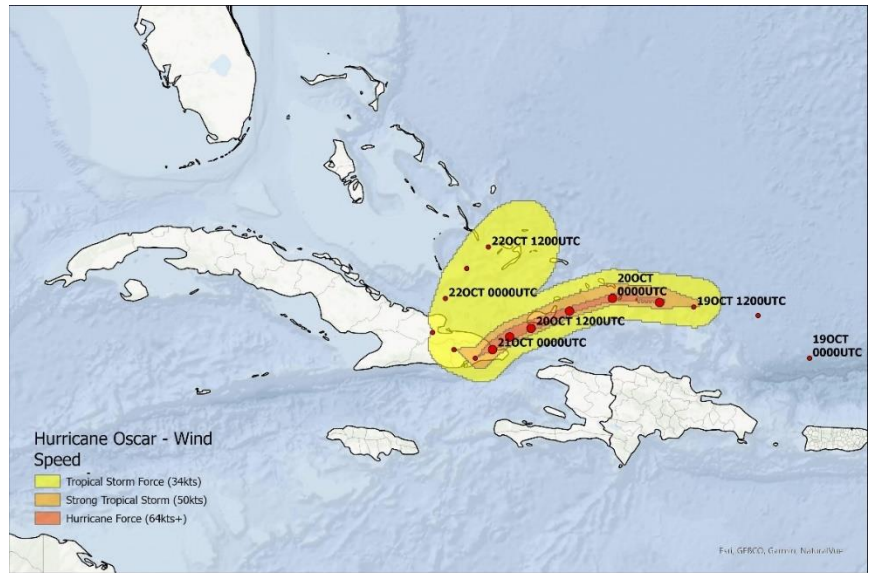
Hurricane Oscar (4–6)

On 20 October 2024, Hurricane Oscar made landfall in eastern Cuba as a Category 1 hurricane. The situation developed amidst a complex national energy situation compounding communications, and emergency response efforts. The province of Guantanamo was the most severely affected, with Hurricane Oscar generating more than 130 km/h winds while moving at a travel speed of only 4 km/h, causing it to remain in the province for over 24 hours. The municipalities of Baracoa, Maisi, Imias, and San Antonio del Sur are the territories with the most affected populations.

More than 1.4 million people in Cuba have been estimated to be affected by Hurricane Oscar, with 7 reported deaths and, about 478,000 people targeted for response activities. The storm is estimated to have affected more than 14,300 homes and essential services leading to a danger of roof collapse in affected buildings. Damage has been reported in more than 56 public health facilities and 150 schools, along with road infrastructure. About 84% of the water collection, treatment, and distribution systems in the four most affected municipalities of Guantanamo (Baracoa, Maisi, Imías, and San Antonio del Sur) were rendered non-functional. More than 15,000 hectares of crops are estimated to be affected, including local salt and coffee production, which could directly impact the livelihood of the population in the area and the local economy.

More than 72 hours after the event occurred the persistence of heavy floods impacted rescue efforts in hard-to-reach areas. The lack of electricity further affected access to drinking water, food, and health services. The complex situation in Guantanamo had caused part of the province to be in the alert phase even days after the rest of the country had returned to normalcy.

Map 1: Observed track of Hurricane Oscar over Cuba



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 Map production: PAHO Health Emergencies Department, Health Emergency Information and Risk Assessment Unit, GIS Team.
 Source: National Oceanic and Atmospheric Administration/National Hurricane Center, NHC GIS Archive - Tropical Cyclone Best Track for Hurricane Oscar. Miami: NOAA/NHC. 14 November 2024. Available from: https://www.nhc.noaa.gov/gis/archive_besttrack_results.php?id=al16&year=2024&name=Hurricane%20OSCAR

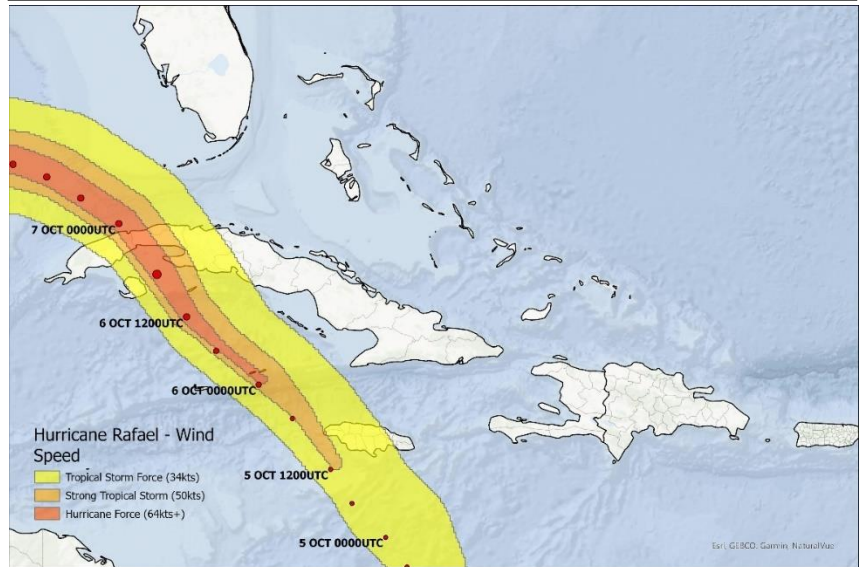
Source: National Oceanic and Atmospheric Administration/National Hurricane Center. NHC GIS Archive - Tropical Cyclone Best Track for Hurricane Oscar. Miami: NOAA/NHC. Available from: https://www.nhc.noaa.gov/gis/archive_besttrack_results.php?id=al16&year=2024&name=Hurricane%20OSCAR

Hurricane Rafael (2,3,7)

Hurricane Rafael made landfall in western Cuba as a Category 3 hurricane, on the afternoon of 6 November 2024, and continued from Playa Majana in Artemisa through the western regions of Artemisa and Mayabeque, including the capital, Havana. Almost 3.5 million people were exposed to the hurricane by the time it passed through the western and central parts of the island, in addition to the populations exposed in eastern Cuba to Hurricane Oscar, 3 weeks prior. Strong sustained winds of >185 km/h speeds were reported for over 3 hours in exposed areas, leading to disruptions in the national electricity system, affecting the provision of basic services. More than 260,000 people were evacuated in 7 provinces and special municipalities.

The province of Artemisa reported the greatest damage, across 11 municipalities. More than 98% of the population in Artemisa as well as 83% in Havana are without access to electricity. This has greatly impacted the delivery of drinking water, as most of the population in Havana relies on pumping stations for regular water supply. Around 200 health institutions have reported structural damage, of which 113 belong to Artemisa. Severe impacts have been reported in the agricultural sectors of Artemisa and Mayabeque, which are the main food suppliers to the capital city. Around 13,000 hectares of crops and 70,000 animals in poultry farms have reportedly been lost. Telecommunications have also been impacted, with Havana reporting damages to 495 telecommunication poles, and >70% of radio communications in Artemisa, Havana, and Mayabeque reportedly out of service. Transportation networks by road and air have been gradually reestablished, but maritime transport between Artemisa and Isla de la Juventud has continued to be suspended.

Map 2: Observed track of Hurricane Rafael over Cuba



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 Map producer: PAHO Health Emergencies Department, Health Emergency Information and Risk Assessment Unit, GIS Team.
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Source: National Oceanic and Atmospheric Administration/National Hurricane Center. NHC GIS Archive - Tropical Cyclone Best Track for Hurricane Rafael. Miami: NOAA/NHC. Available from: https://www.nhc.noaa.gov/gis/archive_besttrack_results.php?id=a118&year=2024&name=Hurricane%20RAFAEL

Key Figures – cumulative data associated with Hurricanes Rafael & Oscar



8
Deaths



493
Rescued



+2,200
Homes Damaged



+267,000
Evacuated

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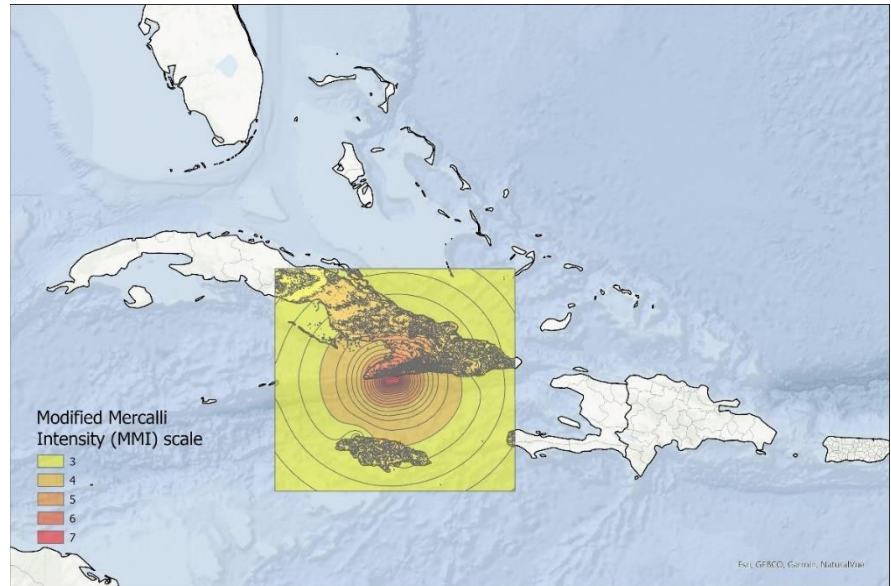
5.9 M and 6.8 M earthquakes (3,8,9)

On 10 November 2024, at approximately 15:50 UTC and 16:49 UTC, two earthquakes of 5.9 M and 6.8 M occurred over the sea, around 8 km off the south-eastern coast of Cuba. The epicenter was located 30 km south-east of Pilon, and 40 km south of Bartolome Masó, both municipalities in Granma province, which is the territory most impacted by the event. According to USGS reports, up to 39,000 people were exposed to very strong shaking, and more than 599,000 to strong shaking. According to media reports, effects were felt in the entirety of south-eastern Cuba, in the provinces of Santiago de Cuba, Guantanamo, Granma, Holguin, and Ciego de Avila.

Significant damage to buildings and infrastructure has been reported, with 200 partial and total collapses. In Granma, almost 14,000 people are estimated to be without access to electricity. The damaged buildings include health and education infrastructure, and buildings of historical value such as the 150 years old Cabo Cruz lighthouse. The greatest impact was in the south of Granma, but Bayamo, the province capital, as well as the neighboring province of Santiago de Cuba have also been affected.

The timing of the earthquakes, 20 days after the most recent hurricane to impact Cuba has complicated emergency response efforts. Guantanamo, the province impacted the most by Hurricane Oscar, and still recovering, still faces issues with access to drinking water, owing to damage to water pumping stations and aqueducts, compounded by the interruptions to the electricity supply. Although 4 injuries have been reported in preliminary estimates of this event, the impacts on people and their livelihoods have not been quantified.

Map 3: Epicenters of the 5.9 M and 6.8 M earthquakes in Cuba



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Map production: PAHO Health Emergencies Department, Health Emergency Information and Risk Assessment Unit, GIS Team.
Source: United States Geological Survey. M 5.9 - 35 km S of Bartolomé Masó, Cuba. Virginia: USGS. 14 November 2024. Available from: <https://earthquake.usgs.gov/earthquakes/eventpage/us7000nr0n/executive>

Source: United States Geological Survey. M 5.9 - 35 km S of Bartolomé Masó, Cuba. Virginia: USGS. 14 November 2024. Available from: <https://earthquake.usgs.gov/earthquakes/eventpage/us7000nr0n/executive>

Key Figures – cumulative data associated with earthquakes


0
Deaths


4
Injuries


+200
Damage to property/ homes

Human Health Risks in Cuba in the Context Hurricanes Rafael, Oscar & Earthquakes in the Next Three Months

Public Health Threat	Likelihood	Public Health Consequences	Level of Risk	Rationale
Water and foodborne diseases	Almost certain	Major	Very High	In the Caribbean subregion, approximately 1 in 49 people acquire foodborne illnesses every year as a result of consuming contaminated food or water. During crowded events/places, this incidence rises to 1 in 11 people. More than 40% of cases occur in children (10). Storm-driven flooding, as seen in the recent hurricanes and exacerbated by the earthquakes in Cuba, can contaminate water and food. The resulting lack of potable water and damaged infrastructure may lead to poor hygiene and sanitation and affect the ability of health facilities to provide care. Combined with overcrowding, these conditions can facilitate the occurrence of water and foodborne diseases, including diarrheal diseases and intoxications (11). Seven Cuban provinces face severe water shortages, with Artemisa (83%) and Havana (80%) most affected, while power outages and infrastructure damage in Mayabeque, Guantánamo, and Granma exacerbate the crisis (3).
Mental Health and Psychosocial conditions	Highly likely	Moderate	High	Hurricanes Oscar and Rafael, along with recent earthquakes, have devastated Cuba, disrupting livelihoods, food security, and displacing many people. This type of emergencies might contribute to individual, community and social problems, affecting mental health (12). Infrastructure damage has limited healthcare access, worsening mental health conditions, with stress, food insecurity, and violence exacerbating mental disorders. Symptoms of Post Traumatic Stress Disorder (PTSD), anxiety, and depression are the most reported mental health impacts following such disasters (13). Socio-environmental disasters and migration contexts cause significant physical, psychological, and social suffering in affected populations. The psychological and social effects of these events are acute in the short term but can also deteriorate the mental health and psychosocial well-being of affected populations in the long term (14). There is a need to focus mental health services not only in the immediate term (1-3 months) following the disaster, but also make efforts for long-term recovery, with follow-up extending over a year or more. (15)
Respiratory diseases	Highly likely	Moderate	High	Overcrowding in shelters and family homes used as refuges can increase the spread of pathogens responsible for these diseases. Additionally, infrastructure damage, reduced hand hygiene, and displacement can increase vulnerability to viral respiratory infections (16). Furthermore, increased allergens and air pollutants during debris cleaning may increase severity of respiratory diseases (17). Exposure to damp areas and the demands of reconstruction work are also significant risk factors for respiratory diseases (18).
Food insecurity	Likely	Major	High	Factors associated with food insecurity in the context of a natural disaster include food loss and damage, destruction of infrastructure and livelihoods, affecting food safety and exacerbating deficient nutritional states (19). The last report estimates a total of 17,779.8 ha. have been affected in Artemisa and Mayabeque, including plantain, cassava, vegetables, rice, beans, corn, soy, and sweet potato crops.

				Poultry farms were also impacted, with 21 farms and 2 warehouses in Artemisa, and 90 farms in Mayabeque (3).
Leptospirosis	Likely	Major	High	Although leptospirosis is not a disease found exclusively in regions with a tropical climate, its prevalence is higher in these areas. The Caribbean subregion, for example, has one of the highest incidence rates of the disease (20). The recent hurricanes Oscar and Rafael, alongside significant earthquakes, have caused widespread flooding and infrastructure damage in Cuba which can lead to contaminated fresh water, including flood sources and rainwater containing animal urine, poses a risk when used for drinking or bathing (21). Direct contact with contaminated soil through wounds and cuts can also lead to exposure. Historically, most cases of leptospirosis in the Caribbean occur during the rainy season (June to December) (22). Cuba has reported a total of 142 cases of leptospirosis in 2024 (23). The high case-fatality rate of the infection requires timely treatment, which could be difficult when routine health services face disruption (24).
Vector-borne diseases	Highly likely	Moderate	High	After the occurrence of a natural disaster such as hurricanes, floods or earthquakes, various risk factors for disease transmission arise, such as changes in the habitat of vectors, increased reproduction of these vectors and increased exposure to them, displacement of animals and changes in water storage practices (27,28). Usually, vector control activities are often interrupted (29). During natural hazards, the most important vector-borne diseases in the Americas are malaria, and dengue fever (27). Recent outbreaks of Oropouche fever have been reported in Cuba, with 555 confirmed cases identified through surveillance of non-specific febrile syndrome across 109 municipalities. Additionally, Cuba reported 985 dengue cases in the first half of 2024, with serotypes DENV-2, DENV-3, and DENV-4 circulating, and 10 severe cases, but no fatalities (30).
Non-communicable diseases (NCDs)	Likely	Moderate	High	Mortality due to non-communicable diseases in Cuba is primarily due to cardiovascular diseases, malignant tumors, chronic lower respiratory diseases, and diabetes mellitus, which together account for 68.0% of deaths. The trend for cancer is upward, and chronic kidney disease is emerging as a serious health problem. Cuba has a known baseline on risk factors, with hypertension and tobacco use being the primary ones related to mortality from NCDs (31). Morbidity and mortality due to non-communicable chronic diseases tend to be elevated after the occurrence of a natural disaster. Disruptions in health services, the availability of routine medical supplies and damage to health structures can aggravate the condition of vulnerable populations, leading to an exacerbated increase in symptoms. The lack of adequate care and treatment, even for a short period, could increase the risk for patients with NCDs (32).
HIV, tuberculosis, and other chronic infections	Likely	Moderate	High	The incidence of HIV in Cuba has been on a declining trend since 2010, with about 1500-2400 new infections in 2022, and about 37,000-47,000 people living with HIV (PLHIV) currently in the country. About 75% of PLHIV in Cuba are aware of their HIV status and 67% are on treatment. Anti-retroviral coverage ranges from 86.5% - 92.4% among high-risk populations (sex workers, men who have sex with men, transgender people) (33). Cuba has seen an 11% increase in the incidence rate of tuberculosis from 2015-2023, with a 17% decrease in TB deaths. The total incidence of TB cases in 2023 ranged from 740-1,000, among which multi-drug or rifampicin-resistant TB

				<p>incidence ranges from 6-68 (0.06-0.62 per 100,000 people). Around 87% of new and relapsed cases are on treatment coverage, with 85% of new or relapse cases in 2022 having successfully completed the course of treatment. 7.7% of TB patients have a positive HIV status, while 100% of these patients are on anti-retroviral treatment (34).</p> <p>Populations displaced after natural disasters often live in temporary shelters or overcrowded areas, where access to basic health and sanitation services can be limited (35). The continuity of proper treatment for the infectious chronic diseases can be compromised, as disasters often damage health infrastructure and interrupt the provision of medical services. This could aggravate conditions, and results in rebound of HIV viral load or tuberculosis reactivation with the increase of risk of transmission. Also, sexual violence could occur in these closed settings, so proper post exposure prophylaxis programs should be in place.</p>
Neonatal and maternal diseases	Likely	Moderate	High	<p>In Cuba, between 2000 and 2021, infant mortality increased from 4.9 to 7.6 deaths per 1000 live births, an increase of 55%. The maternal mortality ratio in 2023 was estimated at 38.7 deaths per 100 000 live births, representing a 3.25% reduction compared to the estimated value in 2020 (40 per 100.000 births)(36,37). Pregnant women are particularly vulnerable during disasters. Adverse conditions and limited access to medical treatment can lead to obstetric complications, increasing the risk of neonatal and infant mortality, given the hospitals that have been affected in Artemisa, Mayabeque and Havana (38,39). Additionally, maternal stress resulting from exposure to natural disasters can elevate the risk of perinatal complications (40).</p>
Trauma	Highly likely	Minor	High	<p>Hurricane-related traumatic events most reported are tree-related injuries, falls, motor vehicle crashes, and injuries due to power outages. Sharp objects can be present in floodwaters and debris. Injuries caused by these objects and exposed to water can facilitate the emergence of other diseases, such as tetanus (41). The largest proportion of reported injuries occur during recovery and rebuilding (13). Preliminarily, as a result of the earthquakes in Cuba, press reports confirm four injuries, about 200 partial collapses and several total collapses, although the impacts on people, livelihoods and materials are still to be quantified (3).</p>
Vaccine-preventable diseases	Unlikely	Moderate	Moderate	<p>Cuba has consistently maintained a national coverage rate of >98% for Polio, DPT-containing vaccine, and the measles-containing vaccine from 2010-2023. However, variations in coverage might occur at subnational levels, which is particularly important in areas with vulnerable populations (25). Displaced populations are susceptible to outbreaks of communicable diseases, including vaccine-preventable ones. There is a heightened risk of facilitated transmission of diseases such as meningitis and measles, particularly in shelters and displaced populations due to overcrowding. Populations with historically reduced access to healthcare services and vaccination are especially vulnerable (26). Interruptions to routine immunization services exacerbate the risk to these vulnerable populations.</p>
Violence	Likely	Moderate	Moderate	<p>Lack of access to services and scarcity of essential goods, including food and potable water, increase stress and tensions within communities (42). During these periods of stress, violence against women tends to increase. Women are often affected by the scarcity of food and water, often bearing the brunt of feeding their families (43). Considering According</p>

			Low	to a 2019 survey, 26.6% of women in Cuba were victims of abuse by their partners, but only 3.7% sought help (44).
Drowning	Unlikely	Minor	Low	Floodwaters can pose a risk of drowning to everyone, regardless of swimming ability. Shallow water that moves quickly can be deadly, and even shallow standing water can pose a danger to young children (41).

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.

Water and foodborne diseases (3)

In several provinces of Cuba, access to water is severely impacted. In Artemisa, 83% of the population lacks water, while Havana is facing similar issues with 80% of its residents without service. Mayabeque municipalities such as Batabanó, Melena del Sur, and Nueva Paz are particularly affected by power outages, disrupting water supply. Guantánamo's Imías municipality has experienced a 70% collapse of its hydraulic network, and Granma's Guanito Aqueduct in Niquero suffered earthquake-related damage.

The disruption of water supply in these affected Cuban provinces can significantly increase the risk of waterborne and foodborne diseases. With large portions of the population lacking access to clean water, people may resort to unsafe sources, such as contaminated water from wells or rivers, which can lead to the spread of pathogens like *E. coli*, cholera, and other gastrointestinal diseases.

Additionally, the lack of water for sanitation purposes increases the risk of poor hygiene practices, contributing to the transmission of these diseases. The damage to water infrastructure in areas like Imías and Granma may exacerbate these issues, as residents may be forced to rely on limited or unsafe water sources for drinking, cooking, and hygiene.

Foodborne diseases could also become more prevalent if proper food storage and hygiene are not maintained due to water shortages. Without adequate water for cleaning or proper refrigeration, food may become contaminated or improperly prepared, leading to diseases like Salmonella or Hepatitis A.

The ongoing water crisis creates a favorable environment for the spread of water and foodborne diseases, heightening public health concerns in the affected areas.

Mental Health and Psychosocial (MHPS) conditions (45)

As of 2019, in Cuba, the burden on mental health across the lifespan is marked by varying patterns in different age groups. In children under 5 years old, autism and epilepsy account for most mental health conditions. From 5 to 15 years old, conduct disorders, anxiety disorders, and headaches become more prominent. In young adults, common disorders such as anxiety, depression, self-harm, and somatic symptom disorder account for 45% of the burden, with headaches, substance use disorders (mainly alcohol), and severe mental disorders (schizophrenia, bipolar) also contributing significantly. In older adults, neurocognitive disorders like Alzheimer's disease dominate, reaching 50% of the burden by age 80 and remaining above 70% after 85. Non-communicable diseases (NCDs) consistently represent over 70% of the disease burden across the lifespan.

The recent hurricanes Oscar and Rafael, coupled with significant earthquakes, could have a profound impact on Cuba's mental health landscape. The widespread destruction, displacement, and loss of livelihoods have led to increased stress, anxiety, and depression among the population. Disruptions to healthcare services and limited access to mental health support further exacerbate these challenges. As communities struggle to recover, it is crucial to prioritize mental health and psychosocial support interventions and provide adequate support to those affected by these devastating events.

Respiratory diseases

In 2023 in the Caribbean, influenza activity rose to medium activity levels and the respiratory syncytial virus (RSV) activity increased at low levels. Meanwhile, the SARS-CoV-2 activity has increased, circulating at moderate levels (46). During EW 40 to 44 2024, Influenza-Like Illness (ILI) cases remain low, while Respiratory Syncytial Virus (RSV) positivity has increased sharply in recent weeks. Severe Acute Respiratory Infection (SARI) cases are also low. Influenza activity fluctuates at low levels, primarily A(H3N2) and A(H1N1) pdm09 strains. RSV has seen a significant rise in several countries. Severe Acute Respiratory

Syndrome Coronavirus 2 (SARS-CoV-2) activity continues to decline (47). Between 2015 and 2019, the Caribbean countries had an average mortality rate of 19 per 100,000 population of respiratory viruses.

In Cuba, the damage to health facilities caused by Hurricane Rafael, particularly in Artemisa (119 facilities affected, 59.5% of the total damage in the country), Havana, and Mayabeque, has severely disrupted healthcare services, including those for respiratory diseases (3). The loss of infrastructure, such as roofing, windows, and hydraulic systems, can lead to poor ventilation, water contamination, and overcrowded conditions, increasing the risk of respiratory infections. The inability to access proper medical care and the displacement of people to shelters can further contribute to the spread of acute respiratory diseases, particularly among vulnerable populations. The quantification of the damage caused by the recent earthquakes in the eastern region has not yet been completed, but they could affect at least ten other facilities, potentially exacerbating the situation.

Due to the prioritization of emergency management efforts, the surveillance of diseases caused by respiratory viruses can be compromised, resulting in gaps in monitoring epidemiological changes and viral circulation trends. This hinders the assessment of transmission patterns, clinical severity, and the impact on the health system, as well as making it difficult to identify risk groups susceptible to developing respiratory complications. Additionally, while there are measures in place to prevent the transmission of respiratory viruses, during an emergency many people may be housed in shelters, which hinders the ability for social isolation among symptomatic patients and amplifies the spread of disease.

Leptospirosis

The Caribbean and Atlantic Ocean Islands subregion has one of the highest incidences of leptospirosis (20). During extreme weather events, there is an increase in infectious diseases, such as leptospirosis, which is a disease with epidemic potential in scenarios associated with rainy periods. Cuba has reported a total of 142 cases of leptospirosis in 2024 (23). The high case-fatality rate (6.85%) of leptospirosis requires adequate and timely treatment, which could be difficult in low resource settings, particularly when health services are disrupted in the case of natural disasters (24).

Leptospirosis cases are typically recorded during the rainy season, with studies indicating a positive correlation between flooding events and the incidence of the disease. Flooding often leads to the displacement of rodent populations, thereby increasing human exposure to *Leptospira* bacteria and facilitating its spread in the environment. Consequently, emergency situations experienced by countries following the hurricane can result in an increased occurrence of leptospirosis cases (48).

Immunization and vaccine-preventable diseases

There is varied coverage of routine immunization among the countries of the Caribbean and Atlantic Ocean Islands subregion. There have been fluctuations in these trends in the last 3 years as a result of the COVID-19 pandemic, with a rebound in routine immunization coverage observed in 2023 (49). In Cuba, the National Immunization Program, through systematic and sustained vaccination over time, has had a decisive impact on the Cuban population's health indicators. Among its most notable results is the elimination of six immuno-preventable diseases and the control of other diseases like hepatitis B, meningococcal meningitis, and tetanus, which do not constitute a public health problem. Cuba has consistently maintained a national coverage rate of >98% for Polio, DPT-containing vaccine, and the measles-containing vaccine from 2010 onwards. The use of the MMR (Measles, Mumps, and Rubella) vaccine, which led to the elimination of measles and rubella, and the disappearance of post-mumps meningoencephalitis in Cuba since 1989, has been an important achievement by the country in order to guarantee the health of children and adolescents. Since the 2000s, UNICEF contributes with the annual purchase of 70,000 to 100,000 doses of the MMR vaccine, which guarantees 100% coverage for children up to 2 years of age (25,50).

However, gaps in coverage remain among multiple cohorts of children who have missed vaccinations and remain susceptible to these vaccine-preventable diseases. Disruptions in routine immunization services can occur due to the closure of health centers, inconsistent supplies of vaccines, unstable cold chain mechanisms because of power outages, and diversion of staff to emergency duties. Consistent disruptions in this coverage with a cohort of susceptible children in the background may lead to outbreaks of vaccine-preventable diseases in the coming months.

Vector-borne diseases

There has been an increase in the number of reported dengue cases in the Caribbean subregion since late 2023, with a >300% increase in new cases reported in EW 25 of 2024, relative to the same period in the last year, and a 190% increase relative to the last 5-year average (51). The use of storage containers for drinking water in the short term, as well as stagnant water in damaged infrastructure, are conducive to the breeding of dengue vector mosquitos in the coming weeks.

Recent outbreaks of Oropouche fever have been reported in parts of South America, and most recently in Cuba. In May 2024, samples from 89 cases with non-specific febrile syndrome from the provinces of Santiago de Cuba and Cienfuegos, where a sudden increase in cases of nonspecific febrile syndrome of unknown etiology was detected, were processed by RT-PCR OROV by the national reference laboratory of the Institute of Tropical Medicine “Pedro Kouri” (IPK), confirming the identification of OROV in 83% (n= 74) of these samples. Since this first identification and up to EW 39, 555 confirmed cases of Oropouche were reported. Cases continue to be identified through surveillance for non-specific febrile syndrome, with cases recorded in 109 municipalities in the 15 provinces of the country. The provinces of Havana (n= 170 cases), Santiago de Cuba (n= 74 cases), Pinar del Rio (n= 41 cases), and Cienfuegos (n= 36 cases) accounted for 58% of confirmed cases (30,52).

On 6 August 2024, the Cuba IHR NFP reported that during the first semester of 2024, the total number of dengue cases was 985, with circulation of virus serotypes DENV-2, DENV-3, and DENV-4. The number of severe cases reported was 10 and no fatal cases were recorded (30).

The breakdown of routine vector control measures in many of the severely affected areas, the temporary suspension of routine medical services in some parts of the countries, and environmental conditions suitable for the breeding of different mosquito species could facilitate outbreaks of various vector-borne diseases. This highlights the need for additional surveillance efforts, as well as for vector control measures, to be prioritized.

Non-communicable diseases (NCDs)

The Caribbean and Atlantic Ocean Islands have a high burden of non-communicable diseases, with NCDs accounting for more than 70% of deaths that occur in the subregion. Congenital anomalies, skin and subcutaneous disorders, asthma, and anxiety disorders account for the top causes of DALYs among the young adult population (53). Among older adults, cardiovascular disease, diabetes, and neoplasms contribute to the most common cause of DALYs in these countries (54).

Mortality in Cuba is determined by four major health issues: cardiovascular diseases, malignant tumors, chronic lower respiratory diseases, and diabetes mellitus, which together account for 68.0% of deaths. The trend for cancer is upward, and chronic kidney disease is emerging as a serious health problem. Cuba has a known baseline on risk factors, with hypertension and tobacco use being the primary ones related to mortality from NCDs (31).

This combination of the existing burden of disease and risk factors, while only a limited population has access to treatment, means that any disruptions in the routine supply of drugs and services in the context of heightened stress due to displacements and lack of shelter could have a greater-than-expected impact on NCD morbidity and mortality.

HIV, tuberculosis, and other chronic infections

The incidence of HIV in Cuba has been on a declining trend since 2010, with about 1500-2400 new infections in 2022. Men over 15 years of age comprise the largest proportion of new cases. Cuba has one of the lowest HIV prevalence rates in the world, at 0.05% in the Americas, with about 37,000-47,000 people living with HIV (PLHIV) currently in the country. About 75% of PLHIV in Cuba are aware of their HIV status and 67% are on treatment. Anti-retroviral coverage ranges from 86.5% - 92.4% among high-risk populations (sex workers, men who have sex with men, transgender people). Cuba was the first country to receive official recognition from the WHO for eliminating mother-to-child transmission of HIV. Cuba's HIV/AIDS program includes free, universal health care, a coordinated national strategy, and antiretroviral therapy for all people with HIV (33,55).

Cuba has seen an 11% increase in the incidence rate of tuberculosis from 2015-2023, with a 17% decrease in TB deaths. The total incidence of TB cases in 2023 ranged from 740-1,000, among which multi-drug or rifampicin-resistant TB incidence ranges from 6-68 (0.06-0.62 per 100,000 people). Around 87% of new and relapsed cases are on treatment coverage, with 85% of new or relapse cases in 2022 successfully completing the course of treatment. 7.7% of TB patients have a positive HIV status, while 100% of these patients are on anti-retroviral treatment (34).

The impact of the 2010 earthquake in Haiti on HIV services was described by Waldorf et al., showing immediate declines in HIV testing, initiation of antiretroviral therapy (ART), and distribution of ART at PEPFAR-supported clinics. Services recovered to pre-earthquake levels within six months post-earthquake. Similar effects can be expected in Cuba, provided health services are restored on a priority basis (56). To this must be added the current lack of anti-tuberculosis drugs in the programme, which could influence an increase in transmission.

Maternal and neonatal health

Both maternal and neonatal mortality can be significantly affected in emergency situations. Compromised health infrastructures and the interruption of essential services can reduce the ability to provide adequate obstetric and neonatal care. During a disaster, even in areas where prenatal care was available, the rate of inadequate prenatal care could increase (57). In addition, the physical and psychological stress associated with the experience of a natural disaster can increase complications during pregnancy and childbirth, negatively affecting both mothers and newborns.

The COVID-19 pandemic has significantly impacted health systems and services, resulting in the loss of promising advances made in recent years. The Latin American and Caribbean Region reported one maternal death every hour in 2020, bringing the maternal mortality rate in the Region back to the levels reported 20 years ago (58). In Cuba, between 2000 and 2021, infant mortality increased from 4.9 to 7.6 deaths per 1000 live births, an increase of 55%, and has been maintained at over 7 deaths per 1000 live births until 2023. The maternal mortality ratio in 2020 was estimated at 39.3 deaths per 100 000 live births, representing a 16.5% reduction compared to the estimated value in 2000 (36,37).

Health Systems Impact (3,4,39)

Health systems have been severely impacted by the series of events that occurred in Cuba. The impacts of each of the hurricanes were felt in different parts of the country, with the earthquake complicating response efforts in eastern Cuba. Hurricane Oscar caused the most damage to health infrastructure in Guantanamo province, with damage to roofs leading to loss of medical and dental equipment, and medical supplies. Reports indicate damage to 56 health institutions, including 4 polyclinics, 33 family doctors' offices, and the Octavio de la Concepción and Pedraza General Hospital in Baracoa, which is

the municipality that saw the most damage in Guantanamo. In the Baracoa municipal hospital, damage has been reported in sterilization areas, pregnant patients’ wards, adult and pediatric intensive care units, administrative areas, and water supply systems.

In the aftermath of Hurricane Rafael, the province of Artemisa saw the most damage to health infrastructure, with 119 health institutions affected, including 4 hospitals and 16 polyclinics suffering severe damage. Mayabeque province reported 17 health facilities with structural damage, particularly to roofs, including 1 hospital and 2 polyclinics. In addition, the capital, Havana, reported damage to 12 hospitals and 7 polyclinics, with a total of 39 institutions damaged by the hurricane. As part of the response efforts, Pinar del Rio and Matanzas provinces were ready to receive patients from these affected areas.

The occurrence of the two earthquakes 20 days after the impact of Hurricane Oscar has complicated response efforts in the eastern part of the country. The province most affected was Granma, with the capital Bayamo reporting the most damage to infrastructure. While no injuries to health personnel were reported because of the earthquake, damage to walls were reported in 5 hospitals and 4 polyclinics in Bayamo, Pilon, Bartolome Maso, and Jiguaní municipalities. Minor damages to walls have also been reported in the Juan de la Cruz Martinez North Children’s Hospital in Santiago de Cuba.

The structural damage to hospitals is exacerbated by the loss of electricity in most parts of the affected provinces, as well as the capital. This affects both the running of the health facilities, as well as the availability of clean water since the majority of the water supply requires electricity to the water purification plants and pumping systems. Damage to road networks and air and maritime travel has also been reported in affected provinces, which directly impacts the delivery of essential health supplies, routine medications, and relief supplies. These disturbances to routine healthcare - diagnostic services, maternal and child health, family planning services, regular supplies of vaccines, and medications for chronic illnesses and non-communicable diseases, can lead to diminishing health outcomes.

Surveillance

Surveillance continues to be an area of concern, with limited information available on the situation in shelters in the most affected areas. According to anecdotal information from first responders in the field, there are reported increases in respiratory illnesses in all three provinces after the hurricane, though formal surveillance data is currently lacking.

PAHO/ WHO Response (3,7)

	Official sector	PAHO / WHO	Other agencies
Health	<ul style="list-style-type: none"> The Ministry of Public Health reported that the protocols established for earthquake cases are being complied with and that the necessary aid for the affected territories is being evaluated. In Granma, health personnel were activated to care for vulnerable and bedridden people who require help or transfer to safe places and hospitals. In-hospital facilities, the established protocols are followed. 	<ul style="list-style-type: none"> Mobilized and delivered vital supplies, including emergency health care kits for 3 months, 28 trauma care backpacks, and 32 rolls of tarpaulins to protect supplies to health centers on 13 November 2024. In the process of acquiring emergency relief items to restore the operation of health institutions with CERF funds mobilized, such as generators, 	<p>UNFPA Consultations were held to increase the already approved internal emergency funds (170,000) by USD 82,000 in order to cover the needs of pregnant women and other vulnerable groups with hygiene kits.</p> <p>UNICEF In the process of acquiring 64 basic kits of medicines to serve 64,000 people for 3 months with</p>

	<ul style="list-style-type: none"> • In Pilón, a field hospital has been created in areas of the Félix Lugones Ramírez health institution. Patients are in a safe area and medical services are reinforced for the comprehensive care of patients. The necessary medicines and medical, technical and nursing staff are available for the comprehensive care of patients. • Also, in Pilon, groups of health workers are touring the neighborhoods to check the state of the population. • Public health authorities monitor the supply of water, the operation and coverage of generators, the availability of gas and oxygen, and the organization of services in hospitals and polyclinics. • In the western region, health services are maintained with vitality to cover urgent and emergency matters in the affected territories. The damaged institutions adequate their services to continue quality medical care to the population. • Working groups of the Ministry of Public Health were created to visit the areas affected by the hurricane and guarantee accompaniment in the recovery work. 	<p>water pumps, water tanks, Aquatabs, Chlorine Residual Meter with DPD, diagnostic rapid tests, vector-control supplies and other items for communicable disease surveillance and control.</p>	<p>emphasis on maternal and child health in the most affected areas.</p>
<p>Food Security and Nutrition</p>	<ul style="list-style-type: none"> • Food is being distributed in the territories affected by the earthquakes in eastern Cuba. • The authorities guarantee care for people in vulnerable conditions, through the Family Care Systems • Milk is distributed for children from 0 to 1 year old in Pinar del Río, Artemisa, Havana and Mayabeque. • Intense work is being done to recover the crops that have fallen in the fields. National authorities advised to start an intense planting campaign to guarantee the supply of agri-food products as soon as possible. • Identification of needs to recover the porcine program in the affected provinces. 		<p>FAO</p> <ul style="list-style-type: none"> • FAO activated its internal emergency response mechanisms and is mobilizing its own resources or redirecting existing funds to support the affected territories. <p>PMA</p> <ul style="list-style-type: none"> • WFP remains in dialogue with national and local authorities to support the most affected populations from pre-positioned food and non-food resources. • The delivery of rice, peas and oil continues throughout the province of Guantánamo, as an immediate response during the

			first month, to the impact of Hurricane Oscar.
WASH	<ul style="list-style-type: none"> • Work continues on the restoration of the electricity service and with it the possibility of supplying water to populations without service. • Alternatives are being sought, such as water distribution by tanker trucks or from community water access points. • In Imías, four tanker trucks (pipes) are used in different parts of the municipality. In communities such as El Rincón, Cardonal, El Canal and Yacabo Abajo, easily accessible tanks have been installed so that residents can have water, mainly for cooking food and other essential uses. Other communities receive water in bottles. 		<p>UNICEF</p> <p>Water and Hygiene Supplies:</p> <ul style="list-style-type: none"> • 3,000 10-liter tankettes, 14 water tanks (5,000 and 10,000 liters), and 920 chlorinator tablets delivered to municipalities in Guantánamo (Imías, San Antonio del Sur, Baracoa, Maisí). • 10 additional water tanks (8 of 5,000 liters, 2 of 10,000 liters) and 1,024 hygiene kits for 8,000 people. <p>Support for Water Supply:</p> <ul style="list-style-type: none"> • 20 solar-powered pumping systems, cables, hoses, and supplies purchased in coordination with INRH to support affected communities in Guantánamo and Artemisa. <p>Ongoing Purchases:</p> <ul style="list-style-type: none"> • Acquiring 2,200 family hygiene kits to benefit approximately 11,000 people for 1 month in the most affected municipalities. <p>Portable Water Treatment Plants:</p> <ul style="list-style-type: none"> • 3 pre-positioned plants, including one in Havana, ready for use in the response, in coordination with INRH.
Housing, shelter and Early Recovery	<ul style="list-style-type: none"> • Electricity coverage has been brought to 95.6% of electricity coverage in Havana and 89.7% in Mayabeque after the collapse of the national electrical energy system during the passage of Hurricane Rafael. • As power has been restored in the provinces, the base stations that were turned off have begun to provide mobile services in the localities. • In the case of the two fallen towers in the municipalities of Mariel and 		

	Guanajay, the necessary resources and personnel were transferred to begin the actions to restore the infrastructure.		
Overall	<ul style="list-style-type: none"> The United Nations country team in Cuba is in close communication with the Ministry of Foreign Trade and Investment, the main counterpart of the United Nations System (UNS) in the country. Together, they are coordinating actions for a possible expansion of the Action Plan, consolidating immediate response and recovery efforts into a single document to address the impacts of hurricanes Oscar and Rafael, which hit eastern and western Cuba in a span of less than three weeks. The Office of the Resident Coordinator will be applying for an Emergency Cash Grant (ECG). The Office for the Coordination of Humanitarian Affairs (OCHA) has two people deployed in Havana to support coordination and information management and will be reinforcing the presence with an additional person in the following days. 		

Priority impacts / needs (3)

	Needs
WASH	<p>Artemisa:</p> <ul style="list-style-type: none"> 83% of the population lacks access to water supply. <p>Mayabeque:</p> <ul style="list-style-type: none"> Batabanó, Melena del Sur, and Nueva Paz face major electricity service disruptions, hindering water supply. Quivicán also affected. <p>La Habana:</p> <ul style="list-style-type: none"> 80% of the population lacks water service. Most affected municipalities: La Lisa, Marianao, Playa, Boyeros, Arroyo Naranjo. <p>Guantánamo:</p> <ul style="list-style-type: none"> 70% collapse of the local hydraulic network in Imías, affecting all pumps. <p>Granma:</p> <ul style="list-style-type: none"> Damage to the elevated tank piles of the Guanito Aqueduct in Niquero due to the earthquake.
Food Security and Nutrition	<p>General Agriculture Impact:</p> <ul style="list-style-type: none"> Widespread damage in agriculture, fishing, poultry, and warehouses in Artemisa and Mayabeque. Strong impacts on the pig sector, affecting large producers and pork supply. Artemisa: <p>Crop Damage:</p> <ul style="list-style-type: none"> Significant losses in banana, cassava, vegetables, rice, beans, corn, and sweet potato. Poultry: 21 farms and 2 warehouses affected. Other: Beekeeping facilities and 174 establishments, including 74 wineries and shops, impacted. <p>Mayabeque:</p> <ul style="list-style-type: none"> Crop Damage: 2,085.3 ha affected (75% of total crops), including bananas, cassava, vegetables, and fruit trees.

	<ul style="list-style-type: none"> • Poultry: 40 poultry houses affected.
<p>Health</p>	<p>General Impact:</p> <ul style="list-style-type: none"> • 200 health facilities are reported with damage of different types and intensity, including 29 hospitals, 47 polyclinics, 156 family doctor's offices, and 69 other types in the seven provinces affected by the disasters in the east and west of the country. <p>Main Types of Damage:</p> <ul style="list-style-type: none"> • Loss of carpentry and glassware. • Detachment of blankets and roof coverings. • Damaged false ceilings. • Affected hydraulic networks. <p>Artemisa:</p> <ul style="list-style-type: none"> • 119 health facilities affected (59.5% of the total national damage). <p>Mayabeque:</p> <ul style="list-style-type: none"> • 17 health facilities affected <p>La Habana:</p> <ul style="list-style-type: none"> • 39 health facilities affected <p>Granma:</p> <ul style="list-style-type: none"> • No injuries to patients or healthcare workers. • Wall cracks in five hospitals (e.g., Carlos Manuel de Céspedes in Bayamo). • Wall cracks in four polyclinics (Buey Arriba, Guisa, Bayamo). <p>Santiago de Cuba:</p> <ul style="list-style-type: none"> • Affected 6 institutions in 3 municipalities: Guamá (1 nursing home, 1 family doctor's office and 1 pharmacy); Palma Soriano (1 hospital) and Santiago de Cuba (2 hospitals). <p>Las Tunas:</p> <ul style="list-style-type: none"> • Minor damages in policlinic 14 de Julio, Jobabo municipality.
<p>Shelter</p>	<p>Pinar del Río:</p> <ul style="list-style-type: none"> • Significant electricity deficit due to fallen transmission networks linking with Artemisa. <p>La Habana:</p> <ul style="list-style-type: none"> • 460 collapses reported (total and partial), mainly light roofs, walls, and stairs. • Mobile service availability: 65%. <p>Artemisa:</p> <ul style="list-style-type: none"> • 4,933 homes damaged (estimate to rise after full assessment). • 98.5% of electric customers without power. • 68% of mobile services affected. <p>Mayabeque:</p> <ul style="list-style-type: none"> • 660 homes with significant damage, including 63 total collapses; 99 state institutions affected. • Mobile services at 65% availability.

- Quivicán municipality without electricity.

Granma:

- Major building damage in Pílon, Niquero, Media Luna, Campechuela, Bartolomé Masó.
- Severe damage to housing, education, health, TV, and heritage infrastructure.
- 14,000 customers without power, 69% still without service as of Nov. 11.
- Damage to 19 transformers and 3 lines.
- Cabo Cruz Lighthouse in Niquero affected by cracks.

Santiago de Cuba:

- Facade and interior damage to homes due to earthquakes.

Guantánamo:

- Imías: 11 buildings affected by soil and stones from floods; 4 homes enabled, 7 still buried.

Appendix 1. Risk Assessment Methodology

Table 1. Risk matrix

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		Minimal	Minor	Moderate	Major	Severe	
	Almost certain		Green	Yellow	Orange	Red	Red
Highly likely		Green	Yellow	Orange	Red	Red	
Likely		Green	Yellow	Orange	Orange	Red	
Unlikely		Green	Green	Yellow	Orange	Orange	
Very unlikely		Green	Green	Yellow	Orange	Orange	
		Magnitude					
	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?		

Source: World Health Organization. Public Health Information Services. Geneva: WHO; 2018. Available from: <https://healthcluster.who.int/publications/m/item/public-health-situation-analysis-standard-operating-procedures>

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