BJCMR Brazilian Journal of Clinical Medicine and Review

PCAA PUBLICAÇÕES CIENTÍFICAS DE ACESSO ABERTO

*Health Review*

# Dengue: An emerging public health issue in Brazil

**Lígia Maria Oliveira de Souza [1,*], Alessandra Savi Bellizzi [1], Ruthleia Leoncio de Almeida [1], Marta Lopes [1], Gustavo de Oliveira [2], Raquel Farias Cyrino [3], Evellin Vasconcelos Silva [4], Maryana Raquel Carvalho Feitosa [4], Manuela Fernandes Capêlo Dantas [4], Camylla Pimentel Pereira [5]**

[1] Universidad Politécnica y Artística del Paraguay, Alto Parana, Paraguay.
[2] Maurício de Nassau University Center, Fortaleza, Ceará, Brazil.
[3] Estácio Idomed College, Juazeiro, Bahia, Brazil.
[4] University of Fortaleza, Fortaleza, Ceará, Brazil.
[5] Universidad Privada del Este, Alto Parana, Paraguay.

* Correspondence: ligiamaria2107@gmail.com.

**Abstract:** Dengue is a viral disease transmitted by the *Aedes aegypti* mosquito and represents a major public health challenge in Brazil, where deficiencies in vector control favor its spread. The objective of this study is to analyze dengue fever as an emerging public health problem in Brazil. The study is an integrative review conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines. The PubMed, SciELO and VHL databases were used. The inclusion criteria were studies published between 2021 and 2024, written in English or Portuguese and that addressed the topic in question. The exclusion criteria were articles that were disconnected from the inclusion criteria. The vulnerability of urban areas, the vector's resistance to insecticides and the need for integrated control strategies contribute to the emergence of dengue in Brazil. Epidemiological surveillance, awareness campaigns, improvements in basic sanitation are essential measures for the effective fight against dengue. Therefore, a continuous and collaborative effort between the government, health professionals and the population are necessary, with an emphasis on prevention, education and innovation in the fight against *Aedes aegypti*.

**Keywords:** Arbovirus; Dengue; Epidemiology; Brazil.

Citation: Souza LMO, Bellizi AS, Almeida RL, Lopes M, Oliveira G, Cyrino RF, Silva EV, Feitosa MRC, Dantas MFC, Pereira CP. Dengue: An emerging public health issue in Brazil. Brazilian Journal of Clinical Medicine and Review. 2025:Jan-Dec;03(1):bjcmr20.

https://doi.org/10.52600/2763-583X.bjcmr.2025.3.1.bjcmr20

Received: 19 September 2024
Accept: 27 October 2024
Published: 1 November 2024



## 1. Introduction

Dengue is an acute febrile illness caused by a virus, is one of the most common epidemic infections in the world, estimated at 50 million infections per year [1], which generally presents a benign evolution in its classic form, but can be serious when it manifests itself in a hemorrhagic form. Currently, it is considered the most significant arbovirus affecting the globalized world, representing a serious public health problem, especially in tropical countries. In these regions, environmental conditions favor the development and spread of Aedes aegypti, the main transmitting mosquito. Disorderly urbanization, the accumulation of non-biodegradable materials, such as bottles and tires, as well as trash and plant containers in open areas, create ideal aquatic environments for the proliferation of these mosquitoes.

Dengue is one of the most common epidemic infections in the world, estimated at 50 million infections per year. The World Health Organization (WHO) considers dengue fever a serious risk to public health. Climate change, rapid population growth and lack of medical facilities are some of the factors that have led to the rise in DENV. There are 400 million cases of dengue each year, affecting 5 billion people, and some places have death rates of up to 520 [2].

The disease is widespread throughout the world, posing a risk to almost half of the world's population. Although most cases are asymptomatic, dengue causes a burden on healthcare systems and mainly affects the younger population. The disease is also spreading to temperate countries, making it a global threat [3]. It is estimated that there are 100–400 million new infections each year, although this number may be grossly underreported as surveillance networks are not robust in most tropical countries [4]. In 2019, countries in the Americas reported more than 3 million cases of dengue, the highest number ever recorded, with a higher proportion of severe dengue cases and increased mortality in the pediatric population of children aged 5–9 years.

Dengue is increasingly common as an etiology of fever in international travelers and has been reported as the leading etiology of febrile illness for travelers from some endemic regions during epidemic years [5]. In the absence of effective prevention and control measures, dengue is projected to increase both in disease burden and geographic extent, which makes the epidemiological study of arboviruses important. The objective of this review is to describe the importance of epidemiology as an analytical tool because it studies the distribution and determinants of diseases and health problems in populations, provides essential information to understand disease dynamics, identify risk factors and guide prevention and control actions.

## 2. Method

This study is characterized as an integrative review, which allows for the search, evaluation, and comprehensive synthesis of evidence on the epidemiology of dengue as a public health challenge in Brazil. The research question guiding the study was defined as: "What are the most effective epidemiological strategies for controlling and preventing dengue as an emerging public health issue in Brazil?" The PICO strategy was applied as follows: P (Population) - Individuals at risk or affected by dengue in Brazil; I (Intervention) - Epidemiological surveillance, preventive measures, and clinical management strategies; C (Comparison): Effectiveness of different surveillance and intervention strategies over time or in different regions, and O (Outcome) - Reduction in the incidence, severity, and mortality rates of dengue.

### 2.1 Search Strategy

The search was conducted using the PubMed, SciELO, and Virtual Health Library (VHL) databases, aiming to identify studies published between 2021 and 2024. This period was selected to capture the most recent trends and innovations in dengue prevention, reflecting the current challenges and response strategies in Brazil. The search was carried out in October 2024, using a combination of Boolean operators (AND and OR) to optimize the search process.

The search terms included both English and Portuguese terms, based on Medical Subject Headings (MeSH) and Health Sciences Descriptors (DeCS). The terms used were Dengue OR Aedes aegypti AND epidemiological surveillance AND prevention AND Brazil.

### 2.2 Eligibility Criteria

The inclusion criteria were the studies published between 2021 and 2024, in Portuguese, English, or Spanish; primary research articles focusing on the epidemiological aspects of dengue in Brazil, including surveillance, prevention strategies, or outbreak responses; studies that evaluated the impact of public health interventions on reducing the incidence or severity of dengue, and articles providing quantitative data on the effectiveness of surveillance and control measures.

The exclusion criteria included articles that were not peer-reviewed, reviews, theoretical reflections, opinions, editorials, case reports, and studies that were not related to the epidemiological analysis of dengue in Brazil.

### 2.3 Study Selection and Data Extraction

The study selection process was conducted manually, where the search results were independently screened by two reviewers who analyzed titles and abstracts for relevance. Discrepancies were resolved by a third reviewer through consensus. After the initial screening, the full texts of potentially relevant studies were reviewed, and those that met the inclusion criteria were selected for final synthesis.

### 2.4 Data Synthesis

Data synthesis followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, ensuring transparency and reproducibility of the selection process. A PRISMA flow diagram was used to illustrate the stages of the review, from article identification to final inclusion. Data extraction focused on study design, geographical scope, evaluated interventions, and outcomes related to the incidence and mortality of dengue.

This methodological approach enabled a comprehensive assessment of the epidemiological strategies used in Brazil to address dengue, providing insights into the effectiveness of different prevention and control measures within the unique context of the country.

## 3. Results

According to the results found in the study, for better understanding and transparency in the selection method, the flowchart of scientific articles was used through the Main Items for Reporting Systematic Reviews and Meta-Analyses (PRISMA) guide (Figure 1). The first phase consisted of searching the databases, totaling 170 articles. In the second phase, repeated articles were excluded, which were 92. In the third, titles and abstracts were read, 78 articles were selected. In the last phase of construction, an exploratory, selective and analytical reading of all studies and stratification of excerpts that answered the guiding question was carried out, totaling articles that make up the sample. The data are presented in a descriptive way, aiming to gather and organize knowledge on the topic investigated. Table 1 presents an overview of the articles selected for the study and a summary of the main conclusions reached.

**Table 1**. Studies selected for sample according to title, authors, objectives and main results.

| Reference | Objectives | Main results |
|---|---|---|
| [6] | Dengue infection is a growing public health problem, with the number of reported cases increasing in the Americas and worldwide. This review characterized the epidemiological and economic burden of dengue in Brazil. | A total of 344 publications were included (167 peer-reviewed and 177 gray literature). Dengue outbreaks increased in incidence and frequency, with the highest incidence observed in 2015 at 807 cases per 100,000 population. Outbreaks were related to alternating predominant serotypes. Dengue was more frequent in young adults (aged 20-39 years) and in the Midwest. Cost and societal impacts are substantial and varied across regions, age, and public/private healthcare services. |
| [7] | To identify and describe broadly the factors related to the occurrence of dengue epidemics in Brazil. | Thirty-five studies carried out in the country were selected. The epidemics recorded in Brazil were associated with multiple factors, including |

| | | |
|---|---|---|
| | | environment, socioeconomic conditions, climate, and vector-related aspects. |
| [8] | We devised a citywide integrated surveillance system combining entomologic, epidemiologic, and entomo-virologic data gathered during 2017–2020 in Foz do Iguaçu, Brazil. | We compared five entomologic indices: traditional house and Breteau indices for larval surveys, trap positivity, adult density, and mosquitoes per inhabitant indices for adult trapping. Indices based on adult mosquito sampling had higher outbreak predictive values than larval indices. Choropleth maps of infestation levels were built within <36 hours of each trap inspection round. |
| [9] | Investigated time to death and factors associated with deaths from dengue and chikungunya during the first epidemic after the introduction of the chikungunya virus in Northeastern Brazil. | The lethality coefficients for dengue and chikungunya were 0.08% and 0.35%, respectively. Independent factors associated with death were headache and age ≥50 for dengue; and headache, nausea, back pain, intense arthralgia, age 0-9 or ≥40, and male sex for chikungunya. Time to death from dengue was 2.1 times faster than from chikungunya (95% CI, 1.57-2.72). |
| [10] | To describe the entry of Dengue virus (DENV) serotypes in Brazil and its federative units | From 100 publications, 26 addressed DENV serotypes in the North, 33 in the Northeast, 24 in the Southeast, 14 in the Central-West, and five in the South. DENV-1 and DENV-4 were introduced in the North in 1981, DENV-2 in the Southeast in 1990, and DENV-3 in the North in 1999. |
| [11] | To investigate the prevalence of arbovirus infection in SCD patients from two Brazilian cities, Salvador and Manaus | A total of 409 individuals with SCD were included, with 307 (75.06%) testing positive for DENV-IgG, 161 (39.36%) for ZIKV-IgG, and 60 (14.67%) for CHIKV-IgG. Only one was positive for DENV-NS1, and one for DENV-IgM, both from Salvador. No ZIKV-IgM or CHIKV-IgM cases. IgG testing revealed high arbovirus positivity in SCD patients in both cities, with statistical significance for ZIKV-IgG (p=0.023) and CHIKV-IgG (p=0.005) in Manaus. |

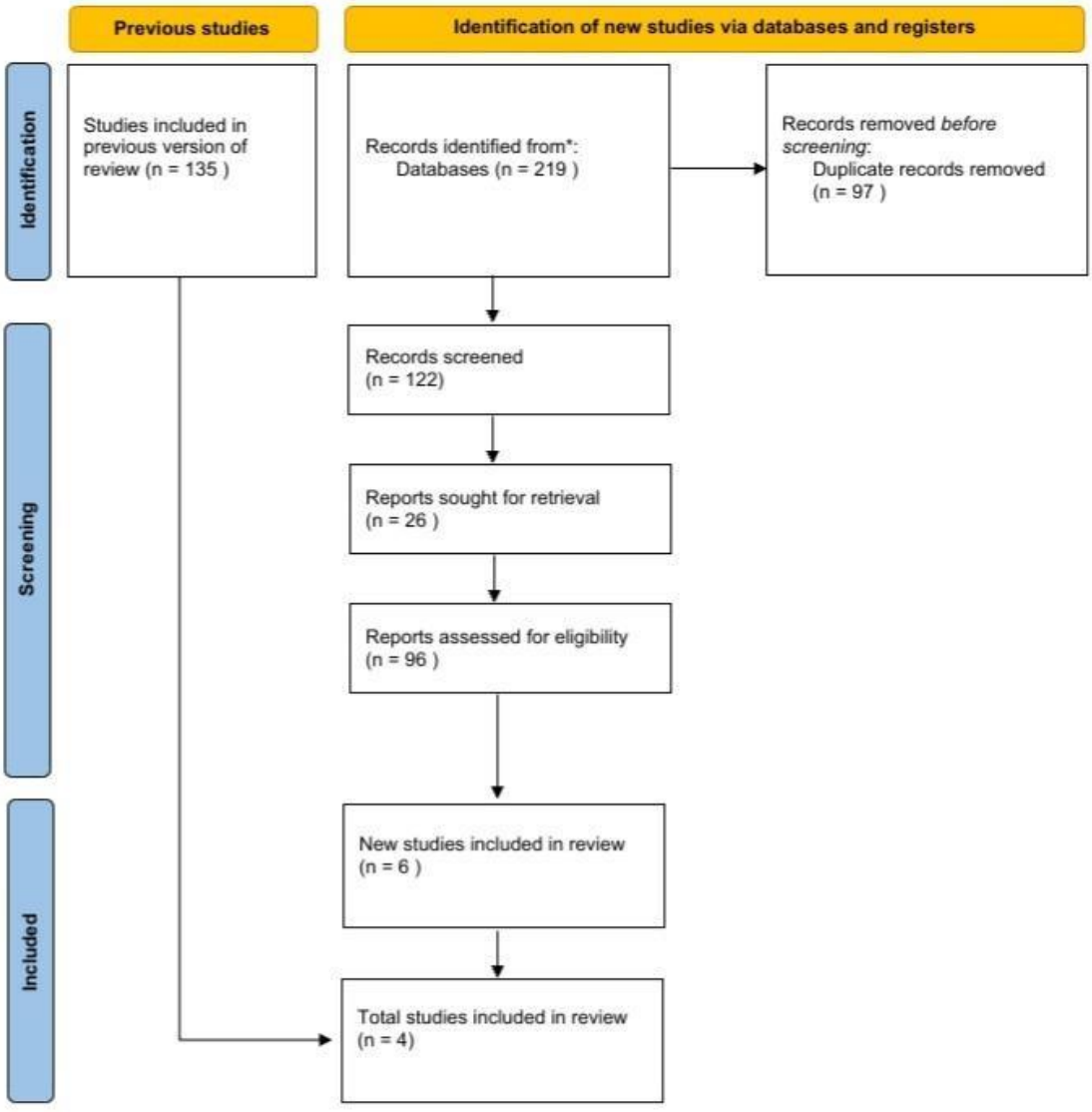
| | | |
|---|---|---|
| [12] | Conducted a cross-sectional study in a riverside population in the Humaitá municipality of the Brazilian Amazon. | More than 80% of the local population participated. Entomological samples identified local mosquito vectors. Serological analysis of 205 samples revealed IgG antibodies against dengue virus in 85 individuals. No molecular positivity in human samples. Entomological analysis found 3,187 Diptera species, with Mansonia being the most frequent genus; Aedes aegypti and Aedes albopictus were not detected. |
| [13] | Explored interactions between dengue and Zika in the context of dengue vaccination. | Dengue vaccine did not enhance symptomatic Zika illness in dengue-seropositive individuals; instead, it reduced the risk of VCZ. Zika infection boosted pre-existing vaccine-induced or naturally occurring dengue-neutralizing antibodies. |
| [14] | Social media usage is growing globally, with exponential increases in low- and middle-income countries. | Social media changes information-sharing, increasing exposure to misinformation, including fake news. This had significant repercussions for global health. The study in Fortaleza faced challenges due to violence, mistrust, and COVID-19, leading to interruption in 2019. Lessons learned may aid other researchers in handling misinformation during health interventions. |
| [15] | To compare sero-incidence of arboviral infection between trial arms and evaluate Wolbachia-infected mosquitoes. | The trial aims to assess Wolbachia-infected mosquito releases in reducing arboviral transmission by Aedes aegypti. Findings will add to field release evidence and enhance rigor in vector control assessment, including simultaneous measurement of entomologic and epidemiologic outcomes. Data from this trial will guide the development of novel vector control methods. |

Arbovirus infection is, in fact, a growing and emerging public health problem, especially in tropical and subtropical regions. The number of reported cases has increased significantly in the Americas and around the world due to several factors, such as uncontrolled urbanization, climate change and the expansion of the Aedes aegypti mosquito, the main transmitter of the dengue virus. Studies indicate that dengue is associated with a substantial economic burden. Previous reviews show that, although the data is not standardized, the financial impact is particularly relevant in Latin America and Brazil [6]. During the 2012-2013 dengue epidemic season, the estimated social cost of dengue in Brazil was US$1,212 million (when adjusted for underreporting). National incidence data in Brazil are collected by the Ministry of Health (MS) and reported to the WHO and the Health Information Platform for the Americas (PLISA) of the Pan American Health Organization. Large epidemics with more than 1,000,000 cases were recorded in 2013, 2015,

2016 and 2019. Since 2000, the highest incidence was recorded in 2015 with 806.5 cases per 100,000 population, followed by 2019 with 735.2 cases per 100,000 inhabitants [6].

Several factors have been related to the spread of the disease and the vector in the country, such as population growth, migration, air travel, inadequate urbanization, poorly functioning health systems, population density and socioeconomic inequalities, among others. In addition to the growing number of cases of the disease, the increase in reports of severe forms in recent decades may be related to the concomitant circulation of different serotypes of the virus, as well as the virulence of the circulating strains [7].

**Figure 1**. Schematic representation of synthesis and analysis of results (PRISMA).




A study was conducted on the integrated surveillance system in the city of Foz do Iguaçu, Brazil, from 2017 to 2020, which combines entomological data (related to the presence of mosquitoes) and virological data (virus detection in mosquitoes), with the aim of monitoring the population of Aedes aegypti mosquitoes, alerting outbreaks of mosquito-borne diseases, helping in a rapid response to transmission [8]. This study counted adult mosquitoes, larvae and pupae for carrying out molecular tests for arbovirus infections consisting of the elaboration of a transmission risk map. "Indices based on adult mosquito sampling showed higher predictive values for outbreaks than larval indices". Thus, the

implementation of technologies for capturing and analyzing adult mosquitoes significantly aided early detection of outbreaks and vector control, providing a possible model for replication in other locations, helping public health authorities act more quickly and accurately in areas of greatest risk [8].

Another study was carried out in the city of Pernambuco, Brazil, from 2015 to 2017, to investigate the risk factors associated with deaths caused by dengue and Chikungunya, during the first Chikungunya outbreak in the region. This study was able to demonstrate that the rate of Chikungunya was four times higher than that of dengue, and that the time to death, in severe cases, was significantly shorter in dengue. The risk factors associated with worsening of the condition, which contribute to the patient's death, are numerous and comprehensive and are present in both diseases. However, the authors identified that advanced age, headache, and symptoms such as nausea and severe joint pain were strongly associated with the risk of death from Chikungunya, unlike dengue, where the most common symptoms are headache and age over 50 years [9]. This study can highlight that the data show that mortality from Chikungunya is higher compared to the time to death in dengue, which is shorter, that is, more people die from Chikungunya, on the other hand, the time to death is shorter compared to dengue. Thus, early identification of the key symptoms mentioned above, especially in elderly patients, should be treated with greater attention, as well as adjusting strategies for the best prognosis for this patient [9].

Dengue control in Brazil faces several challenges, ranging from the limitations of traditional approaches to the need to integrate new technologies. In Brazil, Aedes aegypti is adapted to reproduce in domestic and peridomestic environments, using various types of containers with stagnant water. This adaptability makes control extremely challenging, especially in vulnerable urban areas, where sanitation is inadequate, and waste accumulation facilitates mosquito reproduction [10].

In this context, the introduction of the Dengvaxia vaccine has brought hope for a new strategy to combat dengue, but it has also highlighted important issues. The vaccine was developed for individuals who have already had a dengue infection and is contraindicated for seronegative individuals because it may increase the risk of developing severe forms of the disease during subsequent infections [11]. Although innovative, Dengvaxia does not fully address the dengue problem since its implementation is restricted and it does not provide protection against other arboviruses transmitted by Aedes aegypti. Recently, new technologies have emerged as promising tools for controlling Aedes aegypti, complementing traditional methods. One such technology involves the release of genetically modified mosquitoes (GMMs). These mosquitoes are engineered with a lethal protein during the larval stage, which helps reduce the Aedes aegypti population by preventing them from reaching adulthood [10]. Preliminary results indicate that this approach may be effective in reducing mosquito populations in specific areas, especially when compared to traditional methods like insecticide use. However, long-term studies are still needed to confirm the overall efficacy of this technology for large-scale dengue control in Brazil.

However, when we look at studies that talk about the occurrence of arboviruses in riverine areas. Within these communities there is a lack of basic sanitation and access to health care, leading the riverine population to depend on long and expensive boat trips to urban areas to obtain access to health care. In Brazil, the dengue surveillance system is based on passive notification by laboratory diagnosis. This method underestimates the incidence of the disease due to the underreporting of symptomatic and asymptomatic cases [12]. So, the main difficulty addressed when we talk about riverside communities is the lack of access to basic healthcare. Arbovirus control models in Brazil are still limited to specific investments in educational campaigns, which, although necessary to educate the population about infection and symptoms, prove to be an ineffective strategy when dealing with riverside communities that have little access to healthcare. It becomes an ineffective strategy when there is no adequate support for the patient [12].

In the clinical study evaluating potential interactions between Zika and dengue by Zambrano et al., the potential effect of dengue vaccination on Zika infection was assessed. It was observed that the dengue vaccine has no effect on patients with suspected Zika serology. However, the tetravalent dengue vaccine (CYD-TVD) can reduce the risk of virologically confirmed Zika among individuals seropositive for dengue. This shows that in addition to the application of new technologies for infection control, traditional vector control measures are still necessary to reduce the spread of other arboviruses [13].

In the article by Gagnon-Dufresne et al. (2023), the authors explore how social media and the spread of fake news impact public health interventions in the management of dengue in Brazil. They highlight that false information can undermine the effectiveness of prevention and control campaigns, making it harder for the population to adopt measures such as mosquito control and vaccine acceptance. This analysis underscores the idea that dengue is a complex endemic issue in Brazil, extending beyond traditional epidemiological control and requiring effective communication and public education to counter misinformation. While their discussion is relevant in highlighting the challenges posed by misinformation, it could delve deeper into the social and environmental factors that make dengue so persistent in Brazil, such as uncontrolled urbanization and climate conditions favorable to the vector, thus offering a more comprehensive view of the challenges in managing the disease [14].

Another clinical study conducted in Belo Horizonte, Brazil, aimed to control diseases transmitted by the Aedes Aegypti mosquito. The vector was modified using mosquitoes infected with the bacterium *Wolbachia Pipientis* to reduce the transmission of arboviruses. The introduction of this bacteria has already shown potential in inhibiting viral replication, making it a promising technique for vector control. The study compares the incidence of infections in areas where mosquitoes infected with Wolbachia were released and in control areas, monitoring the incidence of infections annually. The EVITA Dengue study is significant for providing evidence on mosquito modification, and its results may contribute to the development of new strategies to combat arboviruses [15].

## 5. Conclusion

Evidently, Brazil and tropical countries are the most affected by the exponential cases of Arbovirus. Which highlights the importance of public health surveillance, which mainly consists of data management, essential for disease prevention. The adequate exercise of public health surveillance requires the use of information systems in active surveillance. These public health surveillance systems bring benefits when used as decision-making support tools, because they provide health authorities and responsible entities with the ability to establish long-term prevention actions, interventions or policies to be able to respond to possible outbreaks quickly and timely, where the short life cycle times of the disease or vector are considered.

In short, combating and preventing endemic diseases such as dengue fever is not easy, which requires broad approaches and certain knowledge of the causes that favor its reproduction (creation and phases), as well as its effects (symptoms). With the incorporation of new open and collaborative technologies, a new perspective of community interaction with professionals and public health authorities is proposed for continuous epidemiological surveillance and timely intervention, which increases trust between actors and information. Therefore, future work that includes the application of a massive study on the most affected regions and the elaboration of a territorial entity for urban and rural areas, in addition to including the development and implementation of mathematical and computational epidemiological models for prediction, which include additional variables, such as population density and climate variations, to support epidemiological surveillance in decision-making.

**Funding:** None.

**Research Ethics Committee Approval:** None.

**Acknowledgments:** None.

**Conflicts of Interest:** The authors declare no conflict of interest.

**Supplementary Materials:** None.

## References

1. Khan MB, Yang ZS, Lin CY, Hsu MC, Urbina AN, Assavalapsakul W, Wang WH, Chen YH, Wang SF. Overview of dengue: an updated systematic review. J Infect Public Health. 2023 Oct;16(10):1625-42. doi: 10.1016/j.jiph.2023.08.001. Epub 2023 Aug 3. PMID: 37595484.
2. Parveen S, Riaz Z, Saeed S, Ishaque U, Sultana M, Faiz Z, Shafqat Z, Shabbir S, Ashraf S, Marium A. Dengue hemorrhagic fever: a growing global menace. J Water Health. 2023 Nov;21(11):1632-50. doi: 10.2166/wh.2023.114. PMID: 38017595.
3. B A Seixas J, Giovanni Luz K, Pinto Junior V. Atualização Clínica sobre Diagnóstico, Tratamento e Prevenção da Dengue [Clinical Update on Diagnosis, Treatment and Prevention of Dengue]. Acta Med Port. 2024 Feb 1;37(2):126-135. Portuguese. doi: 10.20344/amp.20569. Epub 2024 Feb 1.
4. PMID: 38309298.
5. Kularatne SA, Dalugama C. Dengue infection: Global importance, immunopathology and management. Clin Med (Lond). 2022 Jan;22(1):9-13. doi: 10.7861/clinmed.2021-0791. PMID: 35078789; PMCID: PMC8813012.
6. Wong JM, Adams LE, Durbin AP, Muñoz-Jordán JL, Poehling KA, Sánchez-González LM, Volkman HR, Paz-Bailey G. Dengue: A growing problem with new interventions. Pediatrics. 2022 Jun 1;149(6):e2021055522. doi: 10.1542/peds.2021-055522. PMID: 35543085.
7. Junior JBS, Massad E, Lobao-Neto A, Kastner R, Oliver L, Gallagher E. Epidemiology and costs of dengue in Brazil: a systematic literature review. Int J Infect Dis. 2022 Sep;122:521-528. doi: 10.1016/j.ijid.2022.06.050. Epub 2022 Jul 3. PMID: 35793756.
8. de Sousa SC, Carneiro M, Eiras ÁE, Bezerra JMT, Barbosa DS. Factors associated with the occurrence of dengue epidemics in Brazil: a systematic review. Rev Panam Salud Publica. 2021 Aug 6;45:e84. doi: 10.26633/RPSP.2021.84. PMID: 34377143; PMCID: PMC8344382.
9. Leandro AS, de Castro WAC, Lopes RD, Delai RM, Villela DAM, de-Freitas RM. Citywide Integrated Aedes aegypti Mosquito Surveillance as Early Warning System for Arbovirus Transmission, Brazil. Emerg Infect Dis. 2022 Apr;28(4):701-706. doi: 10.3201/eid2804.211547. PMID: 35318912; PMCID: PMC8962889.
10. Mendonça MFS de, Silva AP de SC, Lacerda HR. Factors associated with death from dengue and chikungunya virus infection during an epidemic period in Northeast Brazil: A retrospective cohort study. Rev Soc Bras Med Trop [Internet]. 2023;56:e0030–2023. Available from: https://doi.org/10.1590/0037-8682-0030-2023
11. Bezerra JMT, Sousa SC de, Tauil PL, Carneiro M, Barbosa DS. Entry of dengue virus serotypes and their geographic distribution in Brazilian federative units: a systematic review. Rev bras epidemiol [Internet]. 2021;24:e210020. Available from: https://doi.org/10.1590/1980-549720210020
12. Moura Neto JP, Albuquerque CCMX, Yahouedehou SCMA, Francisco MVL, Fraiji NA, de Siqueira IC, Gonçalves MS. Prevalence of arboviruses in sickle cell disease patients from two different regions of Brazil, the North and Northeast. Braz J Infect Dis. 2024 Mar-Apr;28(2):103741. doi: 10.1016/j.bjid.2024.103741. Epub 2024 Apr 23. PMID: 38670165; PMCID: PMC11070587.
13. Silva JCO, Siqueira IRF, Dornelas LF, Ribeiro CM, Gomes JPB, Guadagnin IW, Pereira AR, Julião GR, Camargo JSAA, Basano SA, Camargo LMA. Occurrence of arbovirus infections in two riverine populations in the municipality of Humaitá, Amazonas, Brazil. Rev Soc Bras Med Trop. 2024 Mar 25;57:e004032024. doi: 10.1590/0037-8682-0515-2023. PMID: 38536999; PMCID: PMC10962355.
14. Zambrano B, Noriega F, Dayan GH, Rivera DM, Arredondo JL, Reynales H, Luz K, Deseda C, Bonaparte MI, Langevin E, Wu Y, Cortés M, Savarino S, DiazGranados CA. Zika and Dengue Interactions in the Context of a Large Dengue Vaccine Clinical Trial in Latin America. Am J Trop Med Hyg. 2021 Jan;104(1):136-144. doi: 10.4269/ajtmh.20-0635. PMID: 33169661; PMCID: PMC7790115.
15. Gagnon-Dufresne MC, Azevedo Dantas M, Abreu Silva K, Souza Dos Anjos J, Pessoa Carneiro Barbosa D, Porto Rosa R, de Luca W, Zahreddine M, Caprara A, Ridde V, Zinszer K. Social Media and the Influence of Fake News on Global Health Interventions: Implications for a Study on Dengue in Brazil. Int J Environ Res Public Health. 2023 Mar 28;20(7):5299. doi: 10.3390/ijerph20075299. PMID: 37047915; PMCID: PMC10093785
16. Collins MH, Potter GE, Hitchings MDT, Butler E, Wiles M, Kennedy JK, Pinto SB, Teixeira ABM, Casanovas-Massana A, Rouphael NG, Deye GA, Simmons CP, Moreira LA, Nogueira ML, Cummings DAT, Ko AI, Teixeira MM, Edupuganti S. EVITA Dengue: a cluster-randomized controlled trial to EValuate the efficacy of Wolbachia-InfecTed Aedes aegypti mosquitoes in reducing the incidence of Arboviral infection in Brazil. Trials. 2022 Mar 2;23(1):185. doi: 10.1186/s13063-022-05997-4. PMID: 35236394; PMCID: PMC8889395.