

5 July 2023

During the first months of 2023, dengue outbreaks of significant magnitude were recorded in South America. Considering the seasonality of dengue characterized by increased transmission in these months in Central America and the Caribbean, the Pan American Health Organization / World Health Organization (PAHO/WHO) recommends that Member States review and adjust their preparedness and response plans to face possible outbreaks of dengue and other arboviral diseases to avoid deaths and complications from these diseases.

### Situation Summary

Dengue is the arbovirus that causes the highest number of cases in the Region of the Americas, with epidemics occurring cyclically every 3 to 5 years. In 2019, the highest number of historical dengue cases was registered, with more than 3.1 million cases, including 28,203 serious cases and 1,773 deaths. In the Region of the Americas, between epidemiological week (EW) 1 and EW 52 of 2022, 2,811,433 dengue cases<sup>1</sup> were reported. 2022 was the third year with the highest record in the number of dengue cases, only surpassed by the years 2016 and 2019.

Between EW 1 and EW 24 of 2023, a total of 2,102,848 cases of dengue were reported in the Region of the Americas, with a cumulative incidence rate of 214 cases per 100,000 population. The highest cumulative incidence rates were observed in the following subregions<sup>2</sup>: the Southern Cone with 564 cases per 100,000 inhabitants, the Andean Subregion with 253 cases per 100,000 inhabitants, and the Central American Isthmus and Mexico with 54 cases per 100,000 inhabitants.

In 2023, until EW 24, of the 2,102,848 dengue cases reported in the Region, 827,493 (39.3%) were laboratory confirmed and 3,201 (0.15%) were classified as severe dengue. The highest number of dengue cases was observed in Brazil with 1,515,460 cases, followed by Peru with 169,504 cases and Bolivia with 133,452 cases.

Regarding the number of severe dengue cases, the highest number of cases was observed in the following countries: Brazil with 654 cases, Colombia with 652 cases, Peru with 597, Bolivia with 590 cases and Mexico with 573 cases. Additionally, in the same period, a total of 876 deaths were reported in the Region (case fatality rate [CFR]: 0.042%).

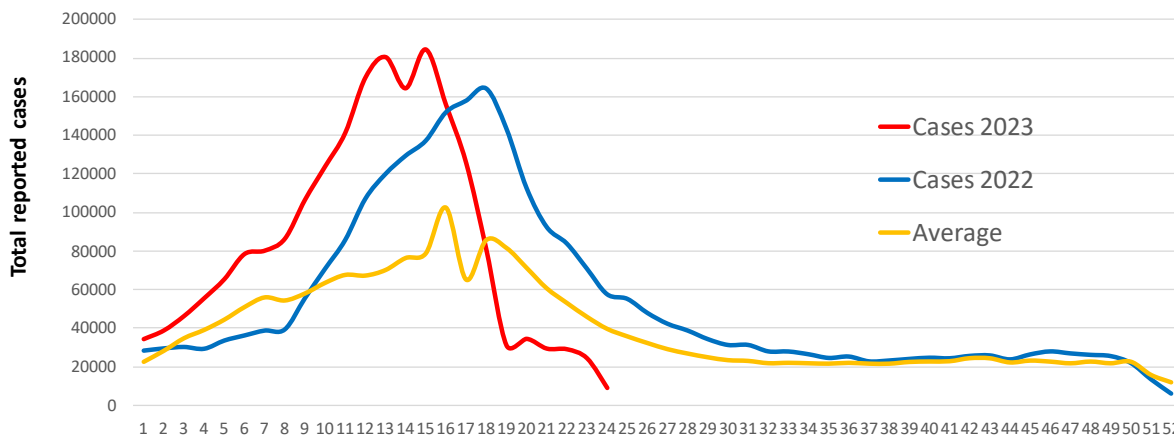
<sup>1</sup> Data available in the Health Information Platform for the Americas (PLISA, PAHO/WHO), accessed June 30, 2023. Available from: <https://opendata.paho.org/es>

<sup>2</sup> Note: The subregions and the corresponding countries and territories follow the divisions described in the Health Information Platform for the Americas (PLISA), available from: <https://bit.ly/3IGwSwc>. Accessed June 30, 2023.

**Suggested citation:** Pan American Health Organization / World Health Organization. Epidemiological Update: Dengue in the Region of the Americas. 5 July 2023. Washington, D.C. PAHO/WHO; 2023.

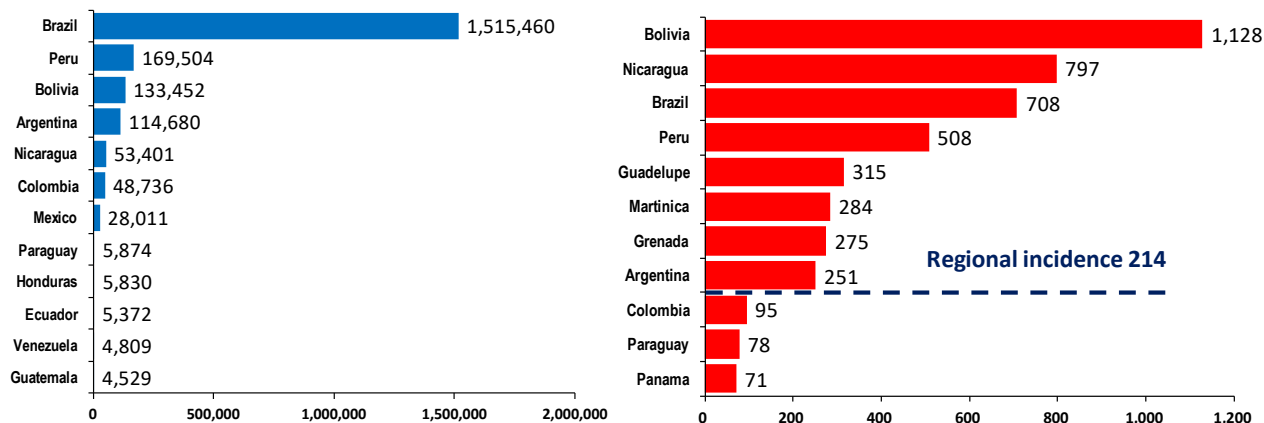
Keeping the case fatality rate for dengue below 0.05% is one of the goals of impact in our Region and therefore the importance of timely clinical diagnosis, early identification of warning signs and proper management and treatment of patients, to avoid serious cases and deaths.

**Figure 1.** Dengue cases in 2022, 2023 (up to EW 24) and average of the last 5 years - Region of the Americas.



**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. Available from: <https://opendata.paho.org/en>. Accessed June 30, 2023.

**Figure 2.** Suspected cases and cumulative incidence\* of dengue in the most affected countries\*\* in the Region of the Americas, as of EW 24, 2023.

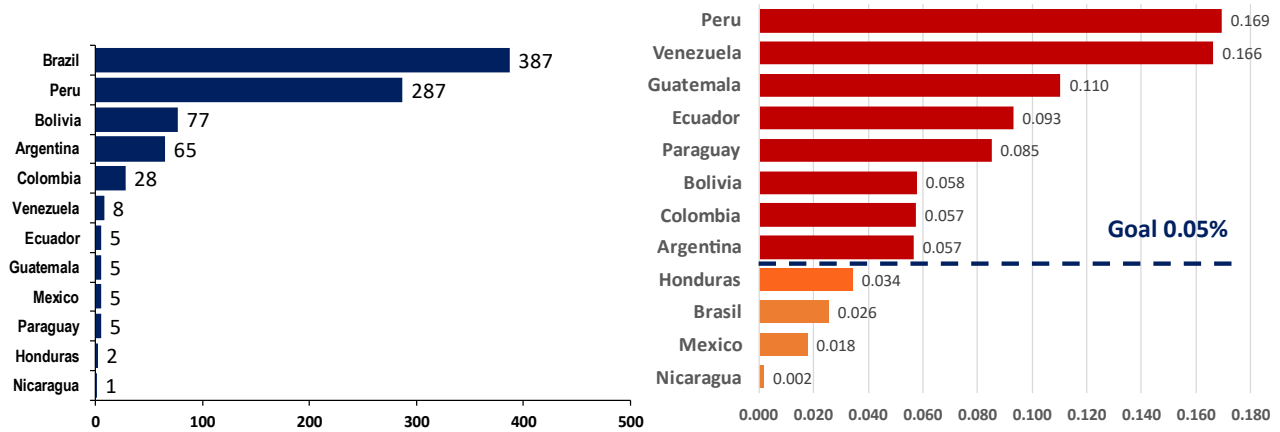


\* per 100,000 population

\*\* Countries which reported 99% of cases in the Region of the Americas

**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. Available from: <https://opendata.paho.org/en>. Accessed June 30, 2023.

**Figure 3.** Deaths and case fatality ratio from dengue in the Region of the Americas, as of EW 24, 2023.

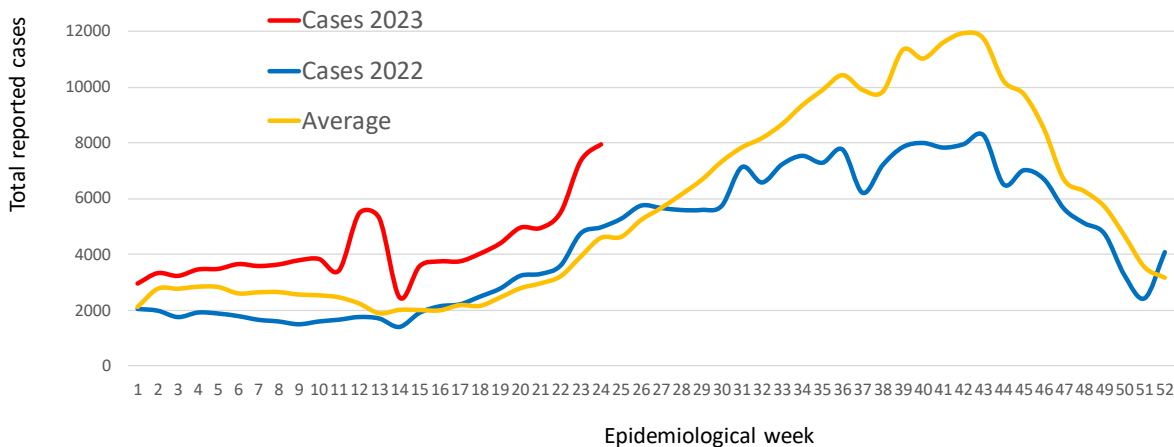


**Source:** Data entered into the Health Information Platform for the Americas (PLISA, PAHO/WHO) by the Ministries and Institutes of Health of the countries and territories of the Region. Available from: <https://opendata.paho.org/en>. Accessed June 30, 2023.

All four dengue virus serotypes (DENV1, DENV2, DENV3, and DENV4) are present in the Region of the Americas. In 2023, up to EW 24, simultaneous circulation of all four serotypes has been detected in Brazil, Colombia, Costa Rica, Guatemala, Honduras, Mexico and Venezuela; while in Argentina, Panama, Peru and Puerto Rico, DENV1, DENV2 and DENV3 serotypes circulate, and in Nicaragua the serotypes DENV1, DENV3 and DENV4.

Additionally, it is expected that in the second half of 2023, some countries in the Region, especially in Central America and the Caribbean, will have an increase in rainfall, which, depending on its magnitude and impact on dengue-endemic areas, could increase the incidence of the disease and constitute an additional burden of arboviral diseases for health systems in affected areas (**Figure 4**).

**Figure 4.** Dengue cases in 2022, 2023 (up to EW 24) and average of the last 5 years – Central American Isthmus and Mexico.



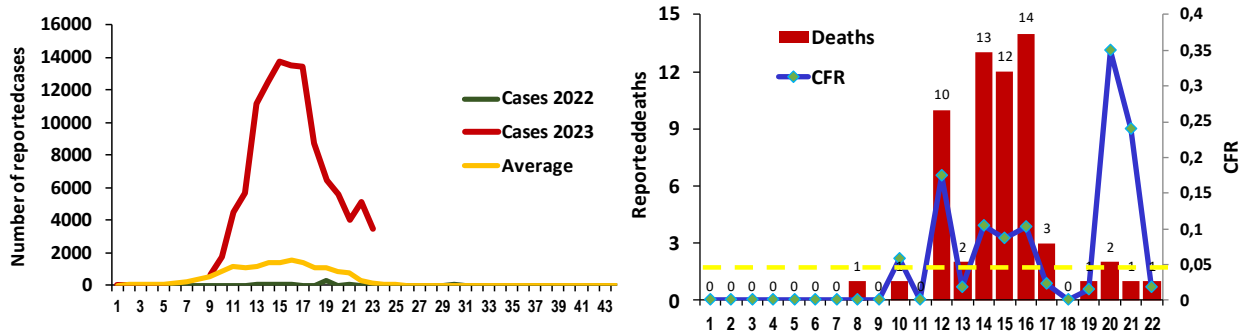
**Source:** Data entered into the Health Information Platform for the Americas (PLISA, PAHO/WHO) by the Ministries and Institutes of Health of the countries and territories of the Region. Available from: <https://opendata.paho.org/en>. Accessed June 30, 2023.

Below is a summary of the epidemiological situation of dengue in selected countries in alphabetical order:

### Argentina

In 2023 up to EW 24, all 114,680 reported dengue cases were laboratory confirmed. The cases registered up to EW 24 of 2023 are 153 times higher than those reported in the same period of 2022 and 7 times higher compared to the average of the last 5 years (**Figure 5a**). In the same period, a total of 65 deaths were reported (case fatality ratio: 0.057%) (**Figure 5b**)

**Figure 5a.** Dengue cases in 2022, 2023 (up to EW 23) and average of the last 5 years – Argentina  
**Figure 5b.** Dengue related deaths and CFR in 2023 (up to EW 22) - Argentina

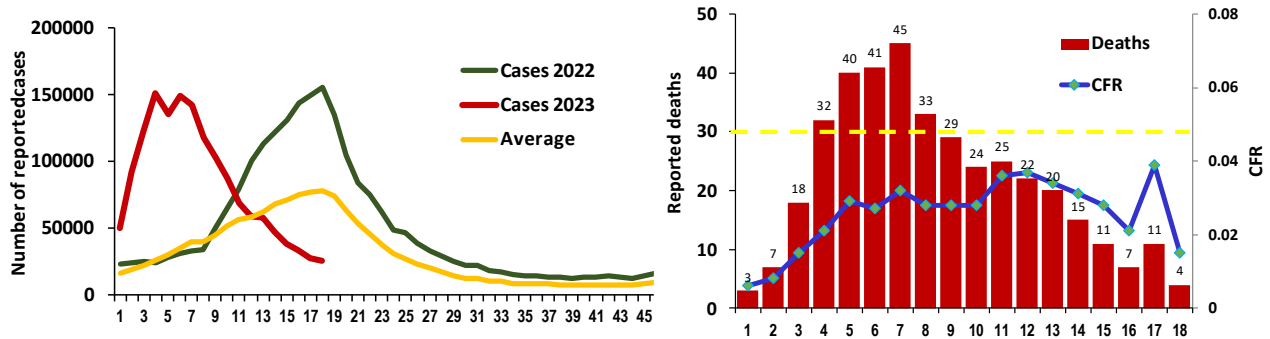


**Source:** Data entered into the Health Information Platform for the Americas (PLISA, PAHO/WHO) by the Ministries and Institutes of Health of the countries and territories of the Region. Available from: <https://opendata.paho.org/en>. Accessed June 30, 2023.

### Brazil

In 2023 up to EW 18, of the 1,515,460 reported dengue cases, 554,542 (36.6%) were laboratory confirmed and 654 (0.04%) were classified as severe dengue. The cases registered up to EW 18 of 2023 are 13% higher than those reported in the same period of 2022 and 73% higher compared to the average of the last 5 years (**Figure 6a**). In the same period, a total of 387 deaths were reported (case fatality ratio: 0.026%) (**Figure 6b**)

**Figure 6a.** Dengue cases in 2022, 2023 (up to EW 18) and average of the last 5 years - Brazil.  
**Figure 6b.** Dengue related deaths and CFR in 2023 (up to EW 18) - Brazil.

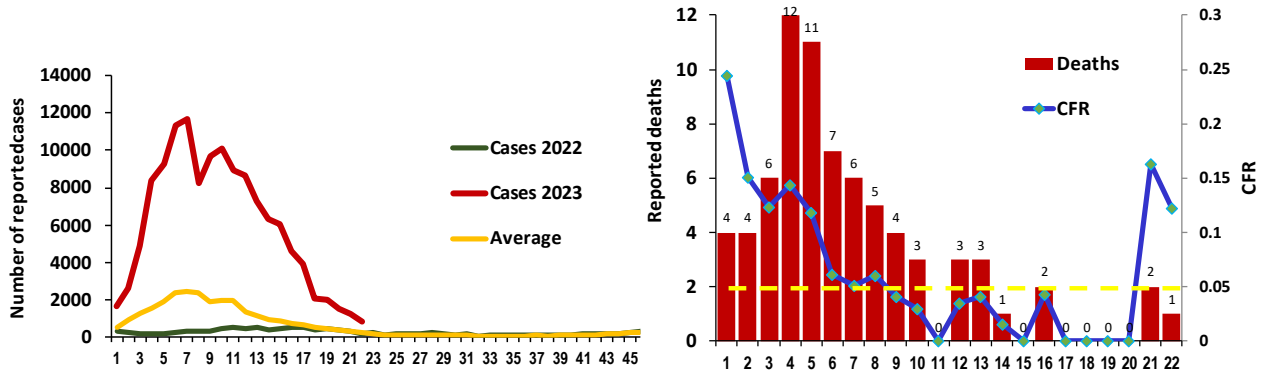


**Source:** Data entered into the Health Information Platform for the Americas (PLISA, PAHO/WHO) by the Ministries and Institutes of Health of the countries and territories of the Region. Available from: <https://opendata.paho.org/en>. Accessed June 30, 2023.

### Bolivia

In 2023 up to EW 24, of the 133,452 reported dengue cases, 22,755 (17.1%) were laboratory confirmed and 590 (0.44%) were classified as severe dengue. The cases registered to EW 24 of 2023 are 16 times higher than those reported in the same period of 2022 and 5 times higher compared to the average of the last 5 years (**Figure 7a**). In the same period, a total of 77 deaths were reported (case fatality ratio: 0.058%). (**Figure 7b**)

**Figure 7a.** Dengue cases in 2022, 2023 (up to EW 22) and average of the last 5 years - Bolivia.  
**Figure 7b.** Dengue related deaths and CFR in 2023 (up to EW 22) - Bolivia.

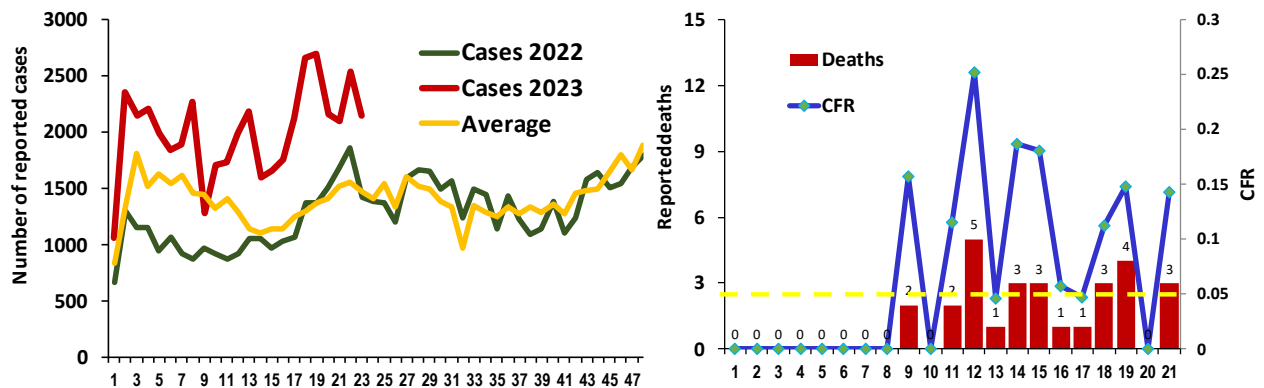


**Source:** Data entered into the Health Information Platform for the Americas (PLISA, PAHO/WHO) by the Ministries and Institutes of Health of the countries and territories of the Region. Available from: <https://opendata.paho.org/en>. Accessed June 30, 2023.

### Colombia

In 2023 up to EW 24, of the 48,738 reported dengue cases, 25,050 (51.4%) were laboratory confirmed and 652 (1.34%) were classified as severe dengue. The cases registered in EW 24 of 2023 are 66% higher than those reported in the same period of 2022 and 47% higher compared to the average of the last 5 years (**Figure 8a**). In the same period, a total of 28 deaths were reported (case fatality ratio: 0.057%). (**Figure 8b**)

**Figure 8a.** Dengue cases in 2022, 2023 (up to EW 23) and average of the last 5 years - Colombia.  
**Figure 8b.** Dengue related deaths and CFR in 2023 (up to EW 21) - Colombia.

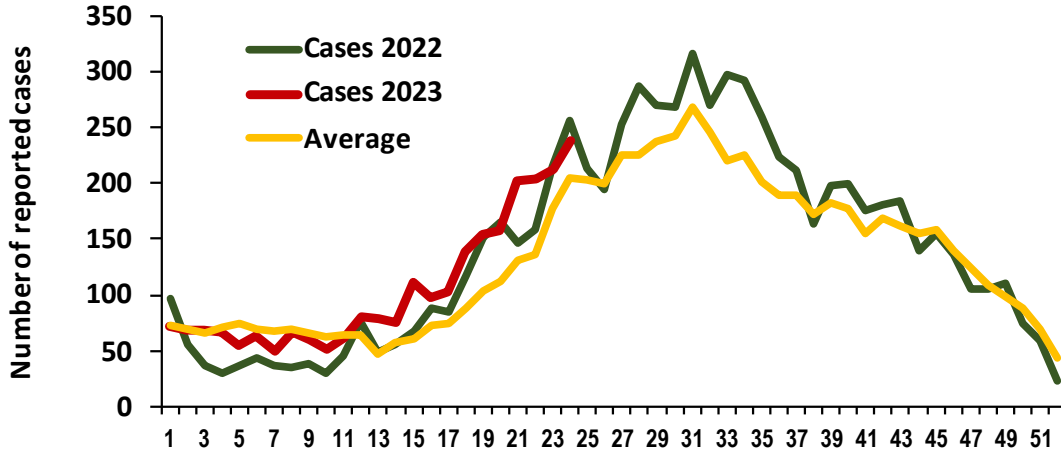


**Source:** Data entered into the Health Information Platform for the Americas (PLISA, PAHO/WHO) by the Ministries and Institutes of Health of the countries and territories of the Region. Available from: <https://opendata.paho.org/en>. Accessed June 30, 2023.

### Costa Rica

In 2023, up to EW 24, of the 2,534 reported dengue cases, 254 (10%) were laboratory confirmed and there were no cases of severe dengue. The cases registered up to EW 24 of 2023 are 20% higher compared to the same period of 2022, and 22% higher compared to the average of the last 5 years (**Figure 9**). In the same period, no deaths were reported.

**Figure 9.** Dengue cases in 2022, 2023 (up to EW 24) and average of the last 5 years – Costa Rica.

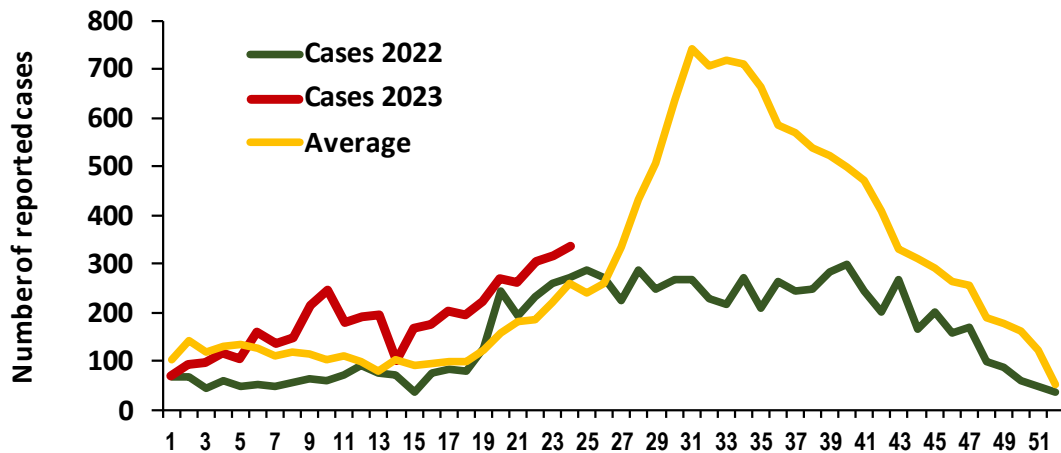


**Source:** Data entered into the Health Information Platform for the Americas (PLISA, PAHO/WHO) by the Ministries and Institutes of Health of the countries and territories of the Region. Available from: <https://opendata.paho.org/en>. Accessed June 30, 2023.

### Guatemala

In 2023, up to EW 24, of the 4,529 reported dengue cases, 699 (15%) were laboratory confirmed and 6 (0.13%) were classified as severe dengue. The cases registered up to EW 24 of 2023 are 81% higher compared to the same period of 2022, and 45% higher compared to the average of the last 5 years (**Figure 10**). In the same period, a total of 5 deaths were reported (case fatality rate: 0.11%).

**Figure 10.** Dengue cases in 2022, 2023 (up to EW 24) and average of the last 5 years – Guatemala.

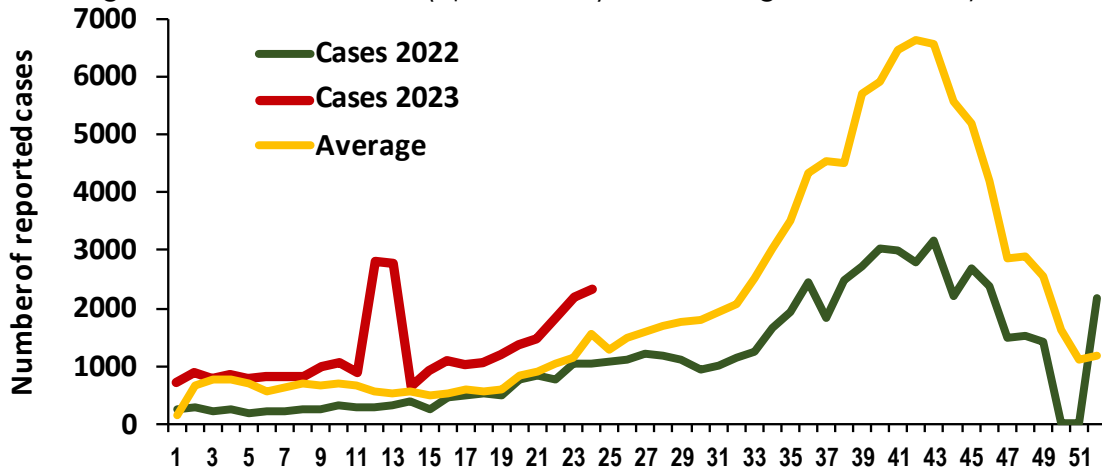


**Source:** Data entered into the Health Information Platform for the Americas (PLISA, PAHO/WHO) by the Ministries and Institutes of Health of the countries and territories of the Region. Available from: <https://opendata.paho.org/en>. Accessed June 30, 2023.

## Mexico

In 2023, up to EW 24, of the 28,011 reported dengue cases, 3,937 (14%) were laboratory confirmed and 573 (2%) were classified as severe dengue. The cases registered up to EW 24 of 2023 are 2.8 times higher compared to the same period of 2022 and 78% higher compared to the average of the last 5 years (Figure 11). In the same period, a total of 5 deaths were reported (case fatality rate: 0.018%).

Figure 11. Dengue cases in 2022, 2023 (up to EW 24) and average of the last 5 years – Mexico.

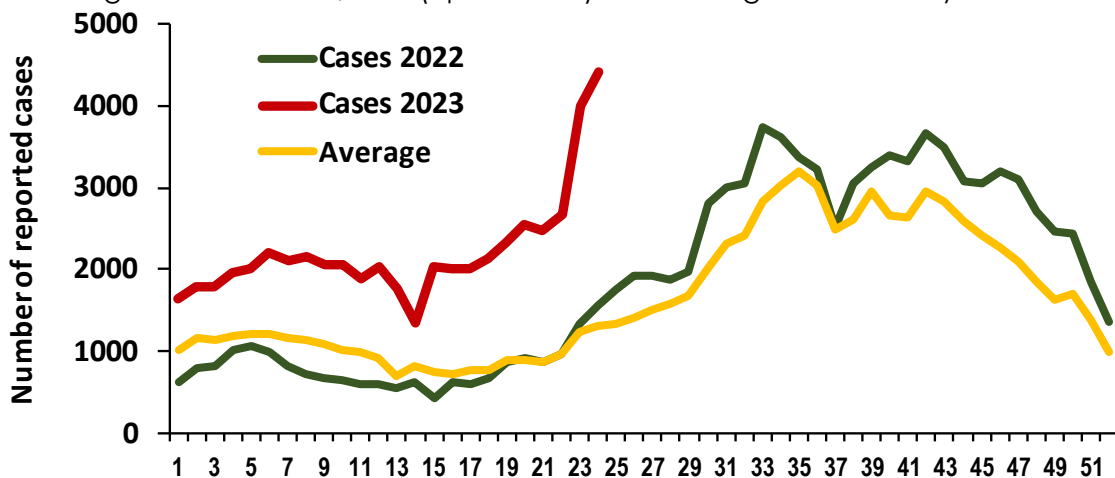


Source: Data entered into the Health Information Platform for the Americas (PLISA, PAHO/WHO) by the Ministries and Institutes of Health of the countries and territories of the Region. Available from: <https://opendata.paho.org/en>. Accessed June 30, 2023.

## Nicaragua

In 2023, up to EW 24, of the 53,401 reported dengue cases, 992 (1.9%) were laboratory confirmed and 10 (0.02%) were classified as severe dengue. The cases registered up to EW 24 of 2023 are 2.7 times higher compared to the same period of 2022 and 2.1 times higher compared to the average of the last 5 years (Figure 12). In the same period, a total of one death was reported (case fatality rate: 0.002%).

Figure 12. Dengue cases in 2022, 2023 (up to EW 24) and average of the last 5 years – Nicaragua.

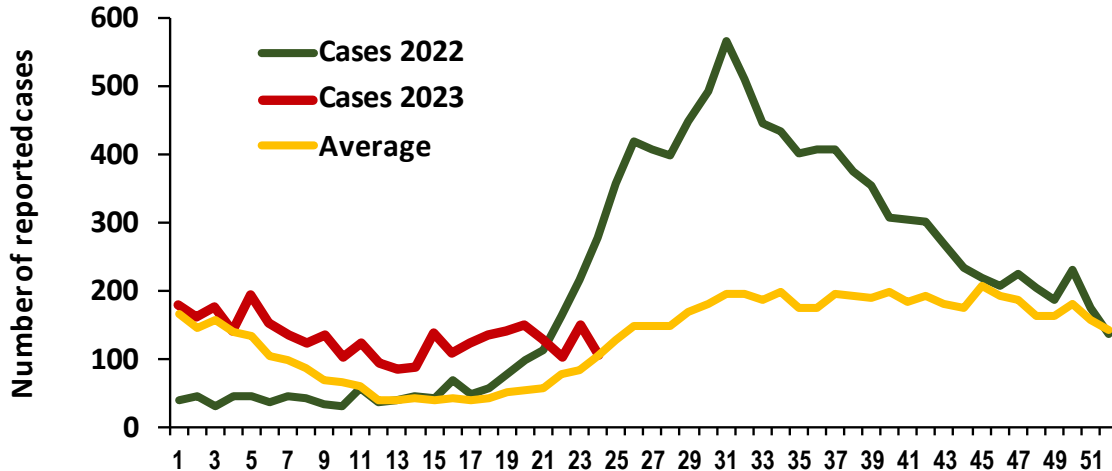


Source: Data entered into the Health Information Platform for the Americas (PLISA, PAHO/WHO) by the Ministries and Institutes of Health of the countries and territories of the Region. Available from: <https://opendata.paho.org/en>. Accessed June 30, 2023.

### Panama

In 2023, up to EW 24, of the 3,176 reported dengue cases, 2,161 (68%) were laboratory confirmed and 7 (0.22%) were classified as severe dengue. The cases registered up to EW 24 of 2023 are 83% higher compared to the same period of 2022, and 63% higher compared to the average of the last 5 years (**Figure 13**). In the same period, no deaths were reported.

**Figure 13.** Dengue cases in 2022, 2023 (up to EW 24) and average of the last 5 years – Panama.



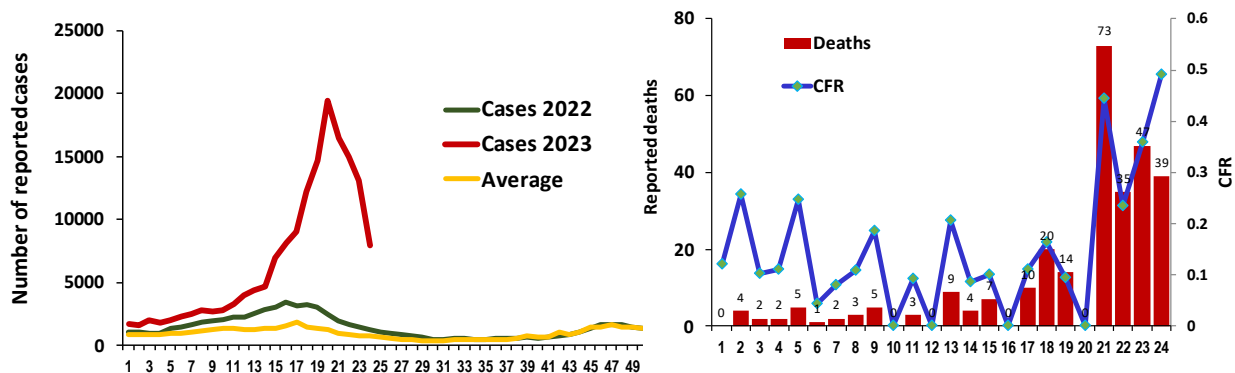
**Source:** Data entered into the Health Information Platform for the Americas (PLISA, PAHO/WHO) by the Ministries and Institutes of Health of the countries and territories of the Region. Available from: <https://opendata.paho.org/en>. Accessed June 30, 2023.

### Peru

In 2023 up to EW 24, of the 169,504 reported dengue cases, 88,648 (52.3%) were laboratory confirmed and 597 (0.35%) were classified as severe dengue. The cases registered up to EW 24 of 2023 are 3.3 times higher than those reported in the same period of 2022, and 5.9 times higher compared to the average of the last 5 years (**Figure 14a**). In the same period, a total of 287 deaths were reported (case fatality ratio: 0.169%) (**Figure 14b**). Of the total reported cases, 55% were in women. Additionally, 38% of the cases were reported in the 30-59 age group and 22% in the 18-29 age group.

**Figure 14a.** Dengue cases in 2022, 2023 (up to EW 24) and average of the last 5 years - Peru.

**Figure 14b.** Dengue related deaths and CFR in 2023 (up to EW 24) - Peru.

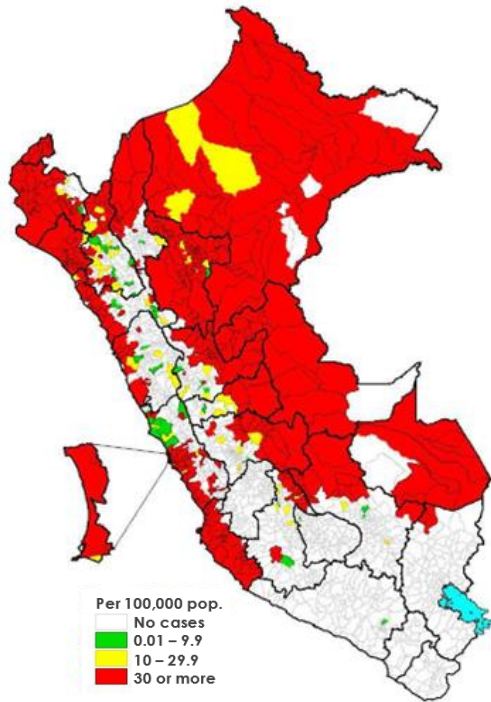


**Source:** Data entered into the Health Information Platform for the Americas (PLISA, PAHO/WHO) by the Ministries and Institutes of Health of the countries and territories of the Region. Available from: <https://opendata.paho.org/en>. Accessed June 30, 2023.

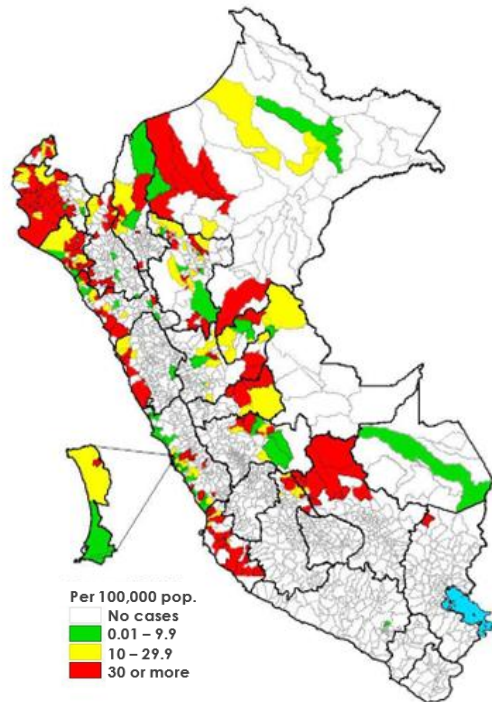


**Figure 15:** Dengue incidence by districts, Peru 2023.

Cumulative dengue incidence in 2023 (up to EW 24)



Dengue incidence as of EW 24 2023



**Source:** Health Situation Room as of EW 24 2023. National Center for Epidemiology, Prevention and Control of Diseases. Ministry of Health. Peru. Available from [here](#)

## Guidance for national authorities

Given the increase in the number of cases and deaths from dengue and chikungunya in countries of the Southern Hemisphere during the seasonal period in the first half of 2023 and given the beginning of the season of greatest transmission of dengue and other mosquito-borne diseases in the Northern Hemisphere, the Pan American Health Organization / World Health Organization (PAHO/WHO) urges Member States to continue to strengthen surveillance, triage, diagnosis, and timely and adequate treatment of cases of dengue, chikungunya, and other arboviral diseases. Simultaneously, it calls for intensified preparedness actions of health care services to facilitate access and proper management of patients with these diseases.

PAHO/WHO reminds Member States that the same guidelines published in the Epidemiological Update of June 10, 2020 on dengue and other arboviral diseases, available from <https://bit.ly/3oPycno>, remain current.

### Adequacy of health care services

Due to recent increases in the incidence of dengue in some areas of the Region, Member States are urged to adapt their health care services to provide timely and adequate response to the population at all levels of care.

- Organize in each institution, by levels of care, the screening, patient flow, clinical surveillance, and hospitalization areas.
- Reorganize healthcare services in outbreak/epidemic situations at different levels of patient care.
- Strengthen patient care networks in diagnosis, management, and follow-up of patients with suspected chikungunya (including the chronic phase of the disease) or dengue.

### Integrated Surveillance

PAHO/WHO encourages continued epidemiological surveillance and sharing reports of suspected and confirmed dengue, chikungunya and Zika cases.

Given that the clustering of cases is common in both diseases (dengue and chikungunya), efforts should be made to analyze the spatial distribution of cases to allow a rapid response at the local levels of the most affected areas. Information on dengue and chikungunya hotspots should be consulted for intensive vector control.

Sentinel entomological surveillance assists with assessing changes in the risk of vector-borne diseases and the impact of vector control measures.

### Laboratory confirmation

It is important to note that the initial diagnosis of DENV infection is clinical, and adequate suspicion can guide the confirmation protocol. However, laboratory results should always be

analyzed in tandem with demographic information and according to the epidemiological context, for surveillance purposes and not for clinical decision-making.

Laboratory confirmation of dengue infection is based on virological tests (RT-PCR, NS1 antigen detection, and in some cases viral isolation in culture for further characterization) and serological tests (IgM and/or IgG detection). However, for the confirmation of cases, virological assays that demonstrate the presence of the complete virus, its genetic material or its proteins should be prioritized. In general, virological assays for dengue are performed on serum samples taken during the first 5 days after symptom onset (acute phase), although highly sensitive molecular methodologies can detect viral RNA for up to 7 days depending on viremia (**Figure 16**).

On the other hand, serological assays based on the detection of IgM (or IgG) should be analyzed carefully, considering the time that antibodies circulate in the blood after an infection, as well as the possibility of cross-reaction with other flaviviruses (including Zika, yellow fever and others) and nonspecific detection. Thus, a single IgM result in a patient only indicates a possible recent contact with the virus, but it may have occurred up to 6 months ago. A second sample taken at least one week apart, processed in parallel with the first and with a quantitative serological assay (PRNT, for example) that demonstrates seroconversion or increase in antibody titer, may be useful to clarify the diagnosis (**Figure 17**).

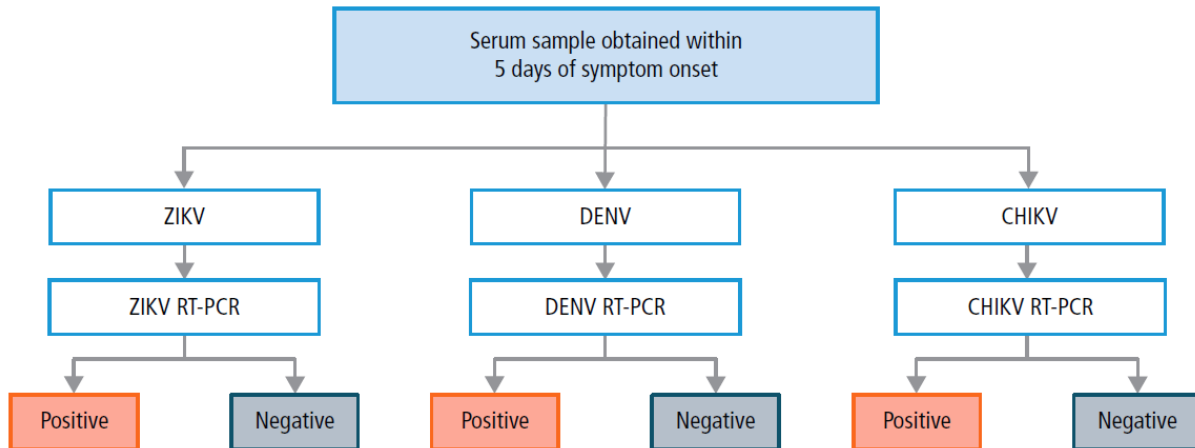
It is important to have a clear laboratory algorithm that allows early detection. Although multiple molecular methodologies (multiplex PCR) are useful when there is no clear clinical suspicion, in a case of dengue that meets the established definitions and where the clinical picture is compatible, it is suggested to prioritize protocols for specific detection (*singleplex*) of the virus.

In fatal cases, tissue sampling (liver, spleen, kidney) should be considered both for detection of genetic material (RT-PCR) and for histopathological and immunohistochemical study. Taking biopsies in a patient with suspected dengue is completely contraindicated.

On the other hand, the use of rapid tests (NS1 and/or antibodies) is not recommended since their low sensitivity can lead to false negative results; Its use should be limited to community studies under established protocols, but in no case to rule out infection or to implement medical behaviors.

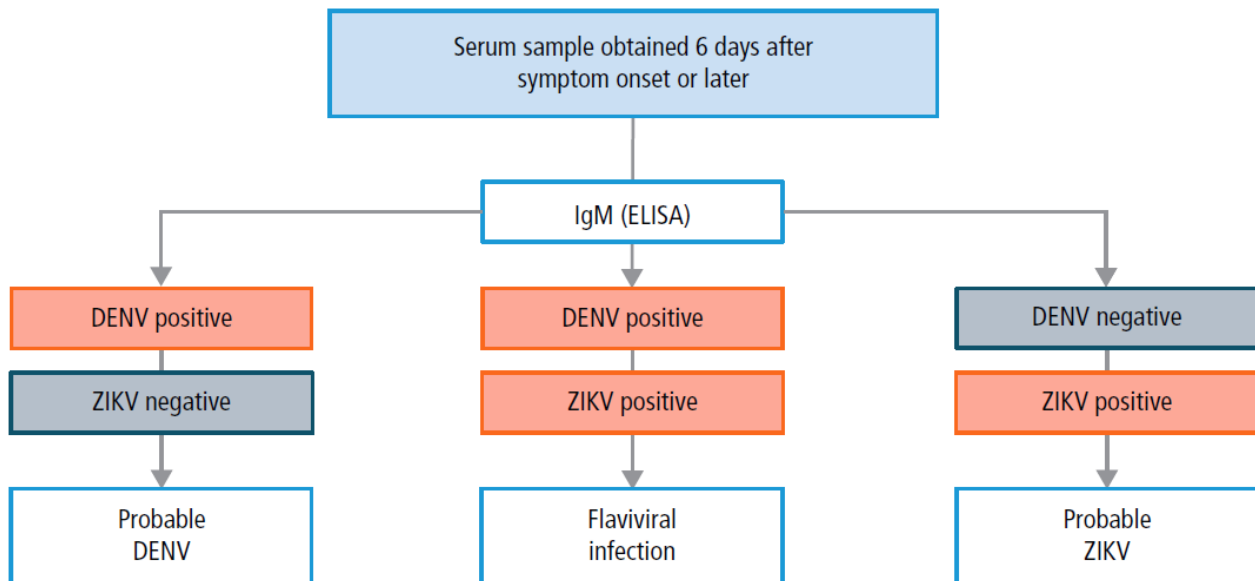
Since laboratory services are a key component of dengue epidemiological and virological surveillance, timely detection and characterization in appropriate samples should be maintained. Where possible and depending on the capacities of each laboratory, confirmation of all severe and fatal cases of dengue is recommended, while only a proportion (10-20% or a limited number of samples depending on installed capacity) of those cases without warning signs will be necessary for surveillance.

**Figure 16.** Algorithm for virological testing in suspected cases of dengue, chikungunya and Zika.



**Source:** PAHO/OMS. Recommendations for the detection and laboratory diagnosis of arbovirus infections in the Region of the Americas. 29 August 2022. Available in Spanish from [this link](#)

**Figure 17.** Algorithm for serological testing in suspected cases of dengue and Zika



**Source:** PAHO/OMS. Recommendations for the detection and laboratory diagnosis of arbovirus infections in the Region of the Americas. 29 August 2022. Available in Spanish from [this link](#)

### Case management

Measures to ensure proper clinical management of suspected dengue cases should be a priority.

Capacities must be strengthened at the primary health care level to avoid progression to severe forms and deaths from dengue. Therefore, it is necessary that health workers conduct early

clinical diagnosis and recognize serious warning signs in dengue (such as severe and sustained abdominal pain or tenderness of the abdomen, persistent vomiting, clinical fluid accumulation, mucosal bleeding, lethargy, restlessness, liver enlargement > 2 cm below the costal margin, and progressive increase in hematocrit) in order to initiate appropriate management in accordance with the recommendations published in the PAHO clinical guidelines. In cases where dengue is suspected, healthcare workers should provide clear guidance to patients and/or families to monitor for warning signs and seek immediate medical attention. These measures will also help reduce the number of patients that need to be referred to hospitals, thus avoiding the saturation of these facilities and intensive care units.

At the same time, all second and third level hospitals must be prepared to handle cases of dengue with warning signs and cases of severe dengue.

More information on the clinical management of dengue cases is available in the Guidelines for the clinical diagnosis and treatment of dengue, chikungunya, and Zika<sup>3</sup> and in the Tool for the diagnosis and care of patients with suspected arboviral diseases<sup>4</sup>, both published by PAHO.

PAHO reiterates the recommendations for technical teams in charge of malaria control, as those also apply to personnel involved in arboviruses care and are available from: <https://bit.ly/3ZucrPK>.

### **Community involvement**

Every effort should be made to gain community support for the prevention of dengue.

Simple Information, Education and Communication (IEC) materials can be disseminated through various media (including social media).

Household members should be encouraged to eliminate both residential and peri-domiciliary sources of mosquito breeding.

Highly productive mosquito breeding sites, such as water storage containers (drums, elevated tanks, clay pots, etc.) must be subject to preventive measures to avoid vector reproduction. Other breeding sites, such as roof gutters and other water-holding containers, should also be cleaned periodically.

Local teams often know how to convey this information more effectively, and in many cases national campaigns and messages are not as effective as local awareness initiatives.

### **Aedes prevention and control measures**

PAHO/WHO urges effective use of available resources to prevent and/or control vector infestation in affected areas and in health care services. This may be achieved through the implementation of integrated vector control strategies in emergencies, which include the following processes:

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<sup>3</sup> Pan American Health Organization. Guidelines for the clinical diagnosis and treatment of dengue, chikungunya, and Zika. Washington, DC. PAHO; 2022. Available from: <https://iris.paho.org/handle/10665.2/55867>

<sup>4</sup> Pan American Health Organization. Tool for the diagnosis and care of patients with suspected arboviral diseases. Washington, DC. PAHO; 2017. Available from: <https://iris.paho.org/handle/10665.2/33895>

- Selection of control methods based on knowledge of vector biology, disease transmission, and morbidity.
- Use of multiple interventions, often in combination and synergistically.
- Collaboration of the health care sector with public and private sectors linked to environmental management whose work impacts the reduction of the vector.
- Integration of individuals, families, and other key partners (education, finance, tourism, water and sanitation, and others) in prevention and control activities.
- Strengthening of the legal framework permitting an integrated and intersectoral approach.

Given the high infestation by *Aedes aegypti* and the presence of *Aedes albopictus* in the Region, it is recommended that prevention and control measures aim to reduce the density of the vector and have the acceptance and collaboration of local populations. Prevention and control measures for implementation by national authorities should include the following:

- Strengthen environmental management actions, primarily the elimination of vector breeding sites in households and in common areas (parks, schools, cemeteries, etc.).
- Reorganize solid waste collection services to support breeding site elimination actions in areas of greatest transmission and, if necessary, plan intensive actions in specific areas where regular garbage collection has been interrupted.
- Apply measures for the control<sup>5</sup> of breeding sites using physical, biological and/or chemical methods, while actively involving individuals, families, and the community.
- Define the high-risk transmission areas (risk stratification<sup>6</sup>) and prioritize those with high concentrations of people (schools, terminals, hospitals, health care centers, etc.). In these facilities, the presence of mosquitoes must be eliminated in a diameter of at least 400 meters. It is important to pay special attention to health care units, and to ensure that these are free of the presence of the vector and its breeding sites so that they do not become spreading sources of the virus.
- In areas where active transmission is detected, implementing measures aimed at eliminating infected adult mosquitoes (primarily using insecticides) is suggested in order to stop and cut transmission. This action is of an exceptional nature and is only effective when it is conducted by well-trained personnel under internationally accepted technical guidelines; and when it is carried out simultaneously with the other proposed actions. The main action to interrupt intensive transmission is the elimination of infested adult mosquitoes (active transmission) through indoor spraying by using individual equipment added to the destruction and/or control of vector breeding sites within households.

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<sup>5</sup> Pan American Health Organization. Methods of entomological surveillance and control of the main vectors in the Americas. Washington, DC: PAHO; 2021. Available in Spanish from: <https://iris.paho.org/handle/10665.2/55241>

<sup>6</sup> Pan American Health Organization. Technical document for the implementation of interventions based on generic operational scenarios for *Aedes aegypti* control. Washington, D.C.: PAHO; 2019. Available from: <https://iris.paho.org/handle/10665.2/51652>

- An effective modality of adult control that can be used, considering the available operational capacities, is indoor residual spraying, which should be applied selectively to the resting areas of *Aedes aegypti*, avoiding the contamination of storage containers of water used for drinking or cooking purposes. This intervention performed in treated areas is effective for a period of up to four-months; it can be used in shelters, homes, health care services, schools, and others. For more information, consult the PAHO Manual for Indoor Residual Spraying in Urban Areas for *Aedes aegypti* Control<sup>7</sup> and the document on Control of *Aedes aegypti* in the scenario of simultaneous transmission of COVID-19<sup>8</sup>.
- Correctly choose the insecticide to be used (following PAHO/WHO recommendations), its formulation, and be aware of which mosquito populations are susceptible to the chosen insecticide<sup>9</sup>.
- Guarantee the proper functioning of fumigation equipment and its maintenance and ensure insecticide reserves.
- Intensify actions of supervision of the operators' field work (quality control), during both the focal treatment and in the adulticide treatment (fumigation), ensuring compliance with personal protection measures.

### Personal preventive measures

Patients infected with dengue, chikungunya, and/or Zika virus are the reservoir of infection for others in their households and in the community. It is necessary to communicate to the sick, their families, and the affected community about the risk of transmission and ways to prevent contagion by reducing the vector population and the contact between the vector and people.

To minimize vector-patient contact it is recommended:

- Patients should rest under mosquito nets, impregnated, or otherwise, with insecticide.
- Patients, as well as other household members, must wear long sleeves (if there are sick people in the house) to cover the extremities.
- Repellents containing DEET, IR3535, or Icaridine can be applied to exposed skin or clothing and must be used in strict accordance with the instructions on the product label.
- Use wire-mesh/mosquito nets on doors and windows.

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<sup>7</sup> Pan American Health Organization. Manual for Indoor Residual Spraying in Urban Areas for *Aedes aegypti* Control. Washington, DC: PAHO; 2019. Available from: <https://iris.paho.org/handle/10665.2/51637>

<sup>8</sup> Pan American Health Organization. Control of *Aedes aegypti* in the scenario of simultaneous transmission of COVID-19. Washington, DC: PAHO; 2020. Available from: <https://www.paho.org/en/documents/control-aedes-aegypti-scenario-simultaneous-transmission-covid-19>

<sup>9</sup> Pan American Health Organization. Procedures to evaluate the susceptibility to insecticides of the main mosquito vectors of the Americas Washington, DC: PAHO; 2023. Available in Spanish from: <http://bitly.ws/HTNA>

## Additional resources

- Pan American Health Organization. PLISA Health Information Platform for the Americas, Core Indicators Portal. Washington, DC: PAHO; 2023 [cited 24 March 2023]. Available from: <https://bit.ly/3n4FKBs>.
- Pan American Health Organization. Recommendations for Laboratory Detection and Diagnosis of Arbovirus Infections in the Region of the Americas. Washington, D.C.: PAHO; 2023. Available from: <https://iris.paho.org/handle/10665.2/57555>.
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- Pan American Health Organization. Methodology for evaluating national arboviral disease prevention and control strategies in the Americas. Washington, DC. PAHO; 2021. Available from: <https://iris.paho.org/handle/10665.2/55745>.
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- Pan American Health Organization. Tool for the diagnosis and care of patients with suspected arboviral diseases. Washington, DC. PAHO; 2017. Available from: <https://iris.paho.org/handle/10665.2/33895>.
- Pan American Health Organization / World Health Organization. Early Warning and Response System (EWARS) for dengue outbreaks: operational guide using the web-based dashboard. 2nd ed. Washington DC: PAHO/WHO; 2021. Available in Spanish from: <https://bit.ly/3H1Oz3D>
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- World Health Organization and United Nations Children's Fund. Community-based health care, including outreach and campaigns, in the context of the COVID-19 pandemic. Interim guidance. 5 May 2020. WHO and UNICEF; 2020. Available from: [https://www.who.int/publications/i/item/WHO-2019-nCoV-Comm\\_health\\_care-2020.1](https://www.who.int/publications/i/item/WHO-2019-nCoV-Comm_health_care-2020.1). License: CC BY-NC-SA 3.0 IGO.