Revista ARACÊ
ISSN: 2358-2472

DATA ANALYSIS ON THE ARBOVIRUSES DENGUE, ZIKA AND CHIKUNGUNYA IN SOUTHEASTERN BRAZIL

https://doi.org/10.56238/arev6n3-149

Submitted on: 13/10/2024 **Publication date:** 13/11/2024

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ABSTRACT

The analysis of the increase in cases of diseases transmitted by Aedes aegypti in the Southeast region of Brazil, especially in 2023 and 2024, is essential to understand the dynamics of these arboviruses and develop effective control strategies. The diseases in question, Dengue, Zika and Chikungunya, represent a serious public health challenge, exacerbated by factors such as climate, heavy rainfall and deficiencies in prevention and control actions. To understand this situation, the work is based on data collected from the Information Bulletins and the Arbovirus Monitoring Panel, made available by the Ministry of Health. The quantitative analysis of these data will allow the identification of patterns and

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possible correlations between environmental conditions and disease incidence rates in Minas Gerais, Espírito Santo, Rio de Janeiro and São Paulo. Data Comparison, evaluate the incidence statistics of dengue, Zika, and Chikungunya in the first half of 2024 compared to the same period in 2023. Identification of Factors, analyze social and environmental factors that may have contributed to the increase in incidences. Intervention Recommendations, propose specific control and prevention actions for each state, taking into account regional particularities. The strengthening of Aedes aegypti control measures and the implementation of more effective public policies are essential to contain the spread of these arboviruses. In-depth analysis of the available data is a crucial step in understanding the seriousness of the situation and acting proactively to protect the health of the population.

Keywords: Arboviruses. Public health. Statistical analysis. Sanitation.

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INTRODUCTION

The arboviruses Dengue, Chikungunya and Zika in Brazil correspond to significant threats to public health in the country due to their epidemic potential. These are diseases whose monitoring is of paramount importance for the maintenance of preventive and sanitation methods, in order to mitigate the socioeconomic impacts caused by the incidence of diseases, including the overload and considerable increase in spending on health systems in surveillance, care and diagnosis, an increase in the number of cases of premature deaths and the economic impact of increased absenteeism at work.

The Epidemiological Bulletin made available by the Secretariat of Health and Environment Surveillance (SVSA), of the Ministry of Health, reveals the analysis of data on the manifestation of arboviruses in Brazil, including surveys on Zika, Dengue and Chikungunya, and demonstrates graphs, maps and tables that visualize the distinction between the behavior of these diseases in each geographic region of the country. In this way, the work allows the verification of statistics for each state, enabling better conditions for the initiation of intervention measures according to the variables of each region, such as climatic, structural, environmental and socioeconomic conditions.

According to the statistics presented by the SVSA newsletter, the Southeast is one of the regions with the highest rates of probable cases of arboviruses in 2023 and 2024, and there is an increase in the number of probable cases for 2024 across the country. In view of this scenario, the statistical analysis of this information is motivated, focusing on each geographic region, to corroborate the implementation of preventive methods for these arboviruses and their efficiency according to the different aspects of the country's zones.

According to Nascimento and Soares (2018): "education in schools about dengue is of great importance to combat the disease, promoting work and projects on the mosquito and the disease". These initiatives include massive propaganda in the written, spoken and television press, courses for health professionals and the like, actions are undeniably capable of attenuating the number of cases of people infected by the viruses transmitted by Aedes aegypti in the five Brazilian regions, from the shortest cases of duration and recovery to those that require hospitalization.

Such initiatives are adopted in order to alleviate the occupation of beds that could be destined to more complex ailments. For this to happen, it is necessary that government investments maintain public policies that aim to solve chronic problems of our society, such as lack of basic sanitation, housing deficit, precariousness and/or inexistence of sanitary

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sewage structures and, in instructional terms, the little emphasis given to environmental education.

However, before entire communities were rammed by the discomfort of such statistics that affect all Brazilian regions with the numerous cases of dengue according to Johansen et al (2016), there were 1,649,008 new cases in 2015. This year, with a higher number of occurrences of probable cases of dengue and death due to the consequences related to the disease. The Secretary of Health Surveillance of the Ministry of Health, in the government of Dilma Roussef, Antônio Carlos Nardi, says in an interview with the website, Portal Brasil that:

> If today we do not have a vaccine or something concrete and have an effect different from everything else done in controlling and combating the vector, the Aedes aegypti mosquito, the most effective thing is the elimination of any and all containers that can collect standing water and proliferate the mosquito". (NASCIMENTO; SOARES, 2018, p. 15).

For Luz, Santos & Vieira (2015), the vectors of the endemic diseases treated in this study are called Aedes aegypti and Aedes albopictus. The dengue virus (Flavivirus). There are 4 serotypes: DENV1, DENV2, DENV3 and DENV4. Chikungunya fever (CHIKV) is an RNA virus that belongs to the genus Alphavirus. The yellow fever virus (YFV) or yellow fever virus, of the genus Flavivirus. Zika virus (ZIKV) is an arbovirus in the family Flaviviridae and genus Flavirirus. The common hosts for dengue, zika, chikungunya and yellow fever are humans as an exceptional reservoir, vertebrate with epidemiological esteem. Primates are wild hosts. In wild yellow fever (SAF), the yellow fever virus has primates as hosts, on the other hand, the contamination of man happens accidentally. The modes of transmission of these diseases are very similar, all have the Aedes vector as the main transmitter. This process happens as follows: a mosquito (female) bites a person infected with the dengue, zika, chikungunya and yellow fever viruses during the summer period. By sucking the blood of this person who is contaminated with the virus, it will travel to the digestive tract and salivary glands, starting to multiply. Around 8 to 12 days you will be ready to transmit it, that is, for your entire life (6 to 8 weeks). There is no person-to-person transmission.

By Zanluca et. al (2015), the clinical manifestations of the diseases differ in the case of dengue, because it has 4 serotypes: DEN 1, DEN2, DEN4. In this sense, the individual may be infected more than once, and if the individual has been affected by dengue type 2, he will no longer be infected by the same type serum. The same process does not occur in

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Zika, chikungunya and yellow fever, because they have it. These, because they have a single type serum, there is no possibility of another infestation by the same virus, in this case, the individual will only be infected once and becomes immune. DEN1: presents fever followed by nonspecific symptoms, which only with approval of the positive snare is it possible to observe the hemorrhagic manifestation. DEN 2: there are slight spontaneous hemorrhages throughout the body, such as: epistaxis, skin bleeding, gingivorrhagia and others. DEN 3: presents with narrowing of blood pressure or hypotension, cold viscous skin, circulatory failure, with a weak and rapid pulse and restlessness. DEN 4: is the most severe form of the disease (severe dengue), whose symptoms are as follows: absence of blood pressure and inaudible pulse pressure. In Zika, the manifestations are as follows: malaise, fever, diarrhea, conjunctivitis, headache, maculopapular rash, arthralgia. Some studies point to a relationship between the Zika virus and Guillain-Barré syndrome. Symptoms may last for 3 to 6 days. In Chikungunya, the clinical manifestation of the virus (CHIKV) is similar to that of other viruses, and the symptoms of chikungunya fever can be more debilitating, affecting the upper and lower limbs, especially the joints of the hands and feet. Symptoms are: back pain, joint pain, nausea, myalgias, rashes, vomiting. The individual infected with yellow fever presents the following symptoms: hematemesis, intense prostration, renal liver failure, diarrhea, albuminuria, cephalalgia, low back pain, fever, chills, vomiting, mental obtundation, epistaxis, gingivorrhagia, otorrhagia, drowsiness, coma and anuria.

METHODOLOGY

The present work consists of a Quantitative Study with Data Analysis on the arboviruses Dengue, Chikungunya and Zika in southeastern Brazil, focusing on the impact of these diseases on public health and socioeconomic aspects, as well as on their epidemiological characteristics in the Brazilian Southeast region.

To visualize the data through graphs, data made available by the Health and Environment Surveillance Secretariat (SVSA) of the Ministry of Health were used, which offer detailed information on the incidence and distribution of arboviruses in Brazil.

Using the methodology of bibliographic analysis, a review of academic studies and articles published in specialized journals that deal with the epidemiology, control and prevention of arboviruses was carried out.

Statistical data provided in the epidemiological bulletins to quantify the incidence of diseases in the region, the graphs were organized in Microsoft Excel.

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For the elaboration of this work, the tools available on the Microsoft Excel platform were used, in order to organize the information that was extracted from the Arbovirus Monitoring Panel, of the Ministry of Health, in table systems and then transfer it to graphs.

The graphs were formatted in such a way that the horizontal axis represents the number of weeks of the selected study period (26 epidemiological weeks), while the vertical axis shows the number of probable cases in the survey. In addition, in the formatting of each graph, grade 3 polynomials were aggregated to represent the trends of Dengue, Zika, and Chikungunya in the years 2023 and 2024, whose formulas are represented in the lower right region of the graphs. In all, 6 graphs were created.

This methodology provides a structured approach to investigate arboviruses in the Southeast region, allowing the identification of patterns and factors that can help in the formulation of control and prevention strategies.

RESULTS AND DISCUSSIONS

By organizing the data obtained from arboviruses during the years 2023 and 2024 in tables, carried out in the Microsoft Excel program, the responsible team formatted three graphs to analyze the trends of Dengue, Zika and Chikungunya throughout the geographic region of the Southeast. The data collections were ordered according to the number of probable cases of each arbovirus per epidemiological week, which resulted in structured graphs with an x-axis (horizontal) relative to the 26 weeks of data collection and with a y-axis (vertical) relative to the number of cases listed.

From the collection of data on the incidence of arboviruses in the country, the following graphs and analyses were obtained:

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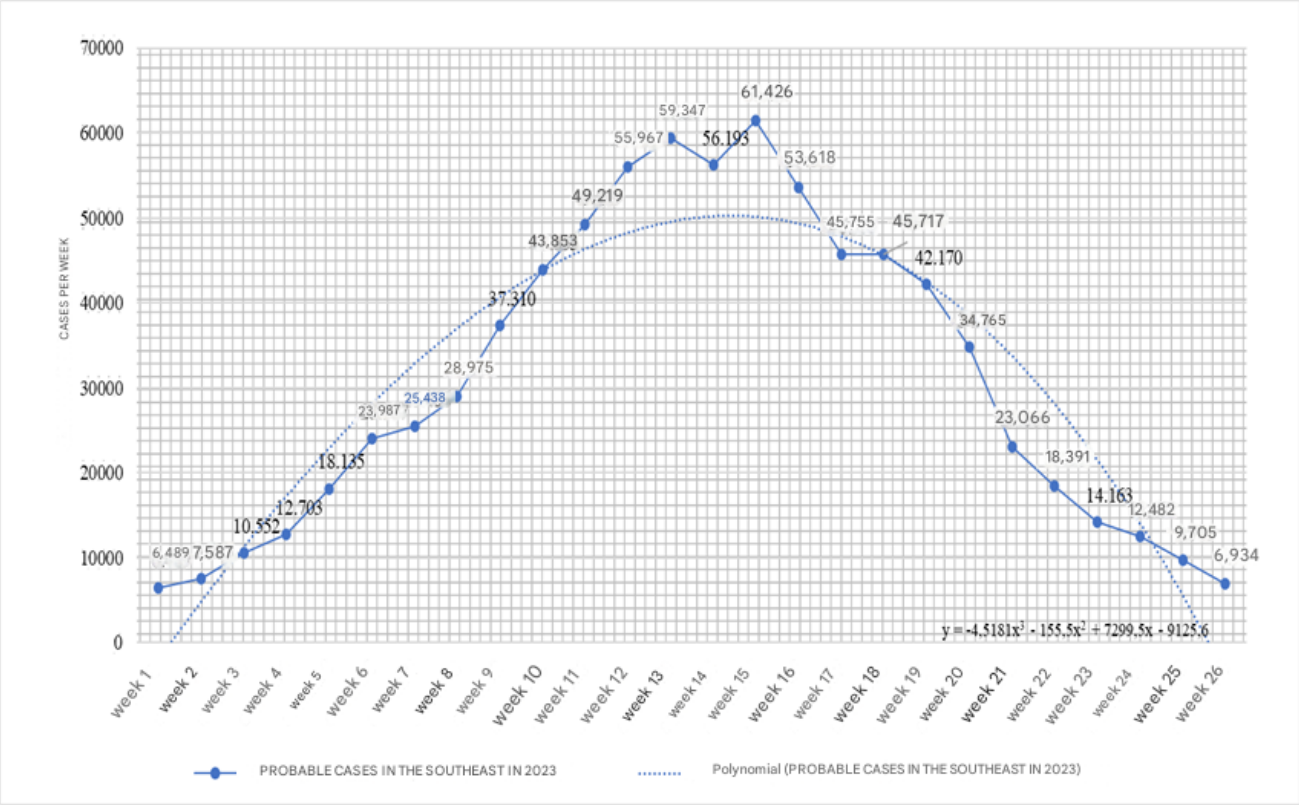
Figure 1. Graph on the number of probable cases of dengue during 26 weeks - 2023.



Source: Ministry of Health monitoring panel.

The analysis of the 2023 data shows the gradual increase in the number of probable cases of dengue in Southeast Brazil over the weeks, which peaked in week 15 with a total of 61,426 probable cases reported, which suggests that there was an outbreak of dengue in the region during this period. It is possible to observe that the number of dengue cases in the region tends to vary over time, which may reflect seasonal factors, such as the climatic conditions favorable to the proliferation of the mosquito that transmits the disease.

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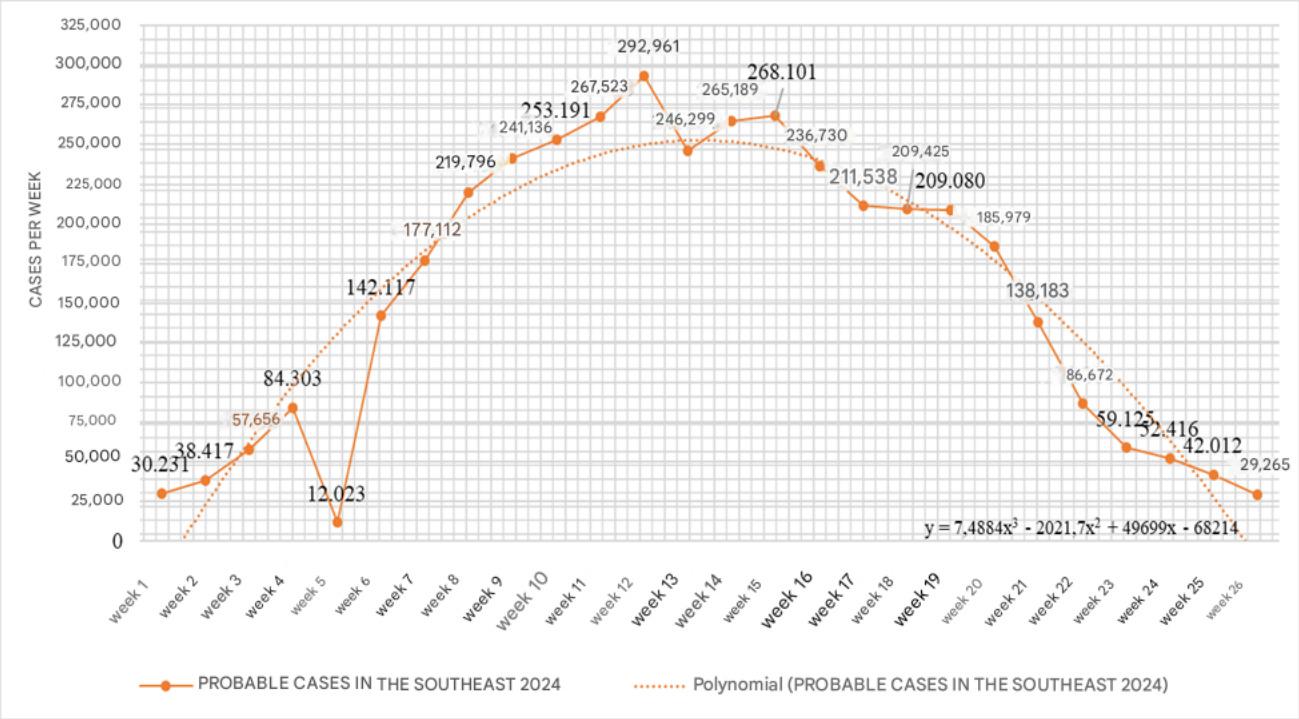
Figure 2. Graph on the number of probable cases of dengue during 26 weeks - 2024.



Source: Ministry of Health monitoring panel.

Regarding the data obtained on the first 26 epidemiological weeks of 2024, it is observed that probable cases in the Southeast in 2024 showed a notable increase over the weeks, with a drop in cases between the 4th and 5th week before a sudden increase from 12,023 to 142,117 cases of dengue symptoms in the 6th week, from which a constant growth is visualized until the count reaches its peak in the 12th week, with 292,961 data on probable cases registered.

After the peak week there was a drop in the numbers of cases, but still the numbers remained relatively high, indicating a situation of high transmission. From the 19th week onwards, the data show a sharper downward trend, indicating a possible reduction in transmission and control of the situation. Thus, the analysis of the data suggests that the public health measures adopted in the Southeast in 2024 seem to have contributed to the reduction of probable cases of the disease.

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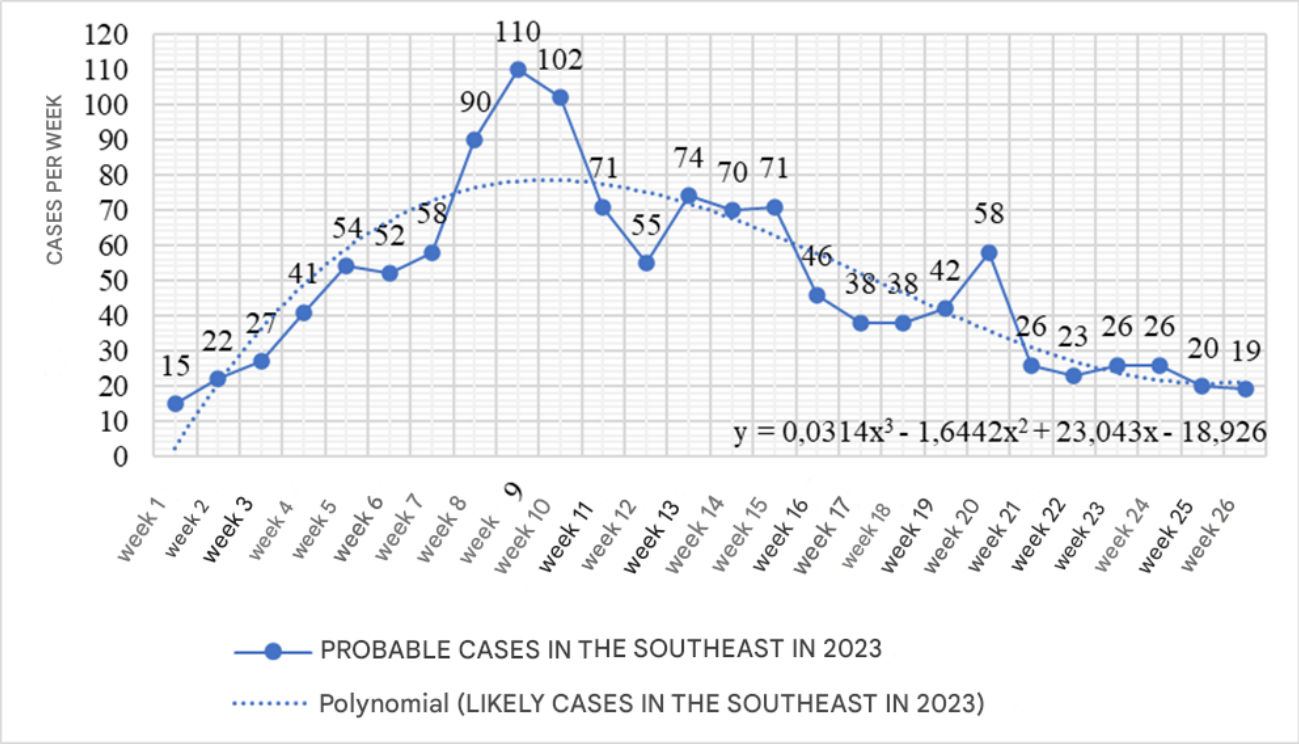
Figure 3. Graph of the number of probable cases of Zika during 26 weeks - 2023.



Source: Ministry of Health monitoring panel.

In 2023, the number of probable cases of Zika started at a low level, between 15 and 22 cases in the first two weeks. Over time, there was a gradual increase until its peak of 110 probable cases in week 9. During the period analyzed, there were significant variations in case counts, especially between week 8 and 9, where there was an increase of 20 cases, and between week 10 and 11, where there was a drop of 31 cases. In addition, after week 10, counts continued to fluctuate between 20 and 74 cases, with no clear upward or downward trend until week 21, after which the numbers demonstrate stability below 30 probable cases per week.

These observations provide a general idea of the evolution of cases over the weeks and may indicate the need for further investigation to better understand the patterns and identify possible factors influencing these variations.

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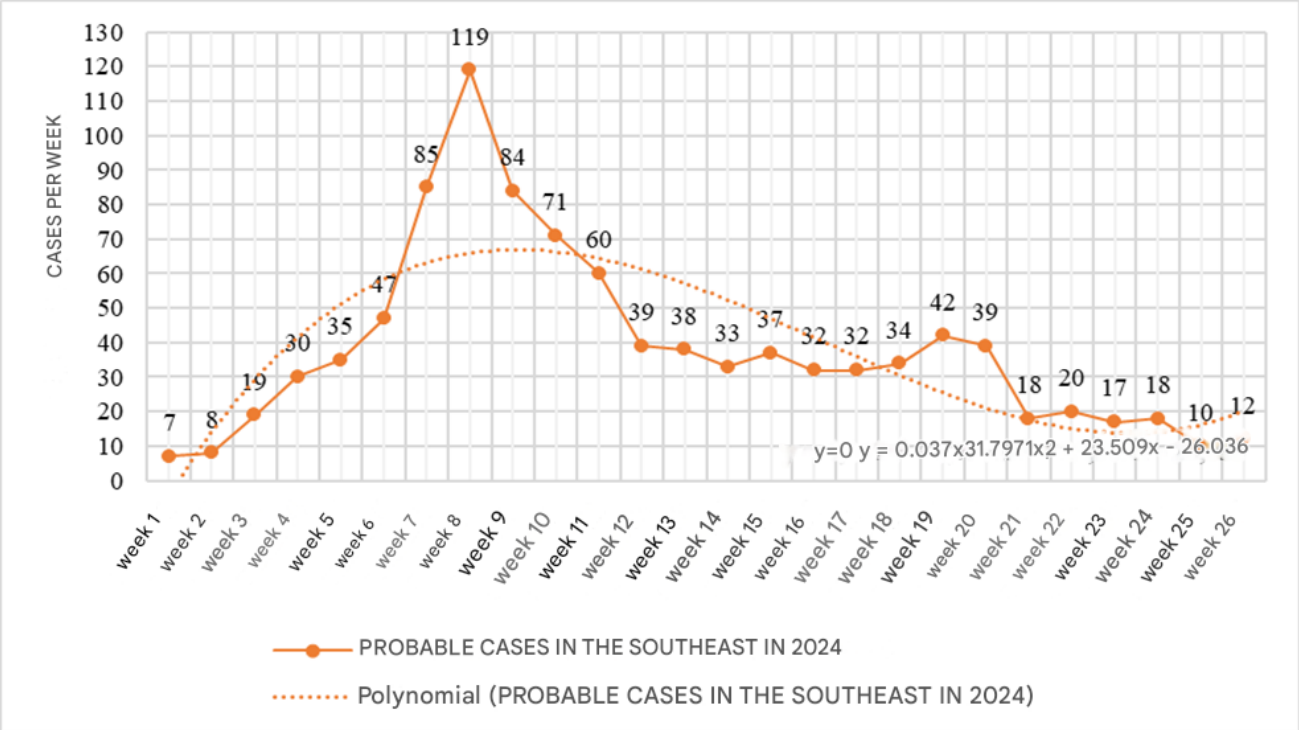
Figure 4. Graph on the number of probable cases of Zika during 26 weeks - 2024.



Source: Ministry of Health monitoring panel.

The analysis of the 2024 data shows a higher maximum number of cases than the number obtained in the peak week of 2023, but shows lower overall rates of possible contagion over the 26 weeks. According to the graph, the number of cases started at a low level, between 7 and 8 cases in the first weeks of the year. There was a gradual increase over the weeks, reaching a peak in week 8 with 119 cases. After week 8, there was a sharp drop until week 12, after which the numbers showed a stable drop with values below 43 cases in the following weeks, with slight oscillations.

During the period analyzed, there was considerable variation in case counts, with a sharper increase in the initial weeks (e.g., from 30 to 85 cases in week 7) and significant drops in some weeks (e.g., from 60 to 39 cases in week 11).

After week 11, the counts show some oscillation around 30 and 42 cases, with few significant variations compared to previous weeks. In the final weeks of the analyzed period, the numbers seem to have stabilized below 21 cases, with only small fluctuations.

These observations provide an overview of the evolution of cases over the weeks in 2024 and may indicate the need for ongoing monitoring and further analysis to better understand patterns of variation and identify potential trends.

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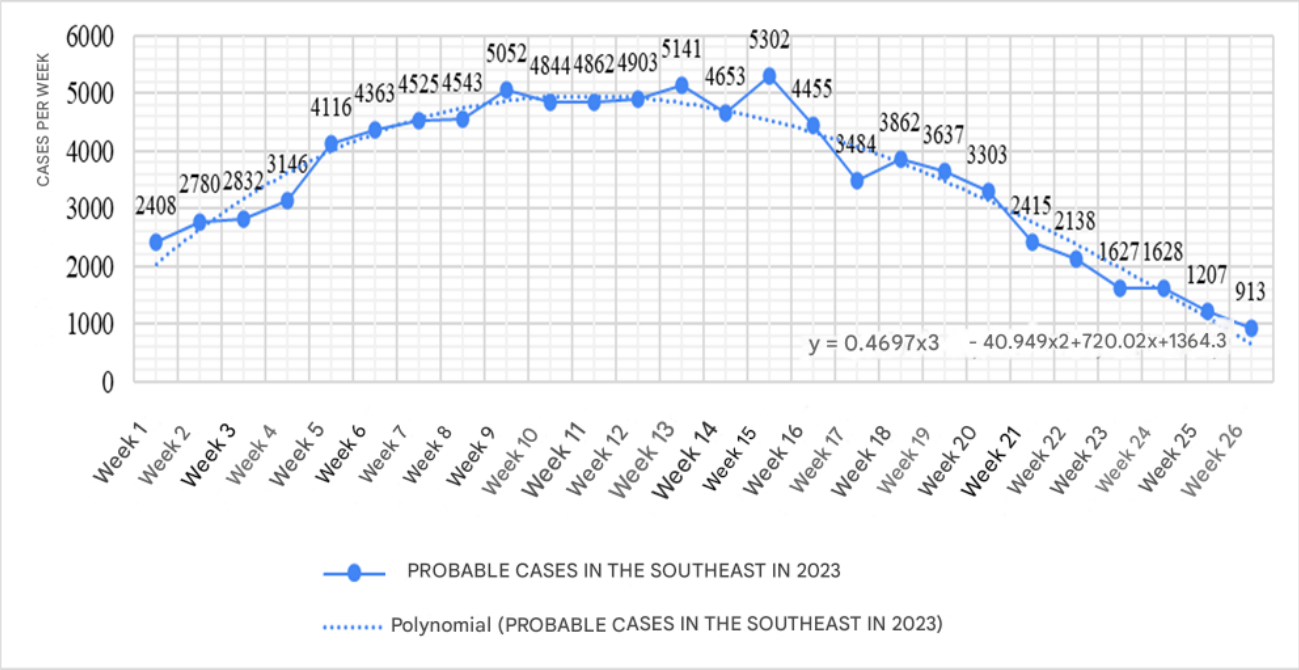
Figure 5. Graph on the number of probable cases of Chikungunya during 26 weeks - 2023



Source: Ministry of Health monitoring panel.

In view of the representation of the 2023 graphs, it can be seen that the number of cases starts at a moderate level, between 2408 and 2780 cases in the first weeks. Over time, a gradual increase is observed until reaching the peak of cases in week 15 with 5302 cases. Subsequently, the decrease in the number of probable cases proceeded with a low oscillation, with a variation between 1207 and 916 cases in the last two weeks.

During the analyzed period of 2023, significant variations in case counts are observed. The sharp growth between week 4 and week 5, with an increase of 970 cases, and the significant drop between week 15 and week 16, with a decrease of 847 cases, stand out. After week 15, case counts continued to fluctuate, with no clear upward or downward trend. There were fluctuations in case numbers, but staying within a reasonable range. In the last weeks of the analyzed period, the number of cases seems to have stabilized at lower values, ranging between 1207 and 913 cases. This may indicate a certain stability in the situation, with the number of cases remaining at lower levels.

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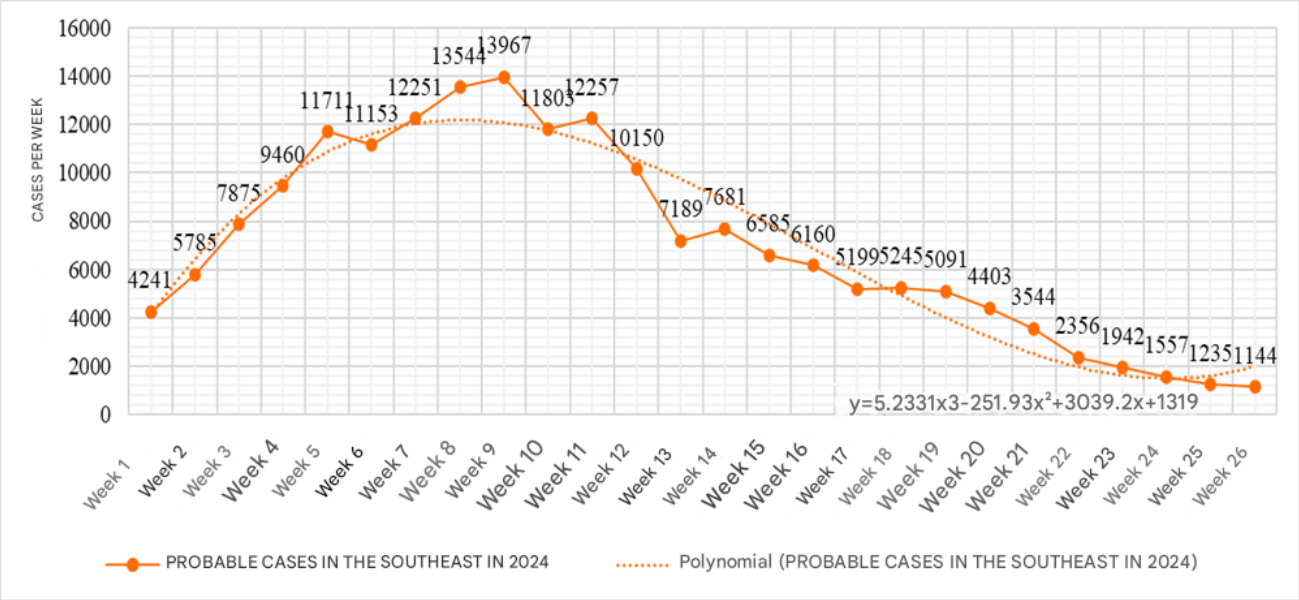
Figure 6. Graph on the number of probable cases of Chikungunya during 26 weeks - 2024



Source: Ministry of Health monitoring panel.

In the comparison of the information for 2023 with the data on the incidence of Chikungunya in the first 26 weeks of 2024, in figure 6, a large increase in the indications of the disease is remarkable, represented by the increase in the amplitude of its polynomial graph.

Through the graph, it is revealed that the 1st week presented 4241 probable cases of Chikungunya, with a difference of 1833 cases in relation to the number of cases in week 1 of the previous year. Meanwhile, the last week recorded is Week 26, with 1144 cases, which is the lowest rate in the entire time interval of the graph.

According to the graph, there were oscillations over the weeks, representing increases and decreases in the number of cases. For example, from Week 4 to Week 5 there was a significant increase of 2251 cases, and from Week 5 to Week 6 there was a drop of 558 cases. In addition, the graph shows that from week 14 onwards there was a decrease with smaller variations in the number of cases, characterizing a gradual stabilization of the occurrence of Zika virus symptoms after this period

The incidence coefficient is the ratio between the number of recorded cases of the disease per 100 thousand inhabitants. Through this index, it is possible to obtain an overview of the data for an improved analysis of the situation of epidemics in the southeastern region of Brazil.

According to information provided by the Ministry of Health on the Arbovirus Monitoring Panel, the incidence coefficients of the diseases in 2024 are: 5019.5 for Dengue,

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1.3 for Zika and 222.6 for Chikungunya. Meanwhile, for the previous year, the incidence coefficients indicated for each disease were: 1038 for Dengue, 1.7 for Zika and 123 for Chikungunya.

Thus, the increase in the number of cases of Dengue and Chikungunya in 2024 compared to 2023 is noticeable, while Zika data showed a reduction in its incidence.

FINAL CONSIDERATIONS

Through the analysis of the number of cases of each arbovirus per epidemiological week, extracted from the Ministry of Health's monitoring panel, and through the inclusion of the polynomial function of the information for each year in the graphs, the following observations were obtained:

i. The graph relating to the number of probable dengue cases per week reveals that the peak period of dengue symptoms in 2024 was anticipated in relation to the previous year, as well as showed a clear increase in its indices and trend, as demonstrated by the polynomial functions of the graph.

ii. The data collected on Zika in the Southeast show a lower number of cases in 2024 compared to 2023, according to the polynomials in the graph, only surpassing the weekly surveys of 2023 in the periods between the seventh and eighth epidemiological weeks, but showing a significant drop in the number of cases after this interval.

iii. For the Chikungunya data, similar to the analysis of dengue incidence, it is verified that the increase in the number of probable cases in 2024 occurred in advance compared to the year 2023, in addition to the increase in the amplitude of the polynomial of the data in 2024, in order to indicate a notable growth in Chikungunya symptom trends during the first 9 weeks, before they gradually decreased.

In this article, the trends of the arboviruses Dengue, Zika, and Chikungunya in Southeast Brazil during the years 2023 and 2024 were verified, in addition to comparisons between the years. The analysis resulted in certain significant increases in probable cases of the diseases in 2024 compared to the previous year, which raises concerns about future prospects regarding environmental and socioeconomic aspects. It is worth remembering that the study based on the Epidemiological Bulletin of the Ministry of Health showed an increase in arbovirus statistics not only in the Southeast, but also throughout the country.

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Faced with such an increase perspective, the need for interventions to combat these diseases and their impacts on society is emphasized.

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