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ORIGINAL ARTICLE

# Profile and costs of dengue hospitalizations in Southeast Pará from the SUS perspective (2000-2015)

## *Perfil e custos das internações por dengue no Sudeste do Pará na perspectiva do SUS (2000-2015)*

## *Perfil y costos de las hospitalizaciones por dengue en el Sudeste de Pará en la perspectiva del SUS (2000-2015)*

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## ABSTRACT

**Background and objectives:** Considering the little evidence associated with dengue hospitalizations, their public expenditures in Southeast Pará and its relevance to the public health in Brazil, this study aims to demonstrate the records of hospitalizations and expenses associated with this arbovirus between 2000 and 2015 from the perspective of the Unified Health System (SUS). **Methods:** This is a descriptive research that sought to assess the records and expenses (USD) of hospitalization caused by dengue (SUS code: 74500457, 74300440, 0303010010) and severe dengue (SUS code: 74300628, 74500627, 0303010029), as well as their associated deaths (CID: A90 and A91), respectively, from the SIH/SUS and SIM/SUS from 2000 to 2015 for all 39 municipalities in the southeast of Pará. **Results:** A total of 1206 deaths, 22,860 individuals with dengue and 306 with severe dengue underwent services in the SUS between 2000 and 2015, representing 23,166 hospitalizations (23,613: dengue and 313: severe dengue), in which Bom Jesus do Tocantins and Goianésia do Pará represent the municipalities with the highest number of hospitalizations associated with dengue. **Conclusion:** It is possible to verify the relevance of continuing efforts to combat and fight dengue in southeastern Pará. It reinforces the need to conduct studies that contribute to a better understanding of the distribution of hospitalizations and deaths in the different municipalities of the state of Pará, as well as reflections on the epidemiological and economic scenario for the implementation of a rational and efficient decision-making process.

***Keywords****: Dengue. Hospitalizations. Unified Health System. Pará.*

## RESUMO

**Justificativa e objetivos:** Considerando as poucas evidências associadas às internações por dengue, seus gastos públicos no Sudeste do Pará e sua relevância para a saúde pública no Brasil, este estudo tem como objetivo



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demonstrar os registros de internações e gastos associados a esta arbovirose entre 2000 e 2015 a partir da perspectiva do Sistema Único de Saúde (SUS). **Métodos:** Trata-se de uma pesquisa descritiva que buscou avaliar os registros e gastos (USD) de internação por dengue (código SUS: 74500457, 74300440, 0303010010) e dengue grave (código SUS: 74300628, 74500627, 0303010029), bem como seus óbitos associados (CID: A90 e A91), respectivamente, do SIH/SUS e SIM/SUS de 2000 a 2015 para todos os 39 municípios do sudeste paraense. **Resultados:** Um total de 1.206 óbitos, 22.860 indivíduos com dengue e 306 com dengue grave foram atendidos no SUS entre 2000 e 2015, representando 23.166 internações (23.613: dengue e 313: dengue grave), nas quais Bom Jesus do Tocantins e Goianésia do O Pará representa os municípios com maior número de internações associadas à dengue. **Conclusão:** É possível verificar a relevância da continuidade dos esforços de combate e combate à dengue no sudeste paraense. Reforça a necessidade da realização de estudos que contribuam para um melhor entendimento da distribuição das internações e óbitos nos diferentes municípios do estado do Pará, bem como reflexões sobre o cenário epidemiológico e econômico para a implementação de um processo decisório racional e eficiente. Fazendo processo.

***Palavras-chave:*** *Dengue. Hospitalizações. Sistema Único de Saúde. Pára.*

## RESUMEN

**Justificación y objetivos:** Considerando la poca evidencia asociada a las hospitalizaciones por dengue, sus gastos públicos en el Sudeste de Pará y su relevancia para la salud pública en Brasil, este estudio tiene como objetivo demostrar los registros de hospitalizaciones y gastos asociados a este arbovirus entre 2000 y 2015 a partir de la perspectiva del Sistema Único de Salud (SUS). **Métodos:** Se trata de una investigación descriptiva que buscó evaluar los registros y gastos (USD) de hospitalización por dengue (código SUS: 74500457, 74300440, 0303010010) y dengue grave (código SUS: 74300628, 74500627, 0303010029), así como sus muertes asociadas (CID: A90 y A91), respectivamente, del SIH/SUS y SIM/SUS de 2000 a 2015 para los 39 municipios del sureste de Pará. **Resultados:** Un total de 1206 muertes, 22.860 personas con dengue y 306 con dengue grave fueron atendidos en el SUS entre 2000 y 2015, lo que representa 23.166 hospitalizaciones (23.613: dengue y 313: dengue grave), en las que Bom Jesus do Tocantins y Goianésia hacen Pará representan los municipios con mayor número de hospitalizaciones asociadas al dengue. **Conclusión:** Es posible verificar la relevancia de continuar los esfuerzos para combatir y luchar contra el dengue en el sureste de Pará. Refuerza la necesidad de realizar estudios que contribuyan a una mejor comprensión de la distribución de hospitalizaciones y muertes en los diferentes municipios del estado de Pará, así como reflexiones sobre el escenario epidemiológico y económico para la implementación de una decisión racional y eficiente. proceso de fabricación.

***Palabras clave:*** *Dengue. Hospitalizaciones. Sistema Único de Salud. Paraca.*

## INTRODUCTION

According to the World Health Organization (WHO), dengue is a viral infection commonly recorded in tropical and subtropical regions caused by the Dengue virus (DENV) and transmitted to humans by the bite of female mosquitoes of the Aedes genus.[1] It is a disease of compulsory notification. According to the Resolution No. 204 of 2016, all diseases associated with this infection registered in Brazil might be notified and communicated to the epidemiological surveillance of the municipality to facilitate better control.[2]

DENV belongs to the Flavivirus genus and has five serotypes (DENV1-5), four of which (DENV1-4) have been associated with human infections. An individual can be infected by different serotypes, and a specific immune response can be generated for each of them. The detection of the fifth serotype, isolated in Malaysia, is considerably recent. A study by Mustafa et al. (2015) showed that DENV-5 is associated with mild infection and has been circulating among primates from the Southeast Asian forest.[3]

The individual infected by DENV may be asymptomatic or present more severe symptoms. In dengue cases, individuals may have a high fever (39° to 40°C), headaches or eye pain, muscle and bone pain, tiredness, nausea, lack of appetite, presence of red spots on the skin, feeling of dizziness, and vomiting. On the other hand, in severe dengue, clinical events such as hemorrhage, circulatory collapse, abdominal pain and shock stand out.[4]

According to the Pan American Health Organization (PAHO), the incidence of dengue in some endemic countries has increased in recent years. Between January and May 2020, about 1.6 million infected people were registered in the Americas. In 2019, Brazil alone was responsible for 2,241,974 occurrences of this infection, ranking first in the total number of cases, with 70% of the records from Latin America and more than half of the deaths that year.[5]

In this scenario, the State of Pará stood out regarding the records of this arbovirus in the North region of Brazil between 2010 and 2016, with about 83,371 cases. This state presents a vast diversity and territorial extension and is popularly known for its climatic variability. Furthermore, it has a hot, humid equatorial tropical climate and high rainfall levels, with average temperatures of 27°C, especially in the mesoregion of Southeast Pará[6], which is important for the proliferation of the vector and,

consequently, a high number of infected individuals.

Dengue represents a significant public health challenge in the country. To date, there is no evidence available on the records of hospitalizations, expenses, and deaths associated with DENV in Southeast Pará. Therefore, it is relevant to carry out this study to demonstrate the records of hospitalizations, as well as the expenses associated with the treatment of dengue and severe dengue, together with the deaths caused by this arbovirus involving 39 municipalities, which comprise the mesoregion of Southeast Pará, from 2000 to 2015, from the perspective of the Unified Health System (SUS).

## METHODS

This is a descriptive study that aims to evaluate the epidemiological and economic impact of dengue and severe dengue in the SUS hospitalization services over 16 years (2000-2015) in the southeastern mesoregion of Pará based on the records available in the Hospital Information System (SIH/SUS) and Mortality Information System (SIM/SUS) databases. The southeast of Pará is composed by 39 municipalities: Abel Figueiredo, Água Azul do Norte, Bannach, Bom Jesus do Tocantins, Brejo Grande do Araguaia, Breu Branco, Canãa dos Carajás, Conceição do Araguaia, Cumaru do Norte, Curionópolis, Dom Eliseu , Eldorado dos Carajás, Araguaia Forest, Goianésia do Pará, Itupiranga, Jacundá, Marabá, Nova Ipixuna, Novo Repartimento, Ourilândia do Norte, Palestina do Pará, Paragominas, Parauapebas, Pau D`Arco, Piçarra, Redenção, Rio Maria, Rondon do Pará, Santa Maria das Barreiras, Santana do Araguaia, São Domingos do Araguaia, São Félix do Xingu, São Geraldo do Araguaia, São João do Araguaia, Sapucaia, Tucumã, Tucuruí, Ulianópolis, and Xinguara. These municipalities were included in our collection and analysis of data.

In 2014, the most severe denomination of dengue infection, previously denominated as dengue/hemorrhagic fever, changed to severe dengue. Furthermore, the terms dengue and severe dengue were used to represent the mildest and most severe conditions associated with DENV infection, respectively.[7]

The analyses followed the following steps: an annual and global assessment of the number of hospitalization records caused by dengue and severe dengue in the SUS, as well as the number of individuals hospitalized with this arbovirus, considering the procedure codes made available by the SUS for dengue (74300440, 74500457, 0303010010) and severe dengue (74300628, 74500627, 0303010029) and analysis of expenditures (USD) recorded with the treatment of hospitalized individuals and the global assessment of deaths associated with DENV in southeastern Pará between 2000 and 2015. The database used for the analyses was previously obtained from the probabilistic matching strategy involving the databases offered by the SUS, namely the Hospital Information System (SIH/SUS) and the Mortality Information System (SIM/SUS). The data obtained by the SIH and SIM platforms were used to acquire data on hospitalizations, expenses, and deaths involving this arbovirus in the mesoregion of southeastern Pará between January 2000 and December 2015. All costs for the treatment of dengue and severe dengue were obtained in US dollars (USD), and the database used was evaluated for previously published studies involving different scenarios, such as the northern region of Brazil,[8] the State of Minas Gerais,[9] as well as Brazil.[10]

This study was approved by the Ethics Committee of the Federal University of Minas Gerais (COEP) under CAEE Registry: 57219816.0.0000.5149 (Approval Report No: 1,619,654).

## RESULTS

A total of 22,860 individuals with dengue and 306 with severe dengue were hospitalized and used SUS services between 2000 and 2015, representing 23,926 hospitalizations (23,613: dengue and 313: severe dengue). It was found that most cases were registered for male individuals, of which 50.8% were dengue cases. Individuals between 05 and 44 years old accounted for 72.9% and 62.4% of dengue and severe dengue cases, respectively. Moreover, 3.2% of the individuals had more than one hospitalization caused by DENV in the same year and/or complications resulting from the infection in the study period.

**Table 1.** Population characteristics: profile of dengue and severe dengue in the Southeast region of Pará (2000-2015).

| Variables | Dengue | Severe Dengue |
|---|---|---|
| Number of individuals (n) | 22.860 | 306 |
| Gender (%) | | |
| Men | 50.8 | 47.4 |
| Women | 48.6 | 52.0 |
| NA* | 0.6 | 0.6 |
| Frequency by age group (years old) (%) | | |
| < 1 | 1 | 5.9 |
| 01 – 04 | 3.7 | 9.2 |
| 05 – 14 | 14.9 | 22.5 |
| 15 – 24 | 24.1 | 14.5 |
| 25 – 34 | 20.2 | 13.4 |
| 35 – 44 | 13.7 | 12 |
| 45 – 54 | 10.1 | 8.8 |
| 55 – 64 | 6.4 | 7.2 |
| 65 – 74 | 3.9 | 4.2 |
| 75 – 84 | 1.6 | 2.0 |
| > 84 | 0.4 | 0.3 |
| Number of hospitalizations (n) | 23.613 | 313 |
| Hospitalizations for Dengue more than once a year (%) | 3,2 | 0,3 |
| Deaths (CIDA90 e A91) | 1206 | 0 |

**Note: NA = Not available*

In addition, 2003, 2007, 2008, and 2011 stood out regarding the number of hospitalizations associated with dengue (Table 2).



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**Table 2.** Summary of infected individuals and hospitalizations associated with dengue and severe dengue in the Southeast region of the Pará State 2000-2015.

| Year | Population | Infected Individuals | Hospitalization | Infected/100 thousand inhabitants | Hospitalizations/100 thousand inhabitants |
|---|---|---|---|---|---|
| 2000 | 6.192.307 | 847 | 876 | 13.7 | 14.1 |
| 2001 | 6.341.711 | 1483 | 1549 | 23.4 | 24.4 |
| 2002 | 6.453.699 | 1905 | 2006 | 29.5 | 31.1 |
| 2003 | 6.574.990 | 2724 | 2830 | 41.4 | 43 |
| 2004 | 6.695.940 | 1203 | 1239 | 17.9 | 18.5 |
| 2005 | 6.970.591 | 1005 | 1039 | 14.4 | 14.9 |
| 2006 | 7.110.462 | 775 | 798 | 10.9 | 11.2 |
| 2007 | 7.249.184 | 2247 | 2310 | 31 | 31.8 |
| 2008 | 7.321.493 | 2969 | 3077 | 40.5 | 42 |
| 2009 | 7.431.041 | 1495 | 1549 | 20.1 | 20.8 |
| 2010 | 7.581.051 | 1454 | 1495 | 19.2 | 19.7 |
| 2011 | 7.688.593 | 2115 | 2163 | 27.5 | 28.1 |
| 2012 | 7.822.205 | 1255 | 1285 | 16.0 | 16.4 |
| 2013 | 7.999.720 | 974 | 991 | 12.2 | 12.4 |
| 2014 | 8.104.880 | 456 | 459 | 5.6 | 5.6 |
| 2015 | 8.206.923 | 259 | 260 | 3.1 | 3.1 |
| Total | | 23166 | 23926 | - | - |

*Note: Data referring to the number of inhabitants were extracted from DataSUS and Statistical Yearbook of Pará 2019.[11,12]*

The municipalities that stood out regarding the highest number of hospitalizations associated with dengue in southeastern Pará were Jacundá (2,294), Goianésia do Pará (1,225), Bom Jesus do Tocantins (1144), São João do Araguaia (1043), Xinguara (1,116), São Domingos do Araguaia (1007), Rondón do Pará (1,007), and Marabá (1,000). For hospitalizations caused by severe dengue, Redenção (94), Conceição do Araguaia (32), Parauapebas (29), and Xinguara (21) presented the highest incidence of hospitalization.

Global costs associated with dengue and severe dengue in terms of hospitalization, from the perspective of the SUS, totaled USD 5,051,272.82 and USD 122,542.97, respectively, from 2000 to 2015 in Southeast Pará. A considerable consumption of public resources for treating DENV infection can be highlighted for 2003 and 2008. In 2003, dengue cost USD 662,228.45; in 2008, USD 45,272.07 were spent on severe dengue hospitalizations. Expenses with dengue represent 98% of total costs with this arbovirus, and the average expense with hospitalization for treating dengue and severe dengue in southeastern Pará was USD 213 and USD 391, respectively (Table 3).

**Table 3.** Summarization of records and expenses (USD) with hospitalization associated with dengue in each of the municipalities in the Southeast region of the Pará State 2000-2015.

| Municipality | Individuals | Hospitalizations (n) | Expenses (USD) | Deaths |
|---|---|---|---|---|
| Abel Figueiredo | 160 | 161 | 32,037.05 | 8 |
| Água Azul do Norte | 613 | 653 | 129,163.08 | 27 |
| Bannach | 97 | 101 | 18,330.81 | 7 |
| Bom Jesus do Tocantins | 1144 | 1182 | 258,574.31 | 49 |
| Brejo Grande do Araguaia | 372 | 394 | 82,379,82 | 20 |
| Breu Branco | 111 | 111 | 25,741.03 | 1 |
| Canaã dos Carajás | 446 | 453 | 104,093.52 | 18 |
| Conceição do Araguaia | 754 | 776 | 164,638.4 | 30 |
| Cumaru do Norte | 47 | 48 | 9,617.33 | 1 |
| Curionópolis | 687 | 708 | 158,146.16 | 50 |
| Dom Eliseu | 553 | 563 | 114,561,13 | 19 |
| Eldorado dos Carajás | 596 | 614 | 139,373.09 | 43 |
| Floresta do Araguaia | 210 | 213 | 43,892.38 | 19 |
| Goianésia do Pará | 1225 | 1264 | 295,069,27 | 64 |
| Itupiranga | 553 | 566 | 116,611,67 | 25 |
| Jacundá | 2296 | 2400 | 519,306.25 | 130 |
| Marabá | 1012 | 1075 | 254,472.72 | 94 |



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| | | | | |
|---|---|---|---|---|
| Nova Ipixuna | 16 | 16 | 3977,03 | 1 |
| Novo Repartimento | 223 | 228 | 47.279,84 | 21 |
| Ourilândia do Norte | 394 | 399 | 80,156.13 | 12 |
| Palestina do Pará | 453 | 461 | 96,214.75 | 15 |
| Paragominas | 233 | 235 | 52,571.51 | 13 |
| Parauapebas | 863 | 881 | 205.903,12 | 55 |
| Pau D, Arco | 124 | 131 | 25,521.05 | 4 |
| Piçarra | 237 | 246 | 48,598.03 | 7 |
| Redenção | 871 | 882 | 209,466.78 | 45 |
| Rio Maria | 636 | 668 | 140,046,58 | 36 |
| Rondon do Pará | 1908 | 1962 | 430,194.7 | 96 |
| Santa Maria das Barreiras | 89 | 90 | 19,049.62 | 3 |
| Santana do Araguaia | 354 | 365 | 74,782.46 | 10 |
| São Domingos do Araguaia | 1011 | 1048 | 234,725.52 | 56 |
| São Félix do Xingu | 687 | 702 | 140,426.18 | 27 |
| São Geraldo do Araguaia | 1047 | 1098 | 214,900.1 | 50 |
| São João do Araguaia | 269 | 271 | 57,450.76 | 13 |
| Sapucaia | 82 | 83 | 15,152.2 | 5 |
| Tucumã | 853 | 886 | 181,529.93 | 26 |
| Tucuruí | 234 | 237 | 59,428.34 | 19 |
| Ulianópolis | 569 | 576 | 124,329.71 | 17 |
| Xinguara | 1137 | 1179 | 246,103.43 | 70 |
| Total | 23166 | 23926 | 5,173.815.79 | 1206 |

It is noteworthy that the municipalities of Bom Jesus do Tocantins, São Domingos do Araguaia, Marabá, São Geraldo do Araguaia, Parauapebas, Xinguara, Tucumã, and Redenção presented between 801 and 1200 hospitalization records, followed by Goianésia do Pará, Jacundá, and Rondón do Pará, with 1,201 to 2,500 cases of hospitalizations during 2000 and 2015 (Figure 1). Figure 2 shows the age profile of cases and deaths due to DENV infections in Southeast Pará.

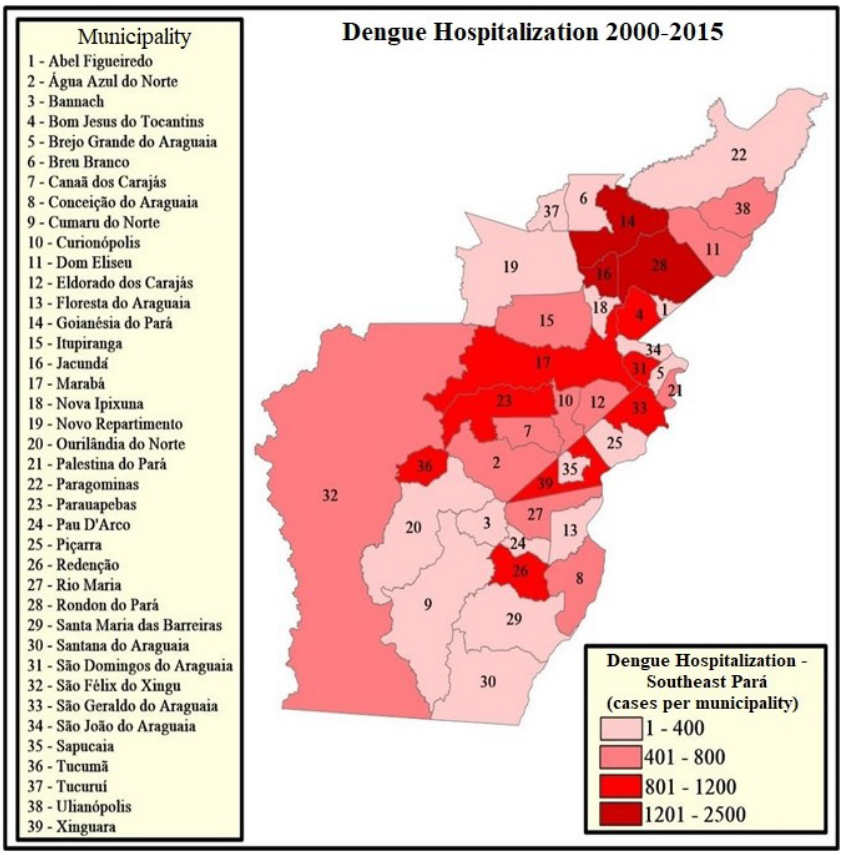


**Figure 1.** Dengue cases by municipality in the Southeast Pará (2000-2015).

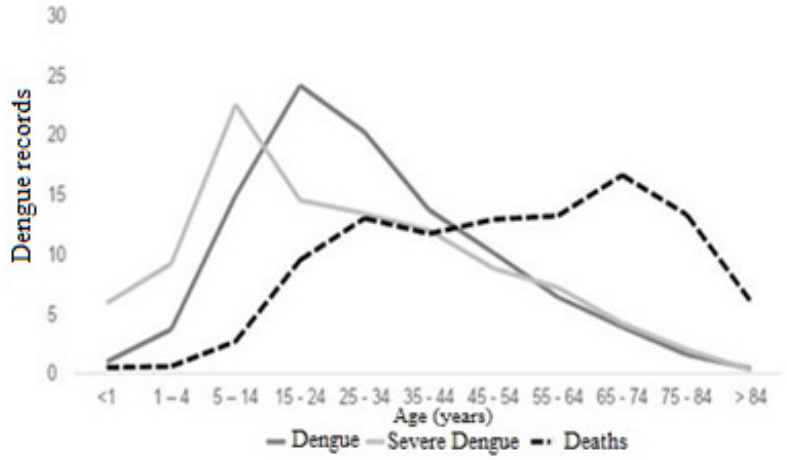


**Figure 2.** Distribution of dengue, severe dengue and deaths, by age, in the Southeast of Pará State from 2000 to 2015.

## DISCUSSION

This study was the first to assess hospitalization records and costs from the perspective of the SUS caused by dengue and severe dengue, as well as the deaths associated with the disease in Southeast Pará over 16 years (2000-2015). A total of 23,166 individuals infected with DENV and 23,926 hospitalizations in the 39 municipalities of this mesoregion were reported, representing an impact on public coffers of USD 5,173,815.79. In this context, the importance of encouraging and directing efforts to prevent this disease is highlighted.

Dengue is a serious public health problem in Brazil. It is endemic in all regions of the country, with a considerable epidemiological burden[13] mainly in the Northeast (336,222), Southeast (137,035) and North (128,471) regions, as demonstrated in a previous study that also considered the same period of the present work.[10] It is relevant to note that from 2000 to 2015, 1,621,797 notifications associated with DENV infection were verified in the North of Brazil, which was higher than the number of hospitalizations (128,471) since for this arbovirus, in most cases, hospitalizations are not necessary.[10,14] Considering the North region of Brazil, the State of Pará was highlighted from 2010 to 2016 regarding the number of notifications of DENV infection, with a total of 83,371 records.[14] In this scenario, the municipalities of Jacundá (10.2%), Goianésia do Pará (5.84%), Bom Jesus do Tocantins (5.11%), Marabá (4.90%), Xinguara (4.74%), São Domingos do Araguaia (4.61%), and São Geraldo do Araguaia (4.2%) presented the highest incidence of dengue hospitalizations in southeastern Pará, corresponding to 39.6%.

Among the states of the North Region, Pará was the most affected by this arbovirus, with 82,211 notifications, 84,693 hospitalizations, 18,340,822.3 (USD) in expenses, and 491 deaths caused by dengue between 2000 and 2015.[8] Based on the results of this study, approximately 23,166 new cases were associated with this infection, with 22,860 dengue cases and 306 severe dengue reports. The southeast of Pará presents conditions that favor the cases of this and other arboviruses, considering its high rainfall, high temperatures, precarious sanitation, and inadequate housing conditions, education and income distribution, which contribute to the increase in the incidence of dengue.[15-17]

Furthermore, it was observed that most of the female population was hospitalized with severe dengue (52%), as found in a study that evaluated the epidemiological profile of this arbovirus in Brazil from 2000 to 2015 and in another study that evaluated in the same period in the North region of Brazil.[8,] In our study, most dengue hospitalizations were reported to the male public (50.8%), differently from what was found in previous studies.[8,10] It is noteworthy that individuals between 5 and 44 years old were the most hospitalized due to DENV infection, representing 72.9% of the dengue cases and 62.4% of severe dengue, a result similar to that found in a published article conducted with individuals within this age group.[8]

Arboviruses are responsible for a high economic and social impact in Brazil. A previous publication showed that the costs related to the management of these infections, including the control and combat of the vector, and direct and indirect medical costs, represented about 2% of the country's health budget for 2016.[18] In this context, it is noteworthy that approximately R$ 1.5 billion in investments to combat the vector were estimated in Brazil in 2016, in which approximately R$ 78.6 million were allocated by the federal government for acquiring larvicides and insecticides. It is estimated that the country spends

approximately R$ 374 million on arbovirus treatment, of which about R$ 175,876,163 is directed only to dengue and R$ 1,684,053 to the State of Pará. Regarding the indirect costs with arboviruses, approximately R$ 431 million were spent with loss of productivity.[18] In this study, 23,926 hospitalizations associated with DENV in the southeastern mesoregion of Pará were reported. It represented an economic impact of USD 5,173,815.79 to public coffers in Brazil and included only medical services and medicines to treat hospitalized individuals for 16 years (2000-2015). Finally, this infection still represents a considerable challenge for the health public in this region of Pará state, as well as for the entire state and country.

To combat dengue, efforts and strategies are carried out by the Brazilian government, emphasizing investments in public policies. Among the measures adopted by the government are the creation of the Aedes aegypti Eradication Program (PEAa) in 1996 and the Aedes aegypti Eradication Program in 2002. National Dengue Control Program (PNCD) was also created, and later, in 2015, the National Program to Combat Aedes and Microcephaly (PNEAM) was created.[15] However, many epidemics and high numbers of cases were reported, indicating the need to improve and review the strategies and adopt them at the national level to combat arboviruses since the vector is present throughout the Brazilian territory, as well as facilitate their implementation and development, especially in the North region of the country. In addition, the importance of carrying out studies that better demonstrate the clinical, epidemiological, and economic panorama of each of these diseases in different locations is also crucial to provide subsidies for the rational decision-making process to face these diseases. This process should involve the population, health professionals, and managers.[10]

It reinforces the need to intensify campaigns to combat the dengue vector, which is also responsible for spreading other arboviruses, such as chikungunya and zika virus. Some strategies can help fight the vector, such as using larvicides in mosquito breeding sites, cleaning and emptying wastewater reservoirs, and using insecticides in homes. Moreover, vaccines are one of the main strategies used to control infections, and so far, new studies have demonstrated the evidence on the first dengue vaccine approved in Brazil so that it can be made available by the SUS.[19-21,24,25]

So far, Brazil has licensed a vaccine called Dengvaxia® to prevent dengue. This vaccine is available only for commercialization in the private market and is not yet available in the National Immunization Program by the SUS.[21]A study evaluated the consumer willingness to pay for a dengue vaccine in Brazil, showing a maximum value of USD 36.04 (120.00BRL) for the three-dose regimen or USD 12.01 (40.00 BRL) per dose.[22] A study developed in Brazil estimated the potential impact of vaccination against dengue. The results show a 22% reduction in dengue records.[23] Furthermore, the decision to incorporate or not a new vaccine or drug in the SUS is made by the National Commission for the Incorporation of Technologies in the SUS (CONITEC). In 2016, Dengvaxia® was not recommended for the National Vaccination Calendar, as the results of clinical studies showed limitations and/or questions about its incorporation in the SUS.[25]

This study sought to contribute and highlight the context associated with direct medical costs, the distribution profile, and the number of hospitalizations due to DENV infections in southeastern Pará. Some limitations can be listed: (i) the availability of only the data applied to direct costs with hospitalizations by the SUS, having adopted the perspective of the Brazilian public health system, and (ii) non-availability and identification of the type of DENV serotype associated with each hospitalization, considering the unavailability of this type of information in the systems (SIH/SIM/SUS) consulted from the SUS. Despite these limitations, it is believed that this study can provide reliable and relevant information to promote discussions and reflections on the epidemiological and economic scenario of dengue in this mesoregion and its municipalities, highlighting the little evidence and publications on the topic.

Dengue remains an important public health problem in southeastern Pará. The present study revealed some of the expenses with hospitalizations due to dengue and severe dengue by the SUS, as well as the epidemiological context of this infection and its deaths for this mesoregion of Pará over 16 years. In this context, the municipalities of Jacundá, Goianésia do Pará, Bom Jesus do Tocantins, Marabá, Xinguara, São Domingos do Araguaia, and São Geraldo do Araguaia presented the highest records of hospitalizations, costs and deaths associated with this arbovirus.

Thus, even with the initiatives to combat this arbovirus adopted so far, the continued efforts and strengthen campaigns, joint efforts and training of Endemic Combat Agents (ACE) to promote actions focused on health education to better monitor and promote awareness of the risks and precautions to be adopted to combat arboviruses are urgently needed. Considering the budgetary limitations experienced in Brazil, the need for the search for prevention strategies that allow a significant reduction of cases and expenses caused by this problem by the SUS is reinforced. Finally, we emphasize the importance of carrying out more studies and disseminating evidence on dengue in different locations of Brazil so that they can contribute to a better perception of the epidemiological and economic situation regarding this arbovirus, which is essential for planning rational and efficient measures in the face of the many scenarios to be discussed and rethought about this.

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## CONFLICT DE INTEREST

The authors have no other relevant affiliations or financial involvement with any organization or entity with a financial interest in or financial conflict with the subject matter or materials discussed in the manuscript

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