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EPIDEMIOLOGICAL TRENDS OF DENGUE IN CHILDREN AND ADOLESCENTS IN BRAZIL FROM 2014 TO 2023

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Abstract: Dengue is one of the arboviruses of greatest global concern, representing a significant challenge for health systems around the world. The year 2024, in Brazil, has been marked by Dengue epidemics. The epidemiological investigation of this disease, which brings challenges to Brazilian public health, is relevant. The study aims to analyze epidemiological data regarding Dengue in the Brazilian pediatric population over a decade. A quantitative epidemiological analysis method was used using data from the Department of Informatics of the Unified Health System (DATASUS) regarding Dengue in Brazil between 2014 and 2023. During the period there were spikes in cases between 2014 and 2016 followed by a new trend of increase until 2023, highlighting a significant increase between 2018 and 2019. The age group with the most probable cases was 15 to 19 years old. The high number of hospitalizations, especially in 2015, highlights the severity of the disease, especially among children between 10 and 14 years old. The dengue problem requires a multifaceted approach with vector control actions, community education and investment in research and development of effective vaccines and treatments.
Keywords: Dengue; Public health; Brazil.

INTRODUCTION

Dengue is a viral disease transmitted mainly through the bite of the Aedes aegypti mosquito (Khetarpal, 2016) and is one of the arboviruses of greatest global concern, representing a significant challenge for health systems around the world. According to the World Health Organization, it is estimated that around 390 million dengue infections occur worldwide annually, with approximately 96 millions of these cases manifesting clinical symptoms (© Pan American Health Organization, 2017). The growth of urbanization and climate change

have contributed to the spread of the dengue virus, making it a threat to public health in tropical and subtropical regions (Khetarpal, 2016).

This arbovirus indiscriminately affects all age groups, but the elderly and individuals with chronic diseases, such as diabetes and hypertension, are at greater risk of progressing to more serious cases and complications (Brasil, 2024). On the other hand, mortality is higher in adults compared to pediatric patients.

Furthermore, dengue presents a wide variety of signs and symptoms, ranging from a mild and self-limited disease to severe and potentially fatal forms. The most common symptoms include high fever, myalgia, arthralgia, headache, rash and fatigue. In more serious cases, the condition can progress with complications such as hemorrhage, pleural effusion, shock and organ failure (Khetarpal, 2016).

Therefore, clinical diagnosis can be difficult, depending on the stage of the disease the patient is in, and it is often necessary to resort to complementary tests such as rapid tests, Elisa serology (IgM and IgG) and the NS1 antigen (Muhammad, 2023).

The year 2024, in Brazil, has been marked by an exponential increase in Dengue cases, causing epidemics in more than 5 Brazilian states (Brasil, 2024). In view of the problem presented, the epidemiological investigation of this disease, which has been bringing several challenges to Brazilian public health, is relevant.

OBJECTIVES

The present work aims to analyze epidemiological data regarding Dengue in the Brazilian pediatric population aged 0 to 19 years, considering information regarding probable cases and hospitalizations by macro-region and age group, in addition to serological tests in the period from 2014 to 2023.

METHODOLOGY

In this study, a quantitative epidemiological analysis was conducted using data from the Information Technology Department of the Brazilian Unified Health System (DATASUS) for the period from 2014 to 2023. This research sought information on probable cases and hospitalizations for Dengue, evaluating variables such as gender, pediatric age groups (between 0 and 19 years old), Brazilian macro-regions and serological tests, in order to examine the evolution of hospitalizations related to the dengue virus over a 10-year period.

Analysis of hospitalization data for dengue was carried out between 2014 and 2023. To carry out this study, data was collected from DATASUS, which was organized into descriptive graphs and tables. The indicators were categorized and compared year by year, allowing us to evaluate variations in Dengue notifications in Brazil.

RESULTS

In 2014, Brazil recorded a total of 153,499 probable cases of dengue, 16,690 (10.87%) in the North, 28,226 (18.38%) in the Northeast, 73,008 (47.56%) in the Southeast, 6,013 (3, 91%) in the South, 29,559 (19.25%) in the Central-West and 3 (0.002%) ignored or abroad. In 2015, 424,666 cases were registered, 10,075 (2.37%) in the North, 98,910 (23.29%) in the Northeast, 244,244 (57.51%) in the Southeast, 11,845 (2.78%) in the South, 59,584 (14.03%) in the Central-West and 9 (0.002%) ignored or abroad. In 2016, 369,939 cases were registered, 11,540 (3.12%) in the North, 88,266 (23.86%) in the Northeast, 199,162 (53.84%) in the Southeast, 15,628 (4.22%) in the South, 55,334 (14.96%) in the Central-West and 9 (0.002%) ignored or abroad. In 2017, 69,029 cases were registered, 7,070 (10.24%) in the North, 25,740 (37.29%) in the Northeast, 14,688 (21.25%) in the Southeast, 782 (1.13%) in the South, 20,769 (30.09%) in the Midwest.

In 2018, 75,381 cases were registered, 5,539 (7.35%) in the North, 25,435 (33.74%) in the Northeast, 17,814 (23.63%) in the Southeast, 459 (0.61%) in the South, 26,129 (34.66%) in the Central-West and 5 (0.007%) ignored or abroad. In 2019, 403,559 cases were registered, 12,210 (3.03%) in the North, 77,844 (19.29%) in the Northeast, 240,457 (59.58%) in the Southeast, 11,535 (2.86%) in the South, 61,504 (15.24%) in the Central-West and 9 (0.002%) ignored or abroad. In 2020, 218,994 cases were registered, 6,404 (2.92%) in the North, 43,218 (19.73%) in the Northeast, 61,869 (28.25%) in the Southeast, 61,571 (28.12%) in the South, 45,925 (20.97%) in the Central-West and 7 (0.003%) ignored or abroad. In 2021, 137,024 cases were registered, 13,586 (9.92%) in the North, 39,918 (29.13%) in the Northeast, 40,985 (29.91%) in the Southeast, 13,550 (9.89%) in the South, 28,975 (21.15%) in the Central-West and 10 (0.007%) ignored or abroad. In 2022, 348,179 cases were registered, 17,409 (5.00%) in the North, 75,992 (21.83%) in the Northeast, 99,083 (28.46%) in the Southeast, 64,630 (18.56%) in the South, 91,031 (26.14%) in the Central-West and 34 (0.01%) ignored or abroad. In 2023, 387,555 cases were registered, 10,916 (2.82%) in the North, 35,802 (9.24%) in the Northeast, 195,602 (50.47%) in the Southeast, 92,443 (23.85%) in the South, 52,788 (13.62%) in the Central-West and 4 (0.001%) ignored or abroad (Table 1) (Graph 1).

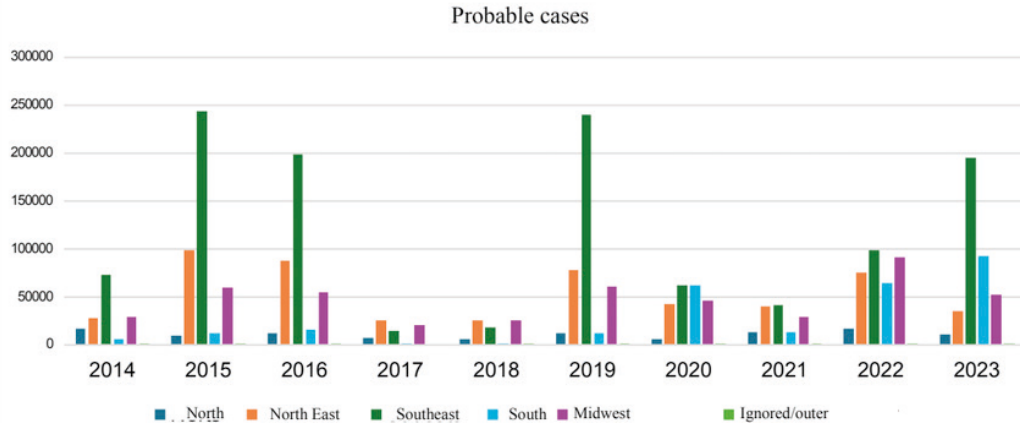
The proportion of the sum of probable cases by Brazilian region (Table 1) during the entire period from 2014 to 2023 resulted in 4% of cases in the North, 21% in the Northeast, 46% in the Southeast, 11% in the South and 18% in the Center -West.

As for the age group affected, in 2014, 7,882 (5.13%) were less than 1 year old, 14,439 (9.41%) from 1 to 4 years old, 24,916 (16.23%) from 5 to 9 years old, 43,735 (28.49%) aged 10 to 14 and 62,527 (40.73%) aged 15 to 19. In 2015, 20,518 (4.83%) were less than 1 year old, 41,337 (9.73%) from 1 to 4 years old, 73,243 (17.25%) from 5 to 9 years old, 121,614 (28.64%) from 9 to 14 years old and 167,954 (39.55%) from 15 to 19 years old. In 2016, 18,065 (4.88%) were less than 1 year old, 37,563 (10.15%) from 1 to 4 years old, 65,014 (17.57%) from 5 to 9 years old, 102,019 (27.58%) from 10 to 14 years old and 147,278 (39.81%) from 15 to 19 years old. In 2017, 3,915 (5.67%) were less than 1 year old, 8,006 (11.60%) from 1 to 4 years old, 12,559 (18.19%) from 5 to 9 years old, 17,749 (25.71%) from 10 to 14 years old and 26,800 (38.82%) from 15 to 19 years old. In 2018, 4,425 (5.87%) were less than 1 year old, 9,344 (12.40%) were 1 to 4 years old, 15,305 (20.30%) were 5 to 9 years old, 19,872 (26.36%) were 10 to 14 years old and 26,435 (35.07%) from 15 to 19 years old. In 2019, 18,016 (4.46%) were less than 1 year old, 42,067 (10.42%) from 1 to 4 years old, 81,961 (20.31%) from 5 to 9 years old, 116,649 (28.91%) from 10 to 14 years old and 144,866 (35.90%) from 15 to 19 years old. In 2020, 11,116 (5.08%) were less than 1 year old, 24,803 (11.33%) from 1 to 4 years old, 45,344 (20.71%) from 5 to 9 years old, 61,312 (28.00%) from 10 to 14 years old and 76,419 (34.90%) from 15 to 19 years old. In 2021, 7,509 (5.48%) were less than 1 year old, 18,088 (13.20%) from 1 to 4 years old, 32,185 (23.49%) from 5 to 9 years old, 37,473 (27.35%) from 10 to 14 years old and 41,769 (30.48%) from 15 to 19 years old. In 2022, 13,843 (3.98%) were less than 1 year old, 40,438 (11.61%) from 1 to 4 years old, 79,519 (22.84%) from 5 to 9 years old, 99,800 (28.66%) from 10 to 14 years old and 114,579 (32.91%) from 15 to 19 years old. In 2023, 14,198 (3.66%) were less than 1 year old, 39,685 (10.24%) from 1 to 4 years old, 88,634 (22.87%) from 5 to 9 years old, 114,962 (29.66%) from 10 to 14 years old and 130,076 (33.56%) from 15 to 19 years old (Table 2) (Graph 2).

Residence region	Ano										Total
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	
North	16690	10075	11540	7070	5539	12210	6404	13586	17409	10916	111439
North East	28226	98910	88266	25740	25435	77844	43218	39918	75992	35802	539351
Southeast	73008	244244	199162	14668	17814	240457	61869	40985	99083	195602	1186892
South	6013	11845	15628	782	459	11535	61571	13550	64630	92443	278456
Midwest	29559	59583	55334	20769	26129	61504	45925	28975	91031	52788	471597
Ignored/outer	3	9	9	0	5	9	7	10	34	4	90
Total	153499	424666	369939	69029	75381	403559	218994	137024	348179	387555	2587825

Table 1: Probable cases of Dengue in individuals aged 0 to 19 years, according to Brazilian macro-regions, from 2014 to 2023.

Source: Adapted by the authors based on DATASUS data (2024).



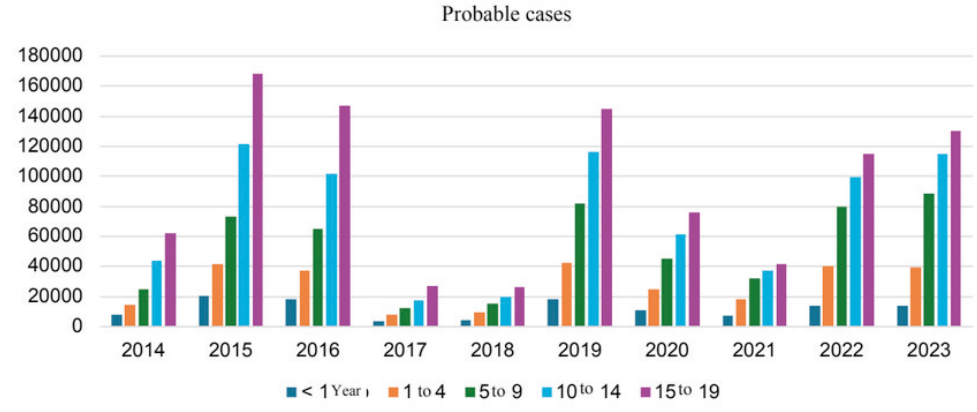
Graph 1: Probable cases of Dengue in Brazil, according to macro-regions, from 2014 to 2023.

Source: Prepared by the authors based on data provided by DATASUS (2024).

Age group	Year										Total
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	
< 1 Year	7882	20518	18065	3915	4425	18016	11116	7509	13843	14198	119487
1 to 4	14439	41337	37563	8006	9344	42067	24803	18088	40438	39685	275770
5 to 9	24916	73243	65014	12559	15305	81961	45344	32185	79519	88634	518680
10 to 14	43735	121614	102019	17749	19872	116649	61312	37473	99800	114962	735185
15 to 19	62527	167954	147278	26800	26435	144866	76419	41769	114579	130076	938703
Total	153499	424666	369939	69029	75381	403559	218994	137024	348179	387555	2587825

Table 2: Probable cases of Dengue in Brazil, according to pediatric age groups, from 2014 to 2023.

Source: Adapted by the authors based on data provided by DATASUS (2024).



Graph 2: Probable cases of Dengue in Brazil, according to pediatric age groups, from 2014 to 2023

Source: Adapted by the authors based on data provided by DATASUS (2024).

Regarding whether or not hospitalization occurred, in 2014, 5,444 (3.66%) were hospitalized, 67,056 (43.68%) were not hospitalized and 80,999 (52.77%) were ignored. In 2015, 10,000 (2.35%) were registered) hospitalized, 176,034 (41.45%) not hospitalized and 238,632 (56.19%) unknown. In 2016, 8,926 (2.41%) were hospitalized, 155,894 (42.14%) were not hospitalized and 205,119 (55.45%) were ignored. In 2017, 3,720 (5.39%) were hospitalized, 34,404 (49.84%) were not hospitalized and 30,905 (44.77%) were ignored. In 2018, 4,922 (6.53%) were hospitalized, 41,023 (54.42%) were not hospitalized and 29,436 (39.05%) were ignored. In 2019, 16,588 (4.11%) were hospitalized, 245,530 (60.84%) were not hospitalized and 141,441 (35.05%) were ignored. In 2020, 8,036 (3.67%) were hospitalized, 143,278 (65.43%) were not hospitalized and 67,680 (30.90%) were ignored. In 2021, 5,928 (4.33%) were hospitalized, 88,848 (64.84%) were not hospitalized and 42,248 (30.83%) were ignored. In 2022, 14,553 (30.83%) were registered as hospitalized, 237,895 (68.33%) were not hospitalized and 95,731 (27.49%) were ignored. In 2023, 14,489 (3.74%) were hospitalized, 263,897 (68.09%) were not hospitalized and 109,169 (28.17%) were ignored (Table 3) (Graph 3).

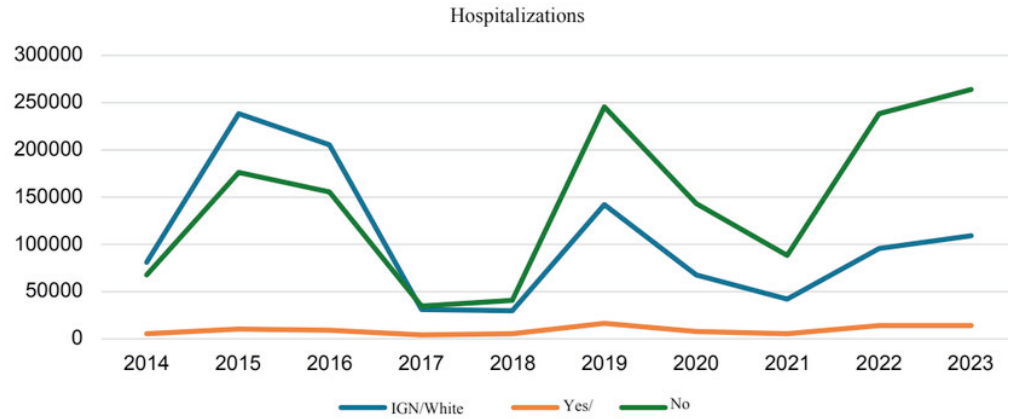
Regarding the age of those hospitalized, in 2014, 401 (7.37%) were less than 1 year old, 677 (12.44%) were from 1 to 4 years old, 1,060 (19.47%) were from 5 to 9 years old, 1,579 (29.00%) aged 10 to 14 and 1,727 (31.72%) aged 15 to 19. In 2015, 804 (8.04%) were less than 1 year old, 1,241 (12.41%) from 1 to 4 years old, 2,107 (21.07%) from 5 to 9 years old, 2,833 (28.33%) from 10 to 14 years old, 3,015 (30.15%) from 15 to 19 years old. In 2016, 853 (9.56%) were less than 1 year old, 1,244 (13.94%) from 1 to 4 years old, 1,952 (21.87%) from 5 to 9 years old, 2,371 (26.56%) from 10 to 14 years old, 2,506 (28.08%) from 15 to 19 years old. In 2017, 357 (9.60%) were less than 1 year old, 637 (17.12%) from 1 to 4 years old, 819 (22.02%) from 5 to 9 years old, 898 (24.14%) from 10 to 14 years old and 1,009 (27.12%) from 15 to 19 years old. In 2018, 464 (9.43%) were less than 1 year old, 795 (16.15%) from 1 to 4 years old, 1,264 (25.68%) from 5 to 9 years old, 1,231 (25.01%) from 10 to 14 years old, 1,168 (23.73%) from 15 to 19 years old. In 2019, 1,416 (8.54%) were less than 1 year old, 2,108 (12.71%) from 1 to 4 years old, 4,491 (27.07%) from 5 to 9 years old, 4,599 (27.72%) from 10 to 14 years old, 3,974 (23.96%) from 15 to 19 years old. In 2020, 743 (9.25%) were less than 1 year old, 1,088 (13.54%) from 1 to 4 years old, 2,002 (24.91%) from 5 to 9 years old, 2,176 (27.08%) from 10 to 14 years old, 2,027 (25.22%) from 15 to 19 years old. In 2021, 568 (9.58%) were less than 1 year old, 937 (15.81%) from 1 to 4 years old, 1,623 (27.38%) from 5 to 9 years old, 1,655 (27.92%) from 10 to 14 years old and 1,145 (19.32%) from 15 to 19 years old. In 2022, 1,068 (7.34%) were less than 1 year old, 2,235 (15.36%) from 1 to 4 years old, 4,034 (27.72%) from 5 to 9 years old, 4,093 (28.12%) from 10 to 14 years old, 3,123 (21.46%) from 15 to 19 years old. In 2023, 1,125 (7.76%) were less than 1 year old, 2,029 (14.00%) from 1 to 4 years old, 3,884 (26.81%) from 5 to 9 years old, 4,127 (28.48%) from 10 to 14 years old and 3,324 (22.94%) from 15 to 19 years old (Table 4) (Graph 4).

Regarding the outcome of the serological test (IgM), in 2014, 39,345 (25.63%) were positive, 2,231 (1.45%) negative, 336 (0.22%) inconclusive, 45,810 (29.84%) ignored and 65,777 (42.85%) were not performed. In 2015, 89,320 (21.03%) were positive, 4,139 (0.97%) negative, 454 (0.11%) inconclusive, 139,417 (32.83%) ignored and 191,336 (45.06%) were not performed. In 2016, 44,639 (12.07%) were positive, 3,743 (1.01%) negative, 611 (0.17%) inconclusive, 174,062 (47.05%) ignored and

Hospitalizations	Year										Total
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	
IGN/White	80999	238632	205119	30905	29436	141441	67680	42248	95731	109169	1041360
Yes	5444	10000	8926	3720	4922	16588	8036	5928	14553	14489	92606
No	67056	176034	155894	34404	41023	245530	143278	88848	237895	263897	1453859
Total	153499	424666	369939	69029	75381	403559	218994	137024	348179	387555	2587825

Table 3: Occurrence or not of hospitalization due to Dengue in individuals between 0 and 19 years old in the period from 2014 to 2023 in Brazil.

Source: Adapted by the authors based on data provided by DATASUS (2024).



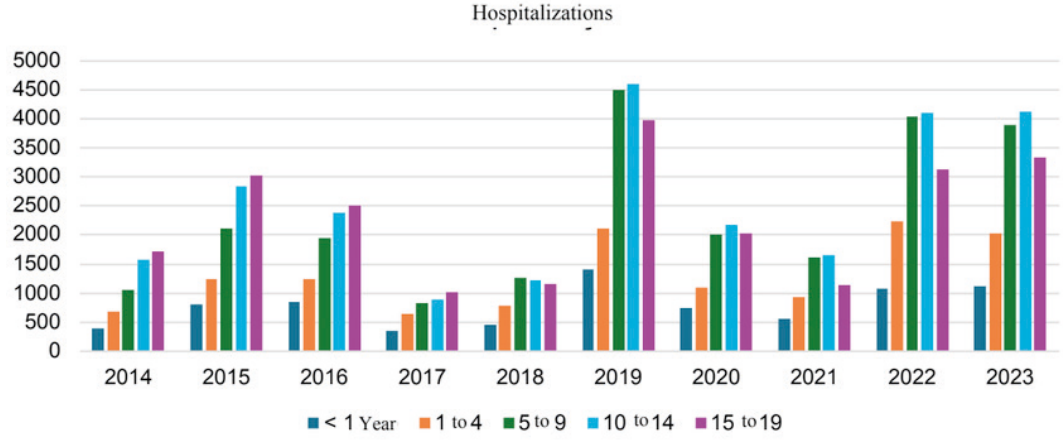
Graph 3: Occurrence or not of hospitalization due to Dengue up to the age of 19 in the period from 2014 to 2023 in Brazil.

Source: Adapted by the authors based on data provided by DATASUS (2024).

Age group	Year										Total
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	
< 1 Year	401	804	853	357	464	1416	743	568	1068	1125	7799
1 to 4	677	1241	1244	637	795	2108	1088	937	2235	2029	12991
5 to 9	1060	2107	1952	819	1264	4491	2002	1623	4034	3884	23236
10 to 14	1579	2833	2371	898	1231	4599	2176	1655	4093	4127	25562
15 to 19	1727	3015	2506	1009	1168	3974	2027	1145	3123	3324	23018
Total	5444	10000	8926	3720	4922	16588	8036	5928	14553	14489	92606

Table 4: Hospitalization for Dengue in individuals aged 0 to 19 years from 2014 to 2023 in Brazil.

Source: Adapted by the authors based on data provided by DATASUS (2024).



Graph 4: Hospitalization for Dengue, according to pediatric age groups, from 2014 to 2023 in Brazil.

Source: Adapted by the authors based on data provided by DATASUS (2024).

146,884 (39.70%) were not performed. In 2017, 6,982 (10.11%) were positive, 1,077 (1.56%) negative, 298 (0.43%) inconclusive, 34,733 (50.32%) ignored and 25,939 (37.58%) were not performed. In 2018, 12,448 (16.51%) were positive, 1,063 (1.41%) negative, 266 (0.53%) inconclusive, 34,448 (45.70%) ignored and 27,156 (36.02%) were not performed. In 2019, 68,882 (17.07%) were positive, 4,561 (1.13%) negative, 1270 (0.31%) inconclusive, 163,842 (40.60%) ignored and 165,004 (40.89%) were not performed. In 2020, 51,775 (23.64%) were positive, 4,605 (2.10%) negative, 767 (0.35%) inconclusive, 84,827 (38.73%) ignored and 77,020 (35.17%) were not performed. In 2021, 36,355 (26.53%) were positive, 3360 (2.45%) negative, 382 (0.28%) inconclusive, 49,134 (35.86%) ignored and 47,739 (34.88%) were not performed. In 2022, 62,602 (17.98%) were positive, 9,231 (2.65%) negative, 722 (0.21%) inconclusive, 133,231 (38.27%) ignored and 142,393 (40.90%) were not performed. In 2023, 64,442 (16.63%) were positive, 9,098 (2.35%) negative, 542 (0.14%) inconclusive, 169,996 (43.86%) ignored and 143,477 (37.02%) were not performed (Table 5) (Graph 5).

DISCUSSION

The present study showed that, over a period of ten years, dengue fever presented a cyclical incidence behavior in Brazil. In the period from 2014 to 2016, there was an increasing trend in the number of cases, with a decline in 2017, which was followed by a new increasing trend, which continued until 2023 (Table 1). Particularly noteworthy is the period between 2018 and 2019, during which there was a 535% increase in disease numbers.

In part, the fluctuation in dengue rates can be explained by its behavior defined by rainfall and hot temperatures. It is known that the larval density of Aedes aegypti changes according to seasonal climatic variations, increasing in seasons with greater rainfall, which predisposes to an increase in the incidence of the disease (Souza et al, 2010).

In relation to the age group of the population affected by the virus, the prevalence of patients between 15 and 19 years old stands out, as they have the highest number of diagnosed cases. Overall, there were 938,703 patients affected by the disease (Table 2). The year in which the most cases were recorded at this age was 2015, where 167,954 victims were recorded.

The involvement of this age group can be associated with the lesser adoption of protective measures against the disease. The adolescent population, in particular, tends not to practice protective measures such as the use of repellents, thus becoming a more exposed part of the community. This fragility is associated with the fact that they are an economically active portion of society, who work or study during the day, thus becoming more exposed to the vector, which leads to higher transmission rates (Menezes et al, 2021).

With regard to hospitalizations of the population affected by Dengue, the year 2015 had a higher prevalence of hospitalizations, with 424,666 registered cases (Table 3).

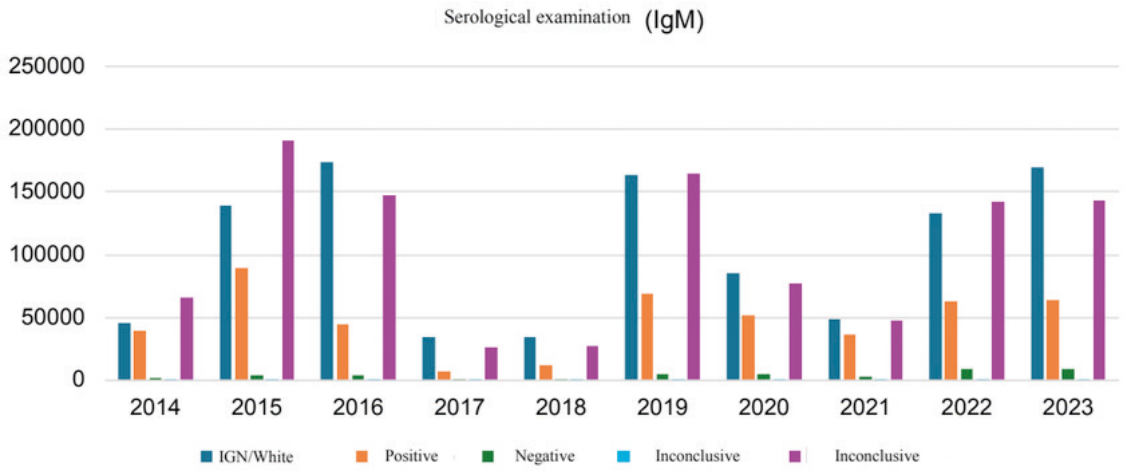
It is possible to relate the need for hospitalization to the greater likelihood that children have of developing hypovolemic shock, resulting from increased vascular permeability, than adults. However, fluid extravasation is the main determinant of dengue severity, being present in the critical phase of the disease. Therefore, children who have plasma leakage are classified as severe dengue fever and are subject to hospitalization (SBP, 2019).

Regarding the age of hospitalized pediatric patients (Table 1), it is possible to see that the child population between 10 and 14 years old was the most affected by the disease, with 25562 cases. In this age group, there was a higher prevalence of victims in 2019, with 4599 hospitalizations.

Serological examination (IgM) Dengue	Year 2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Total
IGN/White	45810	139417	174062	34733	34448	163842	84827	49134	133231	169996	1029500
Positive	39345	89320	44639	6982	12448	68882	51775	36355	62602	64442	476790
Negative	2231	4139	3743	1077	1063	4561	4605	3360	9231	9098	43108
Inconclusive	336	454	611	298	266	1270	767	382	722	542	5648
Unrealized	65777	191336	146884	25939	27156	165004	77020	47793	142393	143477	1032779
Total	153499	424666	369939	69029	75381	403559	218994	137024	348179	387555	2587825

Table 5: Serological test results (IgM) for Dengue from 2014 to 2023 in Brazil.

Source: Adapted by the authors based on data provided by DATASUS (2024).



Graph 5: Serological test results (IgM) for Dengue from 2014 to 2023 in Brazil.

Source: Adapted by the authors based on data provided by DATASUS (2024).

In the pediatric age groups, an estimated greater risk of infection through circulation in non-domestic environments, such as daycare centers and schools, which may be exposed to Aedes aegypti without the knowledge of those responsible. Furthermore, protective measures must be practiced by those responsible for these children and reinforced by their caregivers in the environments in which they are located, so that they are effective against mosquito bites (Fernandes et al, 2022). This way, combating dengue infection in children is a joint action, which involves, in addition to the private sphere, also the environment that these individuals frequent.

CONCLUSION

Dengue fever continues to be a serious threat to global public health, with an alarming increase in cases in tropical and subtropical regions, including Brazil. The cyclical pattern of incidence, influenced by climatic factors such as rainfall and temperature, highlights the need for more effective prevention and control strategies.

During the study period, a cyclical behavior in the incidence of dengue fever was observed, with periods of increase in cases alternating with periods of decrease. The year 2015 recorded the highest number of probable cases and hospitalizations due to dengue. Furthermore, the age group with the most probable cases was 15 to 19 years old, while the children with the most hospitalizations for dengue were between 10 and 14 years old, followed by those aged 5 to 9 years old.

A comprehensive solution to combat dengue requires a multifaceted approach, including vector control, community education, and investment in research and development of effective vaccines and treatments. The implementation of intervention strategies, such as the use of repellents and the elimination of potential mosquito breeding sites, must be combined with efforts to raise awareness and engage the population.

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