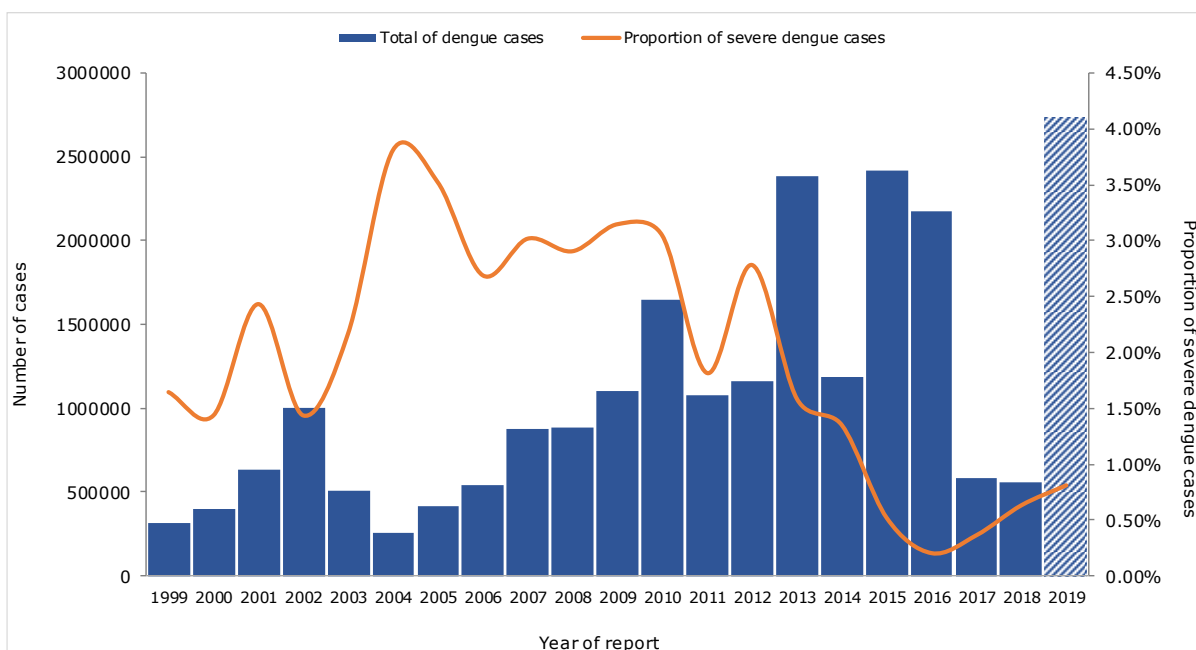


Situation summary

In the Region of the Americas, between epidemiological week (EW) 1 and EW 42¹ of 2019, a total of 2,733,635 cases of dengue (280 cases per 100,000 population) have been reported, including 1,206 deaths. Of the total cases, 1,217,196 (44.5%) were laboratory-confirmed and 22,127 (0.8%) were classified as severe dengue. The reported case-fatality rate was 0.044%.

The number of cases reported in 2019 as of EW 42 (2,733,635) is the largest recorded in the history of dengue in the Americas, exceeding by 13% the number of cases reported in the epidemic year of 2015 (**Figure 1**). In 2019, the proportion of severe dengue (0.8%) has exceeded that observed in the previous four years.

Figure 1. Distribution of reported dengue cases and proportion of severe dengue cases, by year of report. Region of the Americas, 1999-2019 (up to EW 42 of 2019).



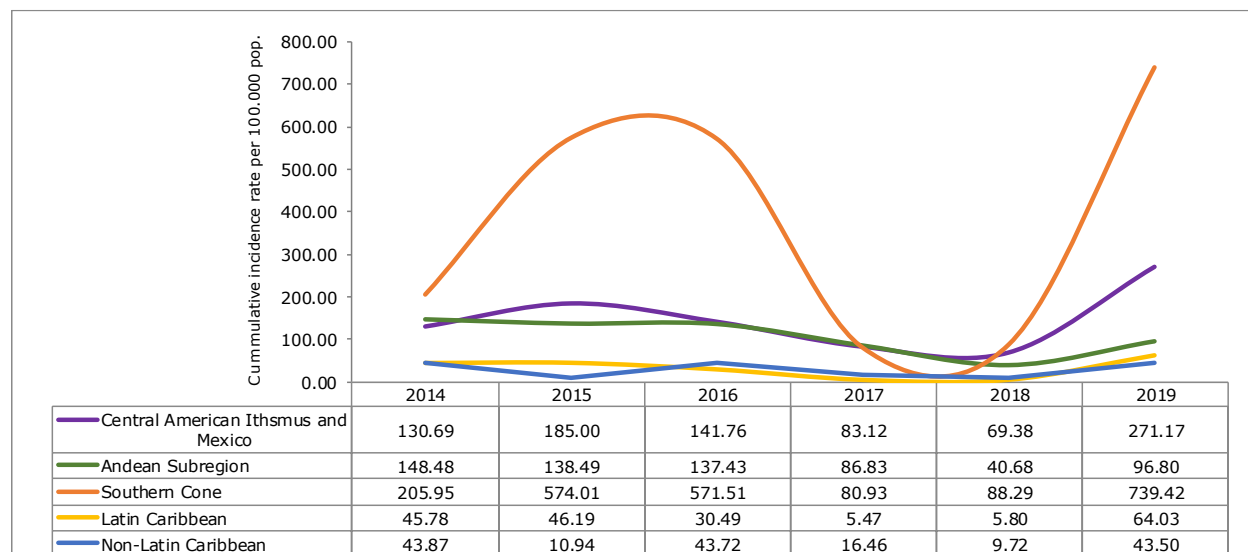
Source: Data entered into the Health Information Platform for the Americas (PLISA, PAHO / WHO) by the Ministries and Institutes of Health of the countries and territories of the Region.

¹ Data available in the Health Information Platform for the Americas (PLISA, PAHO / WHO), accessed 30 October 2019. Available at: <https://bit.ly/314Snw4>

Suggested citation: Pan American Health Organization / World Health Organization. Epidemiological Update: Dengue. 11 November 2019, Washington, D.C. PAHO / WHO. 2019

When comparing the cumulative incidence rates by sub-region in 2019 (as of EW 42) with the previous epidemic period (2015-2016, as of EW 42), with the exception of the Andean sub-region, the incidence rates exceed those during the previous epidemic cycle for the remaining sub-regions (**Figure 2**).

Figure 2. Incidence rates of reported dengue cases as of EW 42 by year and sub-region. Region of the Americas, 2014-2019.



Source: Data entered into the Health Information Platform for the Americas (PLISA, PAHO / WHO) by the Ministries and Institutes of Health of the countries and territories of the Region.

The four dengue virus serotypes (DENV 1, DENV 2, DENV 3, and DENV 4) are present in the Americas and co-circulation of all four has been detected in Brazil, Guatemala, and Mexico in 2019; in Colombia, Guadeloupe, Martinique, Panama, and Venezuela, serotypes DENV 1, DENV 2, and DENV 3 have been co-circulating; and in Paraguay and Peru, DENV 1, DENV 2, and DENV 4 have been co-circulating².

Of the five countries in the Americas with the highest incidence rates (**Table 1**), four are located in the Central American Isthmus: Belize (1,021 cases per 100,000 population), El Salvador (375 cases per 100,000 population), Honduras (995.5 cases per 100,000 population), and Nicaragua (2,271 cases per 100,000 population). The fifth country with highest incidence rate in the Americas is Brazil (711.2 cases per 100,000 population).

² More information on circulating serotypes by country is available at: PAHO / WHO Health Information Platform for the Americas (PLISA): <https://bit.ly/2WS6bJD>

Table 1. Incidence rates and number of dengue cases, proportion of severe dengue cases, case-fatality rates, and serotypes, in 10 selected countries of the Region. EW 1 to EW 42 of 2019.

Country	Incidence rate (cases per 100,000 pop.)	Number of cases	Proportion of severe dengue (%)	Case fatality rate (%)	Serotypes reported
Nicaragua	2.271.12	142,740	N/A	0.018	2
Belize	1.021.20	3,901	2.15	0.000	1-2
Honduras	995.51	91,681	19.47	0.164	1-2
Brazil	711.20	2,069,502	0.08	0.047	1-2-3-4
El Salvador	375.00	24,045	0.44	0.058	2
Guatemala	229.50	40,597	0.19	0.126	1-2-3-4
Colombia	204.45	101,129	1.08	0.068	1-2-3
Costa Rica	144.74	7,169	0.03	0.000	1-2
Paraguay	143.63	9,906	N/A	0.091	1-2-4
Mexico	138.90	181,625	1.08	0.049	1-2-3-4

Note: To calculate the incidence rates, proportion of severe dengue cases, and case-fatality rates, discarded cases were excluded.

N/A: Not applicable – no data available

Source: Data entered into the Health Information Platform for the Americas (PLISA, PAHO / WHO) by the Ministries and Institutes of Health of the countries and territories of the Region. For Brazil, Guatemala, Honduras, and Nicaragua, the data was shared by the International Health Regulations (IHR) National Focal Points (NFPs).

The following is a summary of the epidemiological situation for dengue in select countries.

In **Brazil**, between EW 1 and EW 42 of 2019, a total of 2,069,502 probable cases of dengue have been reported, including 702 deaths. Of the total of cases, 1,131,455 cases were confirmed by laboratory. Of the confirmed cases, 17,313 were classified as dengue with warning signs, and 1,321 as severe dengue and 37,344 cases remain under investigation.

The cumulative national incidence rate was 711.2 cases per 100,000 population, representing a 572.5% increase compared to the same period of 2018 (incidence rate of 106.6 per 100,000 population). By geographical region, the highest incidence rate has been reported in Center-west (1,247.9 cases per 100,000 population), followed by the Regions Southeast (1,152.7 cases per 100,000 population), Northeast (354.6 cases per 100,000 population), North (152.3 cases per 100,000 population) and South (140.1 cases per 100,000 population). The federal units with the highest incidence rates are Minas Gerais (2,281.1 cases per 100,000 population) and São Paulo (1,534.6 cases per 100,000 population) which represent 61% of notified cases in the country.

All four serotypes—DENV 1, DENV 2, DENV 3, and DENV 4—are circulating.

In **Dominica**, between EW 31 and EW 44 of 2019, 599 cases of dengue were notified, of which 30 were confirmed by laboratory, 126 were hospitalized, and 6 were severe dengue. No deaths have been reported. The age group of 1 to 15-years-old represents 52% of the total reported cases and 55% of the total hospitalized cases. DENV 3 is the only circulating serotype.

In **Guadeloupe**, since EW 32 of 2019, an increase in the number of clinical cases reported by the sentinel doctors' network is observed. The observed values exceed the epidemic threshold for the first time.

Since January 2019, 195 cases have been confirmed by laboratory, versus 18 cases confirmed in 2018. In the communes of Grand-Bourg, Saint-Louis, Capester de Marie-Galante, and Le Gosier, the cumulative incidence is greater than 10 cases per 100,000 population between EW 39 and EW 42 of 2019.

No cases of severe dengue or deaths have been reported and the DENV 1, DENV 2 and DENV 3 serotypes have been identified.

In **Martinique**, since EW 27 of 2019, 190 clinical cases of dengue have been reported. During the same period, 25 confirmed cases have been notified, including cases imported from the Ivory Coast, Cuba, the Dominican Republic, Reunion, and Saint Martin. In 2018, no dengue cases were confirmed.

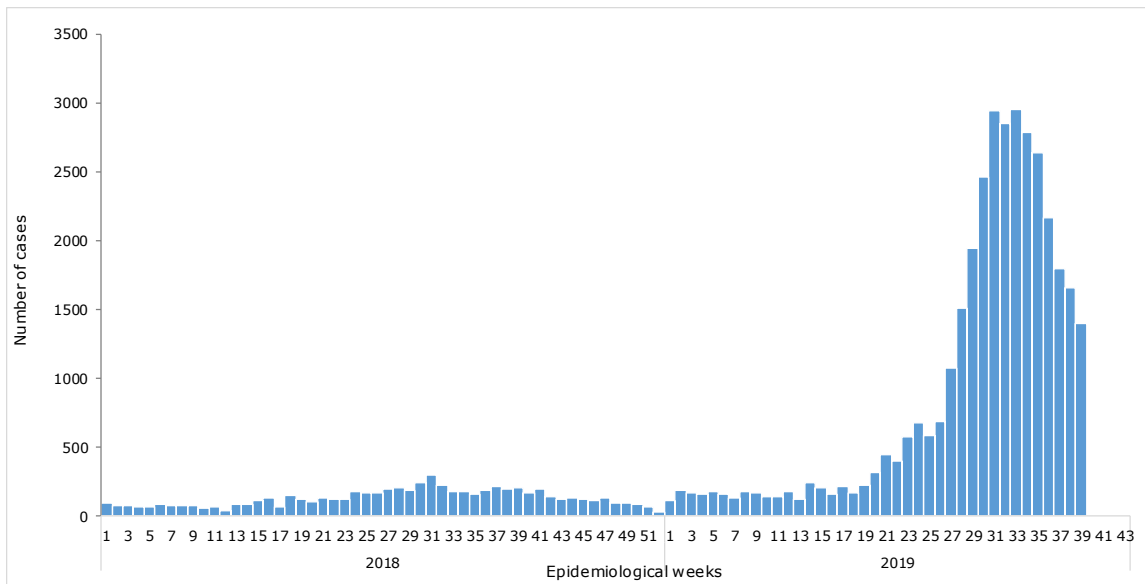
No cases of severe dengue or deaths have been registered and the serotypes DENV 1, DENV 2 and DENV 3 have been identified.

In **Saint-Martin**, since January 2019, 12 cases have been confirmed and DENV 1 serotype has been identified.

In **Guatemala**, between EW 1 and EW 42 of 2019, a total of 40,597 suspected cases of dengue have been reported, of which 988 have been laboratory-confirmed, 14,155 were classified as dengue with warning signs, and 188 as severe dengue, including 51 deaths.

The number of suspected cases notified in 2019, far exceeds the notified cases in 2018. During the current dengue epidemic cycle, the trend of suspected cases increased as of EW 20, where it reached a peak of cases between EW 31 and EW 33 and has started to decline since EW 34, not yet reaching the number of cases notified at the beginning of the year (**Figure 3**).

Figure 3. Distribution of suspected dengue cases by epidemiological week of report. Guatemala, EW 1 to EW 39 of 2019.



Source: Data published by the Guatemala Ministry of Public Health and Social Assistance and reproduced by PAHO / WHO.

Of the total number of cases of severe dengue (188 cases), 79 were confirmed (including 51 deaths) and 67 remain under investigation (including 33 deaths). Among cases of severe dengue, children aged less than 15-years represent 64% of the cases and females represent 63% of the cases. With respect to the incidence rates by age and sex, the age group of 5 to 9-years-old for both male and female, had the highest incidence rates, followed by 10 to 14-year-olds.

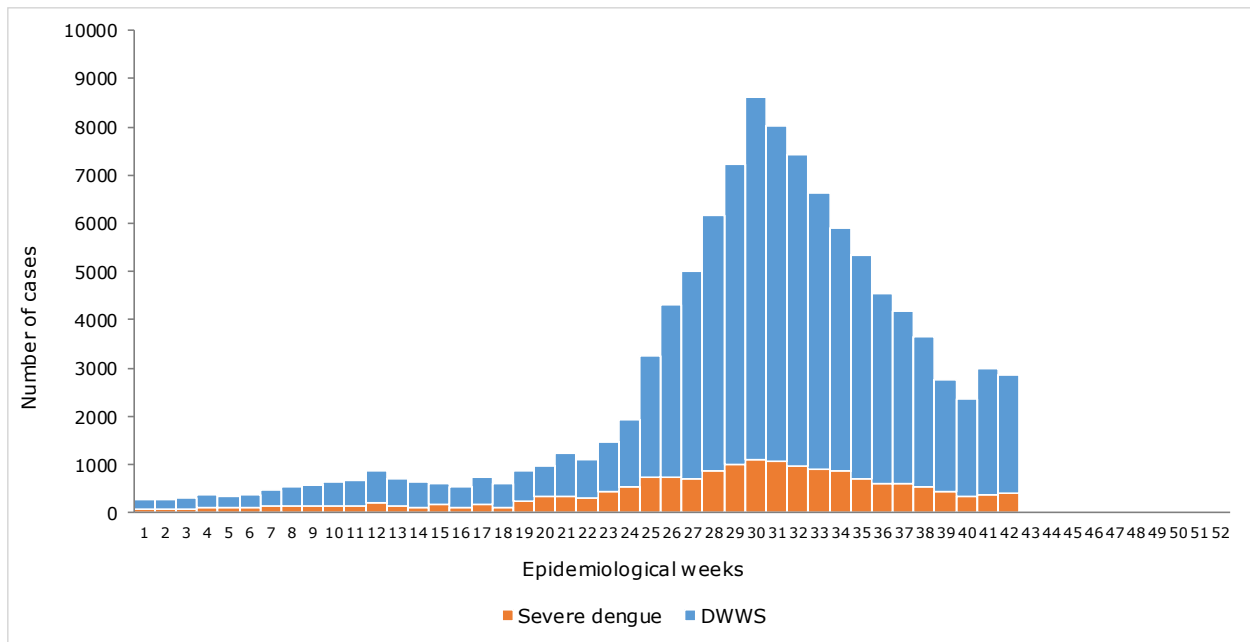
Among the 29 health areas in the country, 13 have reported incidence rates above the national incidence rate (229.5 cases per 100,000 population), as follows: Petén Sur Oriental (1,534.5 per 100,000 population), Baja Verapaz (619.2 per 100,000 population), Zacapa (571.1 per 100,000 population), Petén Sur Occidental (533.7 per 100,000 population) Santa Rosa (479.5 per 100,000 population), Huehuetenango (407.1 per 100,000 population), Jutiapa (358.8 per 100,000 population), Ixcán (339.7 per 100,000 population), Quetzaltenango (334.7 per 100,000 population), Chiquimula (307.7 per 100,000 population), Izabal (302.5 per 100,000 population), Guatemala Center (244.0 per 100,000 population), Retalhuleu (238.6 per 100,000 population).

All four serotypes—DENV 1, DENV 2, DENV 3, and DENV 4—are circulating.

In **Honduras**, between EW 1 and EW 42 of 2019, a total of 91,681 suspected cases of dengue, including 248 deaths, have been reported. Of the total number of suspected cases, 19.5% (17,853 cases) were classified as severe dengue.

Between EW 31 and EW 40 of 2019, a decreasing trend in the number of reported cases has been observed, with a slight rebound during EW 41 and EW 42 (**Figure 4**).

Figure 4. Number of dengue with warning signs (DWWS) and severe dengue cases by EW. Honduras, EW 1 to EW 42 of 2019.



Source: Data shared by the Honduras International Health Regulations (IHR) National Focal Point and reproduced by PAHO / WHO.

Of the total deaths (248), 151 were laboratory-confirmed, 46 were discarded following laboratory testing, 13 were associated to another disease and 38 remain under investigation. Of the total of confirmed deaths by age group and sex, children aged less than 15 years represent 58% (88 deaths) and females represent 57% (85 deaths).

All 20 health regions in the country have reported dengue cases, with the regions of Cortés, Yoro, San Pedro Sula, Olancho, and Santa Barbara accounting for 70% (106 deaths) of the total deaths reported. DENV 1 and DENV 2 serotypes are circulating in the country.

In **Nicaragua**, between EW 1 and EW 43 of 2019, a total of 149,971 suspected cases of dengue have been reported of which 8,131 were confirmed), including 26 deaths, and 988 were severe dengue.

By age group, the highest incidence rates are among the 10 to 14-year-olds group (6.4 per 100,000 population) and the 5 to 9-year-olds (6.09 per 100,000 population).

Geographically, the highest incidence rates were reported in the departments of Estelí (28.19 cases per 100,000 population), Carazo (26.60 cases per 100,000 population), León (24.5 cases per 100,000 population), and Chinandega (20.48 cases per 100,000 population). DENV 2 serotype is circulating.

In the **Dominican Republic**, between EW 1 and EW 40 of 2019, 14,100 cases of dengue were reported (cumulative incidence rate of 177 per 100,000 population), including 34 deaths. Of

the total reported cases, 2,743 were confirmed and 267 cases were classified as severe dengue.

Of the 32 provinces of the country, 10 presented incidence rates above the national rate (177.0 per 100,000 population) and in decreasing order are: San José de Ocoa (702.5 per 100,000 population), Barahona (517.5 per 100,000 population), Independence (408.8 per 100,000 population), Monte Cristi (294.3 per 100,000 population), Valverde (274.0 per 100,000 population), Azua (272.6 per 100,000 population), Peravia (250.3 per 100,000 population), Sánchez Ramírez (228.3 per 100,000 population), Santo Domingo (209.6 per 100,000 population) and Baoruco (198.8 per 100,000 population). DENV 1 and DENV 3 serotypes are circulating.

Advice to Member States

Given the increase in cases of dengue and severe dengue in several countries and territories in the Region of the Americas, the Pan American Health Organization / World Health Organization (PAHO/WHO) emphasizes the need for Member States to implement inter-sectoral preparedness and response measures for these outbreaks. PAHO/WHO reiterates the recommendations provided to Member States in the 21 November 2018 Epidemiological Alert³ and the 22 February 2019 Epidemiological Update⁴.

The following is a summary of the key recommendations regarding outbreak preparedness and response, case management, laboratory diagnosis, risk communication, and integrated vector management.

Outbreak preparedness and response

As part of outbreak preparedness and response, it is recommended that Member States:

- strengthen disease surveillance, including laboratory diagnosis;
- review emergency plans;
- strengthen and intensify vector surveillance and control;
- ensure that healthcare professionals are properly trained for appropriate clinical diagnosis and clinical management of patients with dengue or other arboviruses, **with a special focus on age groups and at-risk groups with the highest case-fatality rates;**
- involve the community in prevention and control activities;

³ Pan American Health Organization / World Health Organization. Epidemiological Update: Dengue. 21 November 2018, Washington, D.C. PAHO / WHO. 2018. Available at: <https://bit.ly/2U13MtX>

⁴ Pan American Health Organization / World Health Organization. Epidemiological Update: Dengue. 22 February 2019, Washington, D.C. PAHO / WHO. 2019. Available at: <https://bit.ly/2VUSX1C>

- ensure performance of the outbreak response is monitored and systematized, including the establishment of a situation room; and
- adapt risk communication according to the epidemiological scenario.

In countries with presence of the vectors but without dengue virus circulation, preparedness and response plans should focus on strategies to reduce the risk of transmission. Rapid investigation of all clinically suspected cases should be carried out as well as laboratory testing to confirm the presence of the dengue virus.

Situation Room

The situation room is a key tool for informed decision making, wherein information is analyzed through multi-disciplinary teams to support health management. It has a key role in the response to outbreaks and emergencies situations. In the case of dengue, the situation room is typically where key aspects of the inter-sectoral response are tracked, bringing together information from all involved sectors. The activities carried out in the situation room include, but are not limited to:

- Analysis and continuous systematic assessment of the current and prospective situation.
- Integration of epidemiological information, including laboratory diagnosis, vector control, and case management, aimed at:
 - Early detection of cases and outbreaks.
 - Monitoring trends and incidence.
 - Understanding the dynamics of viral circulation.
- Guide and maintain data collection, including data quality control.
- Monitor actions and impact of intervention measures.
- Produce periodic concise, operationally focused situation reports to support coordination of the emergency or outbreak response. The situation report should:
 - Provide a snapshot of the current needs, response, and gaps during outbreaks or emergency situations.
 - Be a tool for mobilizing resources.
- Manage key aspects of logistics for the ongoing prevention and control response.

Case management

While the clinical manifestations of the disease are complex, treatment is relatively simple, inexpensive, and very effective in saving lives if timely and adequate management is provided. Early recognition of warning signs at different stages of the disease is critical in order to provide the necessary health care, and therefore prevent progression to severe disease.

When the clinical diagnosis is suggestive of dengue, chikungunya, or Zika, patients (particularly children), should be managed as a case of dengue and monitored daily to detect warning signs of severe illness, especially during the critical phase of the disease⁵.

In cases of dengue without warning signs, patients⁶ should receive information about these signs for timely identification of warning signs and for seeking medical assistance.

WARNING SIGNS OF DENGUE

1. Intense abdominal pain or tenderness.
2. Persistent vomiting.
3. Clinical accumulation of liquids.
4. Bleeding from mucous membranes.
5. Lethargy or irritability.
6. Postural hypotension (lipothymia).
7. Hepatomegaly greater than 2 centimeters.
8. Progressive increase in hematocrit.

Clinical management and treatment of patients suspected with dengue should be initiated without waiting for laboratory confirmation of dengue. Initial clinical diagnosis is sufficient to offer timely and adequate medical care and treatment.

Organization of healthcare services and referral of patients

The main objective of the prevention and control measures during dengue outbreaks is to prevent deaths. Consequently, timely and adequate care of patients, as well as strengthening coordination between different health areas and services, should be promoted. If dengue cases increase, the healthcare network should consider expanding healthcare services and ensuring sufficient supplies, equipment, medication, access to clinical tests, and hospital beds; adequate patient monitoring and the use of patient tracking forms should also be ensured.

The **primary level of healthcare** is key in the management of dengue cases, as this is the level in which the first contact with patients occurs and where most cases receive medical attention. Therefore, it is recommended that the primary level of healthcare:

- Have sensitized and trained personnel for the triage of cases upon arrival at the healthcare service. These personnel should provide instructions and guidance to patients and/or family members on how to identify warning signs of dengue and seek the nearest healthcare service as soon as these signs occur.

⁵ PAHO / WHO. Dengue: Guidelines for patient care in the Region of the Americas, 2nd Edition 2016. Available at: <https://bit.ly/2U1Pp8t>

⁶ Or parents or guardians, in the case of children.

- Have healthcare personnel trained to observe and detect patients who present with warning or severe signs in waiting, in order to ensure immediate care and reduce waiting time.
- Establish *dengue units* for the management of dengue cases with warning signs.
- Ensure continuous clinical monitoring of patients with specialized medical needs, co-morbidities, pregnant women, concomitant conditions, or persons whose social situation makes it difficult to access the necessary care (such as persons living in remote places, refugees, displaced persons, among others).
- Establish referral and counter-referral systems for severe dengue cases between different healthcare levels. Severe cases of dengue should be referred to a higher-level unit (secondary or tertiary level), after stabilization of the patient and coordination between healthcare units.
- All units of this level should have flowcharts and guidelines for the clinical management of dengue, available to all medical and paramedical personnel, for any necessary consultation during medical attention of patients.

The **secondary and tertiary levels of healthcare** should be designed for the management of severe cases of dengue. Thus, overwhelming these units is avoided and specific clinical care can be provided to patients requiring highly specialized care.

As part of the organization of the healthcare systems in emergency situations or outbreaks, the following is necessary:

- A group of highly specialized physicians should be established to provide medical guidance on diagnosis and management of dengue cases, mainly to support physicians in remote areas (peripheral areas).
- A hotline for consultation with a trained physician, particularly for healthcare personnel in peripheral areas.
- The healthcare personnel in healthcare units should have access to clinical guidelines and flowcharts for the care of dengue cases.
- Continuous education should be maintained in healthcare units, particularly regarding the management of severe and difficult-to-treat cases as well as the analysis of dengue deaths.

A timely approach, the correct classification of cases, and proper case management are key elements of healthcare to prevent patient deaths due to dengue. A delay in medical care for these cases is often related to the cause of death.

Laboratory diagnosis

Diagnosis and etiological confirmation of dengue infection can be performed through virological assays (viral isolation, detection of genetic material, detection of NS1 protein, or immunohistochemistry) or by serological tests for the detection of IgM antibodies.

Virological diagnosis

- *Molecular detection*: During the first 5 days from the onset of symptoms (acute phase, viremic period), viral RNA from a serum sample can be detected using molecular techniques such as conventional or real-time reverse transcription polymerase chain reaction (RT-PCR). A positive PCR result (with appropriate controls) confirms the diagnosis.
- *Viral isolation*: Can be performed by intracerebral inoculation in mice or in cell culture. However, due to its complexity, this is rarely used as a routine diagnostic test and is recommended only for research or characterization to complement public health surveillance.
- *NS1 Protein*: The nonstructural protein 1 (NS1) of the dengue virus can be detected by ELISA up to 9 days after the onset of symptoms. However, since it is a protein produced at an early stage of infection, it is most likely detected between the first 3 to 5 days after the onset of symptoms.
- *Post-mortem diagnosis*: In fatal cases, it is recommended to take tissue samples (preferably liver, followed by spleen and kidney) in buffered formalin for histopathological and immunohistochemical assay. Additionally, molecular methods (RT-PCR) from fresh tissue samples (taken in dry tube and maintained in refrigeration), or preserved in paraffin, can also be used for the confirmation of fatal cases associated with dengue or to conduct differential diagnosis.

Serological diagnosis

A positive IgM result using the ELISA technique (MAC-ELISA or any other immunoassay) in a sample taken after the fifth day of symptom onset is presumptive of recent dengue infection. A single serum in the acute phase is considered presumptive, so it is recommended that a second sample be taken between one and two weeks after the first sample to demonstrate seroconversion (negative to positive) or an increase up to four times the antibody titer (with one quantitative assay).

Cross-reactivity with other flaviviruses (mainly in secondary infections) should be considered in areas where co-circulation with other flaviviruses (e.g., Zika, yellow fever, St. Louis Encephalitis, etc.) is documented and where there is a likelihood that the population has been previously infected.

Therefore, the detection of antibodies for other flaviviruses (e.g., IgM for Zika) by ELISA should be conducted in parallel. A positive result for dengue IgM in the absence of IgM for Zika (negative) is presumptive of dengue infection, while a negative IgM result for dengue with Zika-positive IgM will be presumptive of infection by the latter. However, a positive result for

the two assays only indicates a recent flavivirus infection, and therefore, it will not be possible to confirm an etiologic agent. For this reason, results should be analyzed while also considering the clinical characteristics and the epidemiological history of the case.

Rapid tests

Immunochromatography-based rapid tests have been widely used for the diagnosis of dengue. However, in addition to the challenges observed by cross-reactivity, these types of tests have shown low sensitivity so the negative predictive value is very low, and a negative result will not rule out a case. Due to this, implementation and use of these types of tests for public health purposes should be carefully assessed.

Risk Communication

Risk communication and information to the public is essential during outbreaks to reduce adverse impact, decrease domestic breeding sites, and for affected persons to seek timely medical assistance, and therefore prevent severe cases and deaths from dengue. Communication messages should focus on the identification of warning signs and obtaining timely medical assistance.

In addition, communication campaigns should raise public awareness on the importance of vector control interventions at home, identification of febrile cases, and special measures for vector control, specifically the control of intra- and peri-domiciliary breeding sites, and personal protection.

Integrated vector management

The objective of integrated vector management is to improve efficiency and achieve sustainability in vector prevention and control actions, and includes the following:

- Selection of control methods based on knowledge of the biology of the vector, disease transmission, and morbidity.
- Use of multiple interventions, often in combination and in a synergistic and synchronized manner.
- Collaboration of the health sector with other public and private sectors linked to the management of the environment that have work which impacts or could impact reduction of the vector.
- Integration of individuals, families, and other key partners (education, finance, tourism, water and sanitation, and others).
- Establishment of a legal framework that permits an integrated and intersectoral approach.

Given the high infestation by *Aedes aegypti* and the presence of *Aedes albopictus* in the Region, prevention and control measures should be aimed at reducing the density of the vector, with local community acceptance and collaboration in adopting such measures.

Prevention and control measures to be implemented by national authorities should include the following:

- Strengthen environmental management actions, mainly by eliminating vector breeding sites in every home and in common areas of neighborhoods and cities (parks, schools, cemeteries, etc.).
- Organize intensive environmental sanitation campaigns for the elimination of breeding sites in specific areas where routine garbage collection has been interrupted.
- Implement breeding site control measures through the use of physical, biological, and/or chemical methods, with the active involvement of individuals, family members and the community.
- Identify the areas at high-risk of transmission (risk stratification) and prioritize those where there are larger concentrations of people (schools, transportation terminals, hospitals, health centers, etc.). In these areas, the presence of mosquitoes must be removed within a diameter of at least 400 meters. Special attention should be given to health units, so that these are free of the presence of the vector and its breeding sites so that they do not become points of exposure for the virus.
- In areas where active transmission is detected, it is suggested to use adulticide treatment (mainly through spraying) to remove infected adult mosquitoes in order to stop and interrupt transmission. It is important to take into account that this action is of exceptional nature and only effective when executed by properly trained personnel following internationally accepted technical guidelines and when performed concomitantly to other proposed actions. Spraying and elimination and/or control of vector breeding sites within households is the main action to interrupt transmission when it intensely occurs. The greatest impact for the elimination of infected adult mosquitoes (active transmission) is achieved with intra-domiciliary spraying, using individual equipment.
- Select appropriate insecticides (in accordance with PAHO/WHO recommendations), verify the product formula, and consider the susceptibility of mosquito populations to that insecticide.
- Maintain and use spraying equipment in an appropriate manner and maintain insecticide reserves.
- Ensure intensified monitoring actions (quality control) of field work operators both during larval control and during adulticide treatment (spraying).
- Emphasize integrated (simultaneous or coordinated) actions for vector control, in space and time (adulticidal and larval control by trained personnel, coupled with sanitation and the promotion of community actions), is essential to achieve a greater impact in the shortest time possible.

Personal Prevention Measures

Patients infected with the dengue virus are the reservoir of infection for other people both at home and in the community. Therefore, public health measures to minimize the exposure of patients to mosquitoes are critical in preventing the spread of the virus and, consequently, of the disease.

Patients, other household members, and the affected community must be informed about the risk of transmission to others and ways to minimize this risk by reducing the vector population and human-vector contact.

The following actions are recommended to minimize patient-vector contact:

- The patient must rest under mosquito nets, impregnated, or not, with insecticide.
- The patient, as well as other members of the household, must wear long sleeves (when ill persons are in the house) to cover extremities.
- Repellents containing DEET, IR3535, or Icaridine can be applied to exposed skin or clothing and its use must be in strict accordance with the instructions on the product label.
- Use wire-mesh/mosquito nets on doors and windows.

These personal prevention measures are also effective in preventing the transmission of the virus to healthy people.

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