Research Article
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# Profile of hospitalizations for malaria in Brazil from 2014 to 2023

## Abstract

Malaria is an infectious disease caused by protozoa of the genus *Plasmodium*, transmitted by the bite of the female Anopheles mosquito. In Brazil, the disease is most prevalent in the Amazon Region, where most cases and hospitalizations occur. Despite being preventable and treatable, malaria remains a significant public health challenge, potentially progressing to severe and fatal forms if not diagnosed and treated promptly. This study aims to analyze the epidemiological profile of hospital morbidity and mortality due to malaria in Brazil between 2014 and 2023. For this purpose, a cross-sectional epidemiological study was conducted using data extracted from the Hospital Information System of SUS (SIH/SUS). The collected data were tabulated and statistically analyzed to identify patterns of hospitalizations, deaths, and associated factors. During the study period, n=19135 hospitalizations for malaria were recorded in Brazil, with a predominance in the North Region (n=15994), followed by the Midwest (n=1054), Northeast (n=985), Southeast (n=802), and South (n=300). In the same period, 160 deaths from malaria occurred, with most also concentrated in the North Region (n=105). The highest mortality rate was observed in the Southeast Region (2.37%), followed by the South (2,0%) and Northeast (1,83%). Most hospitalizations occurred among males (n=10413), with a predominance in the 20-29 age group (n=4355). Regarding ethnic classification, the mixed-race population was the most affected (n=11147), followed by individuals with no information on race/color (n=4799) and the indigenous population (n=1185). Concerning etiological agents, most hospitalizations were caused by *Plasmodium vivax* (n=12105), followed by unspecified malaria cases (n=3377) and *Plasmodium falciparum* infections (n=2870). The total cost of hospitalizations for malaria during the period was approximately R$7 billion, with the North Region accounting for the largest share of expenses approximately R$5 billion. The study results show that despite control efforts, malaria remains a significant cause of hospital morbidity and mortality in Brazil, especially in the North Region. The data reinforce the need for effective public policies to reduce transmission, expand access to timely diagnosis and treatment, and implement targeted actions for vulnerable groups.

**Keywords:** malaria, epidemiology, hospital morbidity, mortality

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## Introduction

Malaria is an infectious disease, also known as *Plasmodium* disease, and is an acute parasitic infection that occurs predominantly in tropical and subtropical regions. The main route of transmission is through the bite of the female Anopheles mosquito, infected by the *Plasmodium* parasite. However, transmission can also occur through other routes, such as sharing contaminated syringes, blood transfusions, or even from mother to fetus during pregnancy.[1] The parasites responsible for malaria in humans belong to the *Plasmodium* genus. In Brazil, the most common species are *Plasmodium falciparum, Plasmodium vivax, and Plasmodium malariae*. Other species, such as *Plasmodium ovale* and *Plasmodium knowlesi*, are more common in other regions of the world.[2]

In Brazil, malaria is most common in the Amazon region, which includes the states of Acre, Amazonas, Amapá, Maranhão, Mato Grosso, Pará, Rondônia, Roraima and Tocantins, totaling 808 municipalities. In the extra-Amazon region, which includes the other states and the Federal District, more than 80% of reported cases are imported from endemic areas or other countries, especially the African continent. In 2019, *Plasmodium vivax* was responsible for 89% of the cases registered in the country, being the predominant species.[3]

The main symptoms of malaria include fever, chills, sweating, headache and weakness, resulting from the cyclical destruction of red blood cells and the body's inflammatory response. In more severe cases, especially in infections caused by *Plasmodium falciparum*, complications such as severe anemia, acute respiratory distress syndrome, kidney failure and cerebral malaria may arise, which can progress to coma and even death. These serious complications are often associated with the obstruction of small blood vessels due to changes in infected red blood cells.[4]

Identifying malaria is essential for effective treatment and reducing disease transmission. The traditional diagnostic method is microscopic analysis of blood smears, which allows direct observation of the parasites present in red blood cells. This method is considered the gold standard due to its high sensitivity and specificity, in addition to enabling the identification of different *Plasmodium* species. However, its application requires trained professionals and adequate equipment, which represents a challenge in remote regions.[5]

On the other hand, rapid diagnostic tests (RDTs) have emerged as an effective alternative, especially in hard-to-reach and resource-poor areas. These tests are capable of identifying specific *Plasmodium* antigens in the blood and provide results in less than 30 minutes. Although they have lower sensitivity compared to microscopy, RDTs are simple to use and do not require complex laboratory infrastructure, which makes them ideal for use in public health programs.[6]

Progression to severe forms and death in malaria is often associated with complications such as cerebral malaria, renal failure,

hypoglycemia, metabolic acidosis, and multiple organ failure. *Plasmodium falciparum* is the main species responsible for fatal cases, due to its ability to cause erythrocyte sequestration and microvascular obstruction, leading to significant damage to vital organs. Red blood cells infected by *P. falciparum* adhere to the endothelial cells of venules and capillaries of various organs, such as the brain, lungs, and kidneys, through electron-dense protrusions on their surface, facilitating cytoadherence. This phenomenon results in tissue ischemia and hypoxia, contributing to the severity of the disease.[1]

Hospitalization due to malaria occurs mainly in patients with severe forms of the disease, whose progression can be influenced by individual and structural factors, such as late access to medical care and the presence of comorbidities. According to studies carried out in several Brazilian regions, the rate of hospitalization due to malaria in Brazil is still significant, with most cases occurring among young adults, with a higher prevalence in males.[7] In addition, the lethality of the disease may be related to the failure of early identification and inadequate management of patients in remote areas, where there are limited infrastructure and resources for treatment.[5]

Mortality resulting from malaria infection is preventable, given that the disease can be diagnosed and treated in the public health system. However, factors such as underreporting and difficulties in accessing medical services still pose challenges to the effective control of hospital morbidity and mortality due to malaria in Brazil. Given the possibility of prevention and the need for a better understanding of the impact of severe malaria, it is essential to study the epidemiology of hospital morbidity and mortality due to malaria in Brazil from 2014 to 2023.

## Methodology

This study is a descriptive, quantitative, exploratory, cross-sectional epidemiological time series study covering the decade from 2014 to 2023.

The data were collected from the SUS information system, TABNET/DATASUS, Ministry of Health - SUS Hospital Information System (SIH/SUS), therefore using secondary data from official and public databases.

The variables under study are: malaria, Brazil, Region, year, hospitalizations, sex, ICD-10 category, age group, race, amount spent, average hospitalization cost, days of stay, average days of stay, deaths and mortality rate.

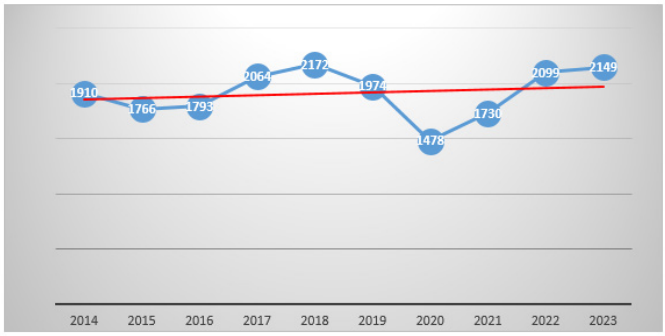
The data collected in the TABNET system were imported by the Excel program, in which the results were tabulated and graphs and tables were created. The data were then exported to the Bioestat 5.3 statistical program, in which descriptive statistics were extracted, using mean, standard deviation and coefficient of variation (CV).

Because it uses secondary data, this research does not require approval from a Research Ethics Committee, as the system used does not allow the identification of an individual's private data, it only allows the collection of population data. Therefore, this work respects the ethical principles related to scientific studies in humans, complying with current legislation, both in Brazil and worldwide.

## Results

Malaria cases in Brazil still attract public health attention and are present in all regions and are related to deaths. The number of hospitalizations from 2014 to 2023 was n=19135 hospitalizations and in the same period there were n=160 deaths from malaria, which were present in all regions.

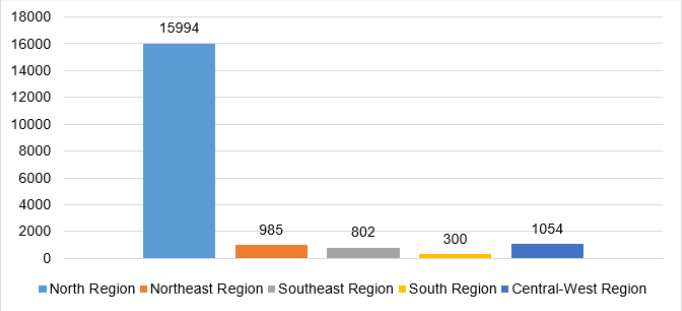
Hospitalizations due to malaria (Graph 1), in this decade studied, remained high throughout the period, with an oscillating trend, with a lower peak in 2020 with n=1478 hospitalizations and 2021 with n=1730, another decreasing peak was in 2015 with n=1766 and 2016 with n=1793. The other years were above the trend line, with higher peaks in 2018 with n=2172 and 2024 with n=2149. Although it does not present many discrepancies, the trend line is at a high point, always above 1478 hospitalizations/year. The average=1913,50 hospitalizations (±221,77) and Coefficient of Variation (CV)=11.59%.




**Graph 1** Distribution of hospitalizations due to Malaria in Brazil, from 2014 to 2023.

Source: Prepared by the authors, with data from the Ministry of Health - SUS Hospital Information System (SIH/SUS), 2025.

Hospitalizations by region (Graph 2) show the highest number of cases in the North region, n=15994, followed by the second highest number of cases in the Midwest region, n=1054. The third highest number of hospitalizations occurred in the Northeast region, with n=985, followed by the Southeast region, with n=802 and, in last place, the South region, with n=300, representing the location with the lowest number of hospitalizations for this pathology.




**Graph 2** Distribution of hospitalizations due to Malaria in Brazil, by region, from 2014 to 2023.

Source: Prepared by the authors, with data from the Ministry of Health - SUS Hospital Information System (SIH/SUS), 2025.

Regarding the distribution by region/year (Graph 3), the North region presented an exorbitant number of hospitalizations due to Malaria in Brazil, standing out in the graph with an oscillating trend line, mostly increasing, significantly above the trend lines corresponding to the other regions throughout the analyzed period. Regarding the North region, in the first year studied, 2014 (n=1638), it showed an eloquent number of cases, followed by a decreasing trend in the subsequent years, in 2015 (n=1535) and 2016 (n=1566). Soon after, there was an increasing trend in 2017 (n=1796) and the largest upward peak in 2018 with n=1838 hospitalizations, accompanied by a decreasing trend of cases in 2019 (n=1649), showing the smallest declining peak in 2020, with n=1181. In subsequent years, there was

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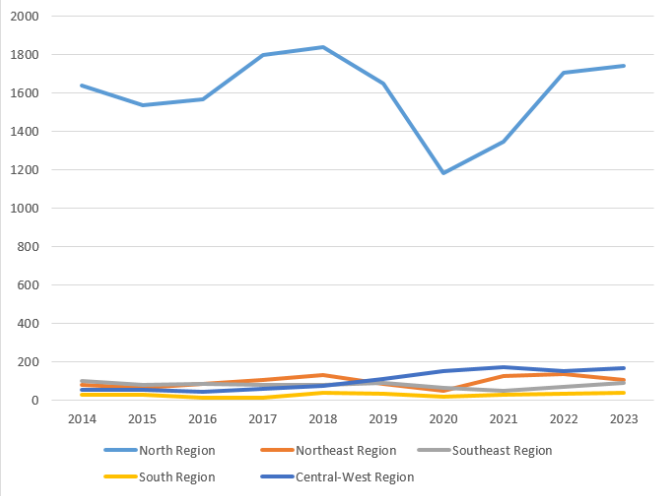
an increase in the number of hospitalizations, in the years 2021 (n = 1346), followed by 2022 (n = 1704) and ending 2023 with n = 1741, configuring an overabundant number of hospitalizations, in a total of n = 15994, during the entire period in the North.

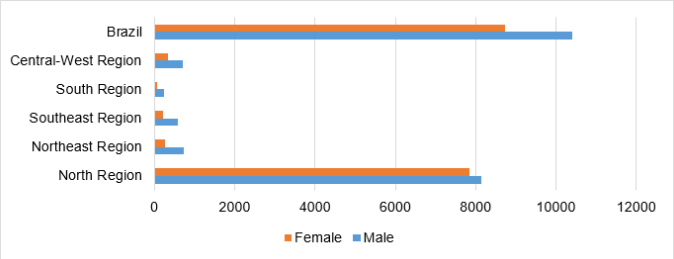



**Graph 3** Distribution of hospitalizations due to Malaria in Brazil, by region/year, from 2014 to 2023.

Source: Prepared by the authors, with data from the Ministry of Health - SUS Hospital Information System (SIH/SUS), 2025.

As for the Midwest, it has the second largest number of hospitalizations due to Malaria in Brazil, totaling n=1054 in the period analyzed, presenting an oscillating, slightly increasing trend, with the largest decreasing peak in 2016 (n=43) and the largest ascending peak in 2021 (n=175), followed by the year 2023 (n=167). The Northeast region represents the third largest share of hospitalizations in Brazil, with a total of n=985 in the years observed, the year with the lowest number of cases was 2020 (n=53) and the largest ascending peak was in 2022 (n=136), surpassing the second largest peak in 2018 (n=134). The Southeast occupies the fourth position in terms of the highest number of cases, with a total of n=802 throughout the period, following a decreasing trend from 2014 (n=104) to 2021 (n=49), acquiring an increasing trend from 2022 (n=69) to 2023 (n=92). The South is the region with the lowest number of hospitalizations, with a total of n=300 in the observed period, presenting a slightly linear trend, with discrete variations, in which the lowest number of cases occurred in 2013 (n=13) and the highest value occurred in the years 2018 and 2023, both with n=41 (Graph 3).

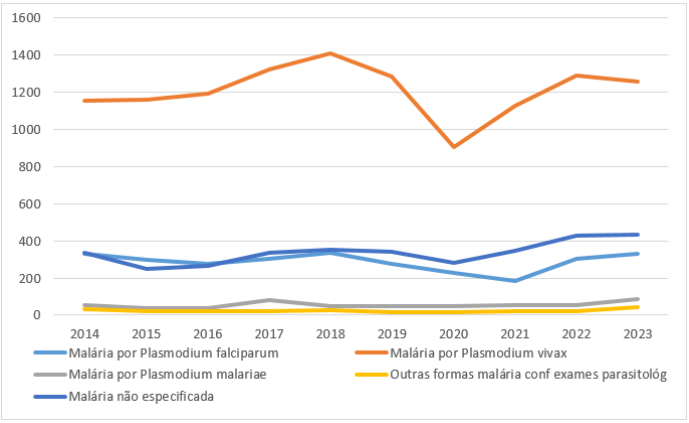
Regarding the distribution of Malaria by gender in each region (Graph 4), males prevailed with n=10413 hospitalizations, while females had n=8722 cases in Brazil during the years studied. The North region had an exorbitant number of hospitalizations in the male portion of the population, with n=8152, while the female portion represented n=7842 cases. The Northeast portrayed the second largest number of cases in males (n=720), followed by the large number of hospitalizations in women, with n=260. As for the Central-West region, there were n=720 hospitalizations in men and n=334 in women in this region. The Southeast region also showed a higher number of hospitalizations in males (n=585) compared to females (n=217). Regarding the South region, which has the lowest number of cases, there was again a discrepant number of hospitalizations, mostly men (n=231), compared to women (n=69).




**Graph 4** Distribution of hospitalizations due to Malaria in Brazil, by gender, from 2014 to 2023.

Source: Prepared by the authors, with data from the Ministry of Health - SUS Hospital Information System (SIH/SUS), 2025.

Regarding the ICD-10 list (Graph 5), there were significant numbers of hospitalizations due to Malaria, mostly due to *Plasmodium vivax* with n=12105, followed by hospitalizations due to Unspecified Malaria n=3377, Malaria due to *Plasmodium falciparum* n=2870; Malaria due to *Plasmodium malariae* n=549 and the category of other forms of malaria confirmed by parasitological exams n=234.




**Graph 5** Distribution of hospitalizations due to Malaria in Brazil, by ICD-10 list, from 2014 to 2023.

Source: Prepared by the authors, with data from the Ministry of Health - SUS Hospital Information System (SIH/SUS), 2025.

Regarding age group, the highest prevalence of hospitalizations due to Malaria in Brazil (Graph 6) occurred in the age group of 20-29 years, totaling n=4355 cases in the observed period. Regarding this age range, the North region dominated the number of hospitalizations, with n=3637, followed by the Central-West (n=245), in third place by the Northeast (n=244), then by the Southeast (n=152) and lastly by the South (n=77). The second age group with the highest prevalence is that of people between 30-39 years in Brazil, with a total of n=3075 hospitalizations, in this range there were in the North (n=2302), in the Central-West (n=275), in the Northeast (n=251), in the Southeast (n=185) and in the South (n=62). The age range with the lowest number of cases occurred in individuals aged 80 or over, totaling n=173 hospitalizations, among which the North stood out, with n=154 hospitalizations, followed by discrepant amounts of n=4 in the Central-West and Southeast, while in the Northeast there were n=5 and the South (n=3) with the lowest number of hospitalizations.

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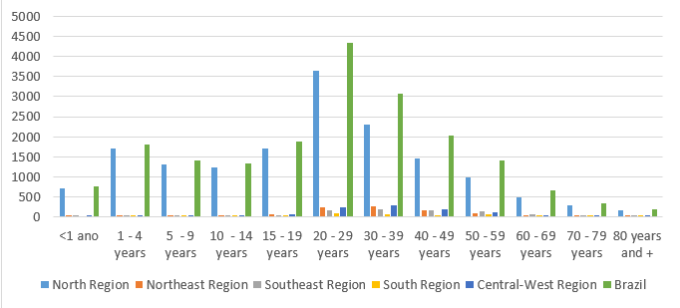
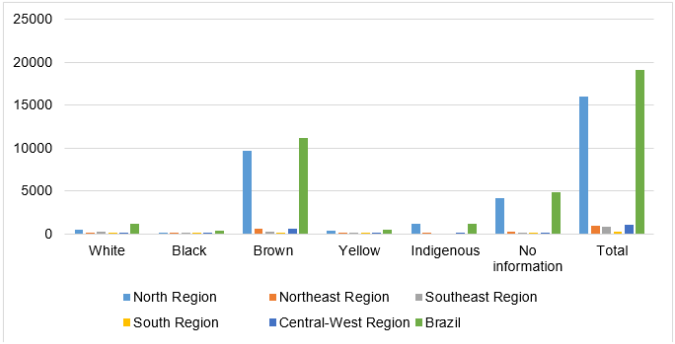



**Graph 6** Distribution of hospitalizations due to Malaria in Brazil, by age group, from 2014 to 2023.

Source: Prepared by the authors, with data from the Ministry of Health - SUS Hospital Information System (SIH/SUS), 2025.

Regarding hospitalizations by race (Graph 7), Malaria prevailed in individuals of the Brown race, with a total of n=11147 hospitalizations in Brazil throughout all the years surveyed. Of this Brown population segment, n=9625 cases occurred in the North, prevailing over the other values found in the other regions, namely the Central-West (n=632), the Northeast (n=581), the Southeast (n=248) and the South (n=61). The data classified as Not Reported also obtained significant values, with a total of n=4799 cases, of which occurred in the North (n=4202), followed by the Northeast (n=286), Central-West (n=155), Southeast (n=132) and South (n=24). The indigenous race occupied the third position of highest prevalence, totaling n=1185 cases, also standing out in the North region (n=1137), followed by the Central-West region (n=43), in discrepancies with the other regions, where it is observed in the Northeast n=5, in the Southeast n=0 and in the South n=0. The fourth position of highest number of hospitalizations was occupied by the white race, representing a total of n=1162, in which in the North it is observed n=472, followed by the Southeast n=295, in the South n=196, in the Central-West n=147 and in the Northeast n=52. In fifth place is the Yellow race, representing a total of n=449 hospitalizations, with a predominance in the North (n=366), a significant number in the Central-West (n=34), and in the Northeast (n=39), with lower values seen in the Southeast (n=6) and in the South (n=4). The Black population had a lower prevalence of hospitalizations, totaling n=393 cases, of which n=192 occurred in the North, n=121 in the Southeast, n=43 in the Central-West, n=22 in the Northeast and n=15 in the South.




**Graph 7** Distribution of hospitalizations due to Malaria in Brazil, by race, from 2014 to 2023.

Source: Prepared by the authors, with data from the Ministry of Health - SUS Hospital Information System (SIH/SUS), 2025.

Regarding the amount spent on hospitalizations due to Malaria in Brazil (Table 1), n=R$6833642,00 was invested during the decade analyzed, in which the largest amount was spent in 2022, with n=R$956642,90 and the lowest amount invested was in 2016, with n=R$508201,00. Regarding the North region, the total amount spent in the decade was n=R$5198785,00, configuring it as the region with the highest amount spent on Malaria in Brazil, in which the year with the highest amount spent occurred in 2022 (n=R$707263,90) and the year with the lowest amount spent was in 2015 (n=R$404017,40). Regarding the Northeast region, the total amount spent was (n=R$425706,30), counting all the years analyzed, of which 2021 (n=R$80445,30) was the year with the highest amount spent, and the year 2020 (n=R$21105,00) the one with the lowest amount spent. Regarding the Southeast region, the total amount spent in the period researched was n=R$558800,60; highlighting the year 2023 which concentrated an amount of n=R$95746,48 of the amount spent, while the year 2021 presented the lowest amount of n=R$29569,02. Furthermore, the South region had a total amount spent of n=R$130362,60 in the observed decade, with 2022 being the year with the highest amount, with n=R$22379,14 and 2016, with n=R$2430,65, the year with the lowest amount spent. Regarding the Central-West, the total amount spent was n=R$487182,50 in all years studied, of which 2022 demonstrated n=R$112923,40, the highest amount in the region, while 2016 represented the lowest amount spent, with n=R$14449,36.

**Table 1** Distribution of hospitalizations due to malaria in Brazil, by amount spent, from 2014 to 2023

| Brazil | Amount spent (R$) |
|---|---|
| *2014* | 546387,90 |
| *2015* | 562246,80 |
| *2016* | **508201,00** |
| *2017* | 640369,60 |
| *2018* | 741217,80 |
| *2019* | 643691,10 |
| *2020* | 552038,70 |
| *2021* | 747318,00 |
| *2022* | **956642,90** |
| *2023* | 892861,20 |
| *Total* | **6833642,00** |
| *North Region* | |
| *2014* | 427148,30 |
| *2015* | **404017,40** |
| *2016* | 407122,10 |
| *2017* | 511238,00 |
| *2018* | 584513,00 |
| *2019* | 493845,60 |
| *2020* | 414554,20 |
| *2021* | 564050,90 |
| *2022* | **707263,90** |
| *2023* | 685031,80 |
| *Total* | **5198785,00** |
| *Northeast Region* | |
| *2014* | 22111,49 |
| *2015* | 37476,31 |
| *2016* | 46249,03 |
| *2017* | 63480,51 |
| *2018* | 45025,81 |
| *2019* | 30244,26 |

**Citation:** Oliveira LM, Reis CC, Silva LF, et al. Profile of hospitalizations for malaria in Brazil from 2014 to 2023. *MOJ Public Health.* 2025;14(1):74–80. DOI: 10.15406/mojph.2025.14.00474

Table 1 Continued..

| | |
|---|---|
| *2020* | **21105,00** |
| *2021* | **80445,30** |
| *2022* | 44684,63 |
| *2023* | 32880,04 |
| *Total* | 425706,30 |
| *Southeast Region* | |
| *2014* | 49714,67 |
| *2015* | 58023,39 |
| *2016* | 37949,86 |
| *2017* | 41008,16 |
| *2018* | 62723,79 |
| *2019* | 62509,29 |
| *2020* | 46378,73 |
| *2021* | **29569,02** |
| *2022* | 69391,89 |
| *2023* | **95746,48** |
| *Total* | 558800,60 |
| *South Region* | |
| *2014* | 7240,10 |
| *2015* | 12457,03 |
| *2016* | **2430,65** |
| *2017* | 8404,06 |
| *2018* | 16602,86 |
| *2019* | 14397,44 |
| *2020* | 16864,42 |
| *2021* | 9514,97 |
| *2022* | **22379,14** |
| *2023* | 18457,35 |
| *Total* | 130362,60 |
| *Central-West Region* | |
| *2014* | 40173,30 |
| *2015* | 50272,72 |
| *2016* | **14449,36** |
| *2017* | 16238,88 |
| *2018* | 32352,26 |
| *2019* | 42694,46 |
| *2020* | 53136,40 |
| *2021* | 63737,80 |
| *2022* | **112923,40** |
| *2023* | 60745,51 |
| *Total* | 487182,50 |

Source: Prepared by the authors, with data from the Ministry of Health - SUS Hospital Information System (SIH/SUS), 2025,

Regarding the average amount spent on hospitalizations due to malaria in Brazil, a general average of n=R$357,13 was invested in media Brazil in this decade studied, of which n=R$696,76 was distributed to the Southeast region, n=R$432,19 to the Northeast, n=R$434,54 to the South region, n=R$462,22 to the Central-West and n=R$327,10 to the North region. Regarding the days of stay, there was a total of 82850 days in Brazil, of which in the North n=67690 days, in the Northeast n=5076, in the Central-West n=4288, in the Southeast n=4465 and in the South n=1331 (Table 2).

Regarding the average number of days of stay, the general average in Brazil was n=4,3 days, of which in the Southeast (n=5,6) and Northeast (n=5.2) the number of days exceeded the general average, in the South (n=4.4) the number of days was equivalent to the Brazilian average, while in the North (n=4.2) and Central-West (n=4,1) this number was below the general average. Regarding the number of deaths, there were a total of n=160 deaths from malaria in Brazil in the decade studied, of which the number of deaths predominated in the North region, with n=105. In the other regions this number was relatively lower, with n=19 deaths in the Southeast, n=12 deaths in the Central-West and n=18 deaths in Northeast region and n=6 deaths in the South. Regarding the mortality rate, there was a mortality rate of n=0,84 in Brazil, distributed in the regions in such a way as to show a higher rate in the Southeast (n=2,37), followed by an also high rate in the South (n=2,00), in the Northeast (n=1,83) and in the Central-West (n=1.14), with a rate lower than the Brazilian average in the North region (n=0,66) (Table 2).

**Table 2** Distribution of hospitalizations due to malaria in Brazil, by average hospitalization cost, days of stay, and average days of stay, deaths and mortality rate, from 2014 to 2023

| Region | Average intern value (R$) | Days stay | Average stay days | Deaths | Mortality rate |
|---|---|---|---|---|---|
| *North Region* | 327,1 | 67690 | 4,2 | 105 | 0,66 |
| *Northeast Region* | 432,19 | 5076 | 5,2 | 18 | 1,83 |
| *Southeast Region* | 696,76 | 4465 | 5,6 | 19 | 2,37 |
| *South Region* | 434,54 | 1331 | 4,4 | 6 | 2,00 |
| *Central-West Region* | 462,22 | 4288 | 4,1 | 12 | 1,14 |
| *Total* | 357,13 | 82850 | 4,3 | 160 | 0,84 |

Source: Prepared by the authors, with data from the Ministry of Health - SUS Hospital Information System (SIH/SUS), 2025.

## Discussion

The data analyzed on the epidemiological profile of hospital morbidity and mortality from malaria in Brazil, from 2014 to 2023, revealed a total of n=19135 hospitalizations and n=160 deaths in the period in question. In this scenario, it was possible to observe a slightly significant decrease in the number of hospitalizations between 2018 and 2020, a fact that possibly reveals the impact of external factors, such as the COVID-19 pandemic, which began in Brazil in 2020. The pandemic triggered a great overload on health systems, which may have contributed to the reduction in the capacity to adequately care for other infectious diseases, such as malaria.[8]

Regarding the distribution of hospitalizations by Brazilian region, the North region of the country represents the largest number compared to the other regions of Brazil, concentrating more than 80% of the data collected in the sample. This finding is closely related to the most recent literature, considering that the North of Brazil is responsible for more than 95% of the registered cases of malaria in the Brazilian territory.[6] Outside the national Amazonian borders, approximately 80% of the registered cases are due to imports from endemic states and other Amazonian countries or the African continent.[9]

According to the profile outlined through this research, it is observed that the largest number of hospitalizations occurred due to infection by *Plasmodium vivax*, which accounted for more than 60% of the total hospitalizations for malaria, followed by unspecified cases

and by *Plasmodium falciparum*, responsible for the most severe form of the disease. This finding converges strongly with recent literature, considering that in studies developed in Pará,[10] Rondônia[11] and Amazonas[7] the same pattern of contamination was found.

Regarding the gender of hospitalized patients, it is possible to observe a predominance of hospitalizations in males, a fact that is supported by studies that demonstrated greater susceptibility among men, such as in the work developed by Sodré et al.,[12] which analyzed the epidemiological situation of malaria in the Legal Amazon in Brazil, and concluded that the male biological gender is the most affected by malaria in all the federative units analyzed.

Furthermore, men are more likely to engage in exploratory activities in the Amazon context, such as mining, fishing, agriculture, and exploration of deforested areas.[13] In addition, another factor that affects this scenario of greater prevalence of hospitalizations due to malaria in males is related to cultural practices: there is a distance between men and health care because, unlike women, who tend to seek hospital and outpatient care more actively, men still resist this search and, consequently, have less adherence to therapeutic protocols and end up needing more intensive care, a fact that results in a greater number of hospitalizations due to malaria in this population.[11]

In respect of the profile of hospitalizations related to age group, the results of this study indicate that the epidemiologically most affected age range is in the 20-29 age range, both at the national level and in the distribution by region. From this perspective, the higher incidence of malaria may be related to the age groups in which individuals have greater participation in the economy, since they are more involved in activities such as agriculture, extractivism, and other exploratory occupations that increase exposure to areas with a high risk of transmission. This relationship is in line with the literature, which points to a higher incidence of malaria in regions far from urban centers, where the climatic conditions of the Amazon rainforest – characterized by heat and high humidity – favor the proliferation of vectors.[14]

About the hospitalizations correlated with race/ethnicity, it is possible to verify that there is a great predominance in the hospitalization of people as brown with 11147 hospitalizations of the total, followed by the group without information on color/race with 4799. The indigenous population ranks third in the number of hospitalizations with n=1185. Thus, considering that the largest number of hospitalizations is concentrated in the North Region, it is possible to find great support in the literature because the Legal Amazon is made up of a great population diversity in which there is a great predominance of remaining quilombola communities, rubber tappers, riverside populations, fishermen and also the indigenous population.[12]

Furthermore, it is worth highlighting the significant number of hospitalizations without adequate identification of the corresponding ethnicity, a fact that should have a significant impact on the development of health and prevention strategies aimed at specific populations, such as indigenous peoples.[11]

The analysis of the distribution of hospitalizations due to malaria in Brazil, by amount spent during the period under study, showed an expenditure of approximately R$7 billion, with the North Region concentrating the largest part of this resource approximately (R$5 billion). This panorama is strongly supported by research developed in this regard. The work carried out by Barreto, Ferko, Rodrigues,[15] which sought to understand the hospital costs of diseases attributable to environmental factors among residents of Boa Vista, the capital of Roraima, found malaria to be one of the pathologies that most burdened the public health system in this location. Furthermore, in regions where malaria is endemic, the pathology can represent around 40% of hospital admissions and represent approximately 40% of public health expenditures.[16]

Finally, in the analysis carried out regarding deaths and mortality rates by Brazilian region, it was possible to identify the Southeast Region, although with a lower number of hospitalizations compared to the North Region, the highest national mortality rate. This scenario may be a consequence of late diagnoses and greater severity of hospitalized cases, considering that malaria is not as common in highly urbanized areas and this should have consequences for the population's immunity.[1] On the other hand, although it had the lowest mortality rate among the 5 regions, the North of Brazil had the highest number of deaths in absolute numbers in the period analyzed, given the discrepant number of hospitalizations in the period under analysis. This data reinforces the high burden of malaria in the region, evidencing the persistence of transmission and the need for more effective prevention measures, early diagnosis and adequate treatment.

## Final considerations

The high number of hospitalizations for malaria in Brazil suggests a significant impact on local health services, requiring greater allocation of resources for disease management and strategies to reduce the need for hospitalizations and, consequently, the associated mortality. The results of this study demonstrate that malaria continues to be a significant cause of hospital morbidity and mortality in Brazil, especially in the Northern Region. The high burden of malaria in this region highlights the persistence of transmission and the need for more effective prevention measures, early diagnosis and appropriate treatment. These data therefore reinforce the need for improvements in public policies to reduce transmission, expand access to diagnosis and treatment in a timely manner, and implement actions aimed at vulnerable groups, in order to reduce contagion, hospitalizations, and deaths from malaria in our country.

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## Conflicts of interest

The authors declare there is no conflict of interest.

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