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ANÁLISE EPIDEMIOLÓGICA DE CASOS DENGUE NA CIDADE DE SÃO MATEUS - ESPÍRITO SANTO

EPIDEMIOLOGICAL ANALYSIS OF DENGUE CASES IN THE CITY OF SÃO MATEUS - ESPÍRITO SANTO

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RESUMO

A dengue é uma doença infecciosa transmitida pela picada de mosquito do gênero *Aedes*. A doença pode ser causada por qualquer um dos sorotipos, que podem ser assintomáticos para um quadro clínico que varia de febre simples a dengue clássica (FD) a febre hemorrágica grave. Atualmente, é um grande problema de saúde pública em todo o mundo. O município de São Mateus é uma das cidades brasileiras, localizadas em regiões de intensa proliferação de vetores. Material e Métodos: Este estudo realizou uma análise epidemiológica dos casos de dengue em São Mateus, utilizando a metodologia do Sistema de Informações Geográficas (SIG) no período de 2008-2014. Resultados: A dengue prevalece em áreas de maior densidade populacional, habitadas por pessoas de baixa renda, onde a infraestrutura de saneamento é precária. Contrariando essa situação, as áreas com maior renda e ocupação recente, com baixo índice de densificação, apresentaram menos casos registrados de dengue. Conclusão: A pesquisa, portanto, foi capaz de delinear especificamente as regiões mais afetadas pelo vírus da dengue. É possível compreender a real situação do vírus da dengue no município e facilitar a tomada de decisão dos gestores para levantar estratégias efetivas que reflitam a redução das taxas desta doença.

ABSTRACT

Dengue is an infectious disease transmitted by the mosquito bite of the genus *Aedes*. The disease can be caused by any of the serotypes, which can be asymptomatic to a clinical picture ranging from simple fever to classic dengue fever (FD) to severe hemorrhagic fever. It is currently a major public health problem worldwide. The municipality of São Mateus is one of the Brazilian cities, which are located in regions of intense vector proliferation. Material and Methods: Our study performed an epidemiological analysis of cases of dengue in São Mateus, using methodology of Geographic Information System (GIS) in the period 2008-2014. Results: Dengue prevails in areas of greater population density, inhabited by people of low income, where sanitation infrastructure is precarious. Contrary to this situation, the areas with higher income and recent occupation, with low densification index, presented less recorded cases of dengue. Conclusion: The research, therefore, was able to specifically delineate the region's most affected by the dengue virus. It is possible to understand the real situation of the dengue virus in the municipality, and to facilitate the decision-making of the managers to raise effective strategies that reflect the reduction of rates of disease.

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INTRODUCTION

Dengue fever is a mosquito-borne viral disease where approximately 3.9 billion people in tropical and subtropical countries are at risk of infection (Word Health Organization [WHO] 2018) and about 390 million dengue infections occur annually in about 125 countries worldwide (Bhatt, et al., 2013).

Dengue fever is a self-limiting systemic viral infection transmitted by mosquitoes of the genus *Aedes* (Gubler, Kuno & Markoff, 2007).The incidence of dengue fever has increased by almost 30 times in recent decades, along with the geographic expansion of Aedes vector mosquitoes and dengue virus (DENVs) (Who, 1997; Who, 2009).

DENVs has 4 antigenically distinct serotypes, being type 1 (DENV-1), DENV-2, DENV-3 and DENV-4 (Rodrigues & Gould, 2013). It is also worth noting that although infection by a serotype confers lifelong protection against this specific serotype, it does not mean that the individual will be protected against a secondary infection with one of the other serotypes of the disease (Rodrigues & Gould, 2013).

Most dengue virus infections are asymptomatic; however, clinical manifestations can range from mild febrile disease to severe and fatal disease (Who, 2015). Dengue transmission shows significant variations in time and space (Tam, et al., 2013; Who, 2015) and outbreaks, these variables being affected by some factors such as: climate, temperature, socioeconomic and demographic. These factors also vary over time and space (Anno, et al., 2015).

It is estimated that more than 3 billion human beings live in endemic regions and that more than 50 million infections occur annually with at least 500 thousand people in need of hospitalization in endemic regions (Pinheiro & Corber, 1997).

Brazil, in agreement with to a survey by in reports from the World Health Organization, Centers for Disease Control and Prevention, Gideon on-line, ProMED and DengueMap, is among the countries with high risk of dengue transmission.

In the year 2014, according to the last epidemiological bulletin of the Ministry of Health, 591,080 cases of dengue in the country were found (BRASIL, 2014). According to data from this same source, the region of Brazil, which presented the highest indexes of cases was the southeast region (312,318 cases, 52.8%) (BRASIL, 2014).

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In the state of Espírito Santo, it part of the southeast region the reality of dengue cases does not differ from that of the national, conforming data from the Secretary of State for Health (SESA), dengue has occurred in the state since 1995, and records of successive epidemics have been made (BRASIL, 2015c). In agreement with to SESA, a vulnerability index was developed after georeferencing analysis using data from the Notifiable Diseases (BRASIL, 2015c). Methods of detection of space-time clusters, characterizing the greater density of occurrences of events in certain places, are dynamic techniques that are essential for the determination of where and to what degree the disease is present. Therefore, these approaches are useful for prioritizing dengue surveillance and to control (Anno, et al., 2015).

According to the data of National Mandatory Reporting System (SINAN), a vulnerability index was developed in which municipalities were divided in line with to the risk of occurrence of dengue, and with this, the municipality of São Mateus was considered to be at high risk for the occurrence of dengue (BRASIL, 2015c).

Considering the municipality of São Mateus, a region with a high risk of dengue contagion and evidencing the precarious condition of the basic and complex health units of the municipality, as well as the high demand of patients from the entire northern region of Espírito Santo, since the city is the headquarters and reference in health for the north region. Considering the scarcity of data on dengue in the northern region of Espírito Santo, the objective of this study was to carry out an epidemiological diagnosis of dengue cases in the municipality of São Mateus, Espírito Santo.

MATERIALS AND METHODS

Ethics: This study was approved by the Ethical Committee of the Centro Universitário do Norte do Espírito Santo (CEUNES) at the Universidade Federal do Espírito Santo (UFES), protocol number 439.289/2013. The study complies with all ethical standards for research.

Study Area: The municipality of São Mateus is located in the northern region of the state of Espírito Santo (ES) (18 ° 43'04.97 "S; 39 ° 51'13.50" W) and has, according to the last demographic census of 2010 of the Brazilian Institute of Geography and Statistics (IBGE), a population of 109,028 thousand inhabitants (BRASIL, 2015b). The number of inhabitants of the neighborhoods was obtained from the number of people attended by the family health teams (FHS) and by the community health agents of the basic health units (UBS) of each unit

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demarcated, due to the lack of delimitation official of the districts in the municipality, impediment to obtain demographic data by administrative units.

The cases of dengue fever were confirmed by the State Reference Laboratory for analysis of epidemiological, health and environmental surveillance areas, linked to the State Health Department (LACEN).

Epidemiological Data: The epidemiological analysis was based on data provided by the municipal health secretary, referring to the years from 2008 to 2014. The years 2009 and 2011 were not mentioned in the present study because the health services did not collect data in this period.

It was analyzed 36 districts, being: Areinha, Aroeira, Airton Sena, Aviação, Boa Vista, Blokos, Bonsucesso, Cacique, Carapina, Centro, Cohab, Guriri, Ideal (Fatima), Inocoop, Lago dos Cisne, Liberdade, Litorâneo, Mariricu, Morada do Ribeirão, Nativo, Nestor Gomes (Km 41), Nova Aymorés (Km 35), Novo Horizonte, Paulista, Pedra D'água, Porto, Posto Esso, San Remo, Santa Tereza, Santo Antônio, São Pedro, Seac, Sermanby, Vila Nova, Vila Verde and Vitória. The city of São Mateus has more than 36 neighborhoods such as Alvorada, Colina, Jardim Country Club, Jardim el Dourado and Nova Lima, but due to lack of information from of these districts, the study was carried out with only 36 districts.

Data analysis: The data obtained was compiled in Microsoft Excel 2013 and converted to the proportion of the total population in each city. The compiled data were submitted to statistical analysis in the statistical software Primer (version 6.0 UK, 2006), and the results were grouped by similarity. To identify Dengue clusters, we used hierarchical clustering similarity (Cluster) using the Bray-Curtis similarity index (Clarke & Warwick, 2001) and non-metric multidimensional scalability (MDS). The hierarchical grouping linked the samples by their associations producing a dendrogram and a graph. The smaller the distance between the points, the greater the similarity between the samples (Neto et al., 1998). Other statistical analyzes used the Chi-square test using the Graphpad Prism® software (version 5.0 CA, USA, 2000). Statistically different values of $P < 0.05$ were considered statistically significant.

RESULTS

The city of São Mateus-ES, between 2008, 2010, 2012, 2013 and 2014 presented 7,187 reports of dengue cases, totaling an average of 1,437 reported cases of dengue / 100,000 inhabitants per year, according to data provided by the epidemiology department of the

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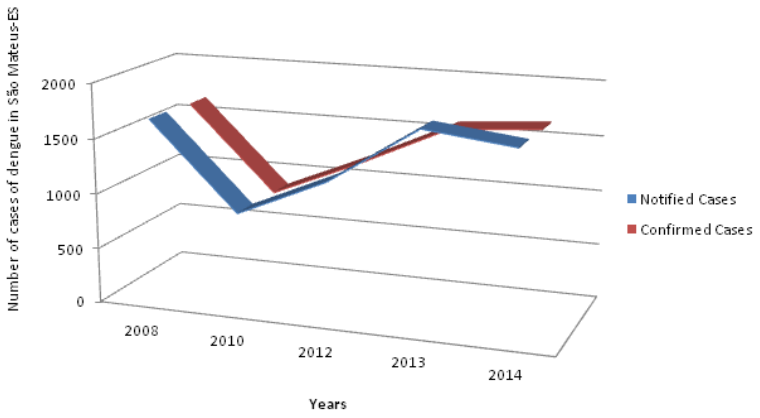
Municipal Health Department. As can be seen in Figure 1, only the year 2010 showed a slight decrease in the number of reported and confirmed cases of dengue; however, in the other years analyzed in the period (2008-2014), there were approximately 1,549 reported cases of dengue /100,000 inhabitants/year. Since this information, it was possible to observe the behavior of the disease in different districts of the municipality. In total, 36 neighborhoods were analyzed, being chosen because they have some viable information to the research. The other districts were not analyzed for lack of relevant information together with the data obtained in the Department of Epidemiology of the Municipal Health Department of São Mateus.

Figure 1. Number of positive cases of dengue in 2008, 2010 and 2012, in the municipality of São Mateus-ES.



The serotype DENV-4 (68.9%) was predominant in the analyzed period, followed by serotypes DENV-1 (20.1%) and DENV-2 (11.2%) respectively in dengue cases in the municipality's population during the period analyzed.

Stratifying the information in the 36 analyzed neighborhoods allows a better understanding of the epidemiological situation of dengue in the municipality, as well as identifying the neighborhoods that have more individuals infected with the dengue virus and in this way can increase the infection both in their region and in nearby neighborhoods. Figure 2 shows the 10 districts of São Mateus with the highest number of reports of dengue cases in each year studied. In most districts, the number of notifications is relatively small compared to the districts Aroeira and Guriri. However, all variations in relation to the number of notifications were statistically significant in all evaluated years ($P < 0.001$).

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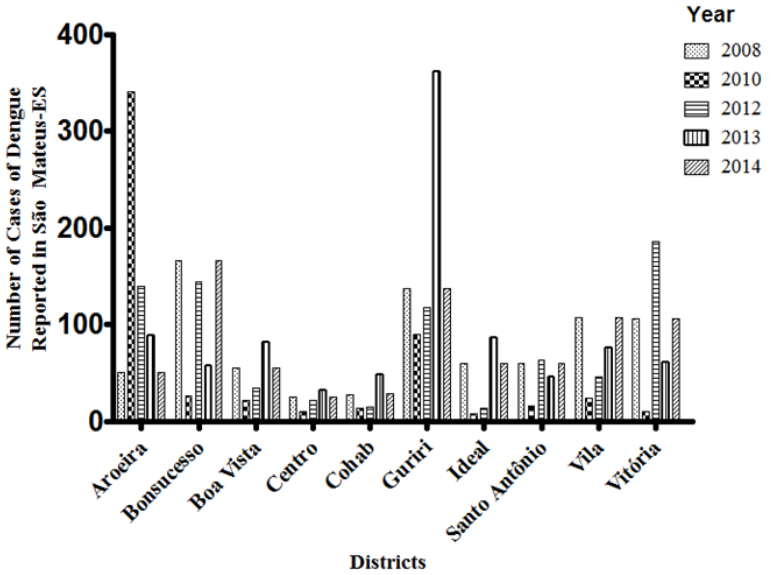
Figure 2. Number of notifications of dengue in 2008, 2010 and 2012, in the municipality of São Mateus-ES. * P <0.05.



Analyzing the data obtained it is possible to observe the formation of a group with significant similarity composed by the neighborhoods: Bonsucesso, Guriri, Vila Nova and Vitória. These communities had the highest number of notifications and positive cases of dengue in 2014 and also had high Infestation Rate Index (IPP), with possible mosquito dissemination zones in that year.

The IIP is a calculation performed by the epidemiology sector of the municipality, which results in the quantity of real estate where the mosquito larvae are found. Therefore, when the number of high outbreaks is encountered, the elevated IIP is likely to be present.

In order to evaluate the similarity between the neighborhoods, a cluster of five communities with the largest numbers of notifications and positive cases was drawn up in each year studied, being represented in Figure 3, which shows all the divisions well defined, with a cut of 70% in the two years, being represented the districts that presented greater cases of dengue in each year grouped by their similarities. Each community represented has considerable similarities.

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Figure 3. Cluster of the districts analyzed in the year 2013 and 2014.

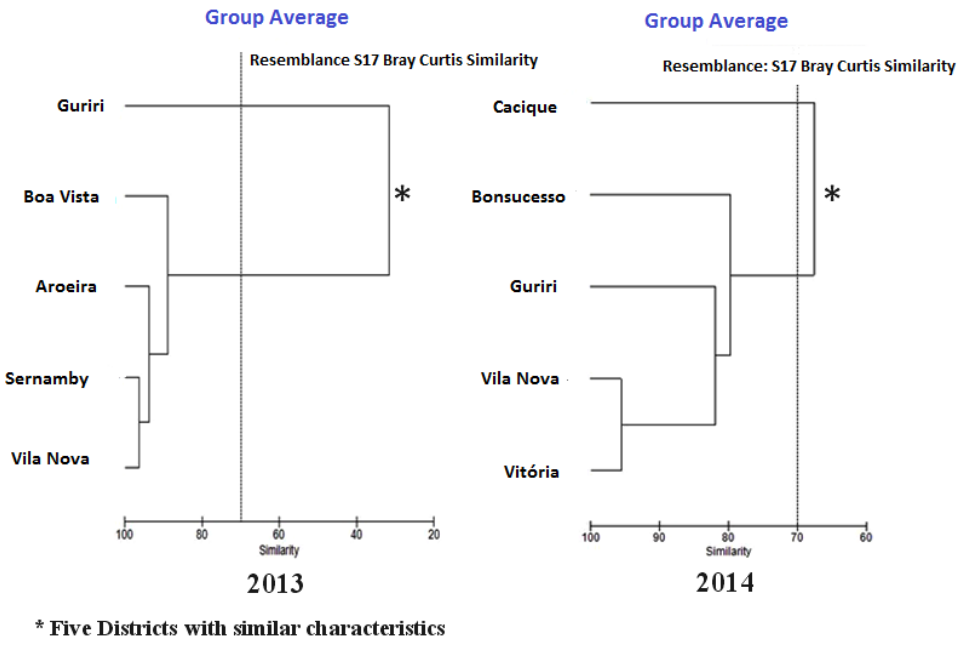
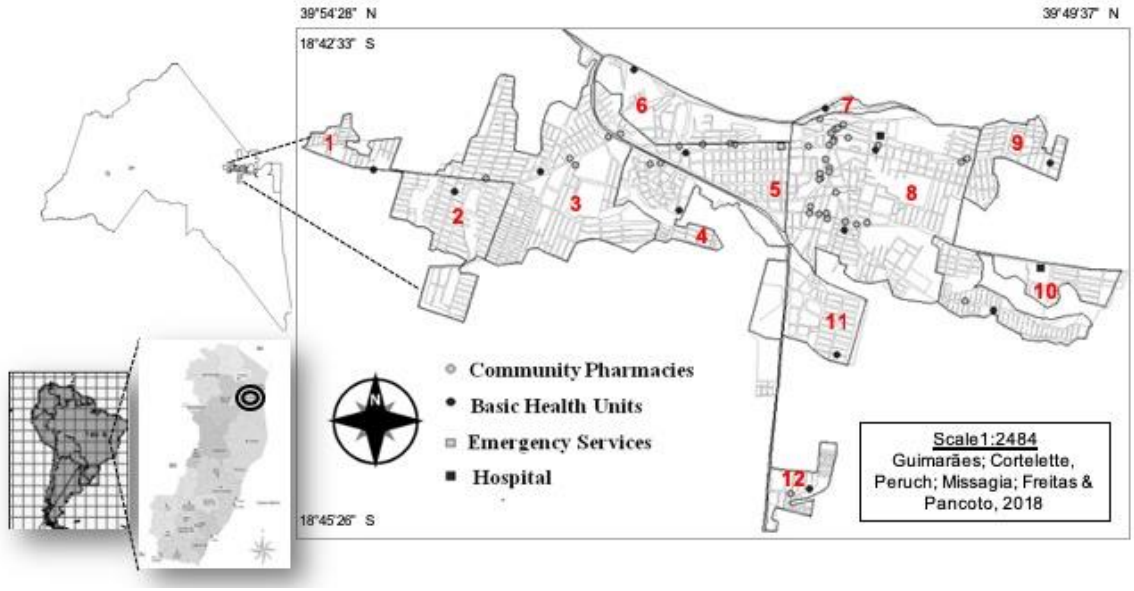


Figure 4 shows the existence of several areas without the presence of UBS, which is extremely important for endemic control (Teixeira, et al., 2002), because it is in the UBS that a large part of the notifications is performed and in the positive cases treatment of the symptoms in an early manner (Herrera, et al., 1992). In addition, well-developed campaigns in the UBS show results in every society, as it is a way of bringing quality information with a language appropriate to the population (Guzman & Kouri, 2002).

Figure 4. Map of UBS presence in the districts.



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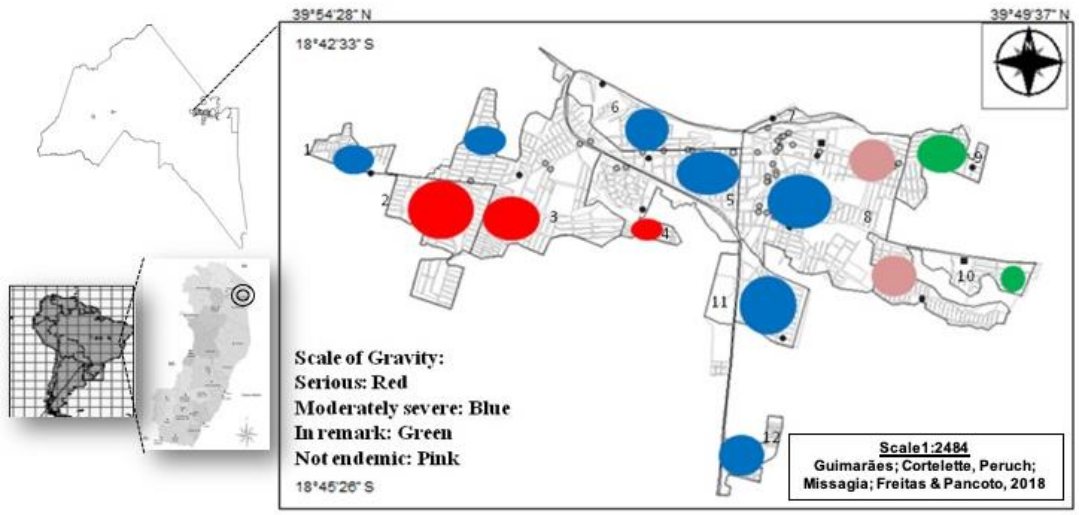
In Figure 5 it was possible to zone endemic areas through a scale of gravity from the number of positive cases. Four classifications were performed: Severe (area with more than 50 positive cases); Moderately Severe (area with between 50 and 10 positive cases); In observation (area that has 10 to 5 positive cases) and Non-Endemic (area that did not present risk of endemicity).

Figure 5. Severity Scale of the Number of Positive Dengue Cases in the years 2008, 2010 and 2012, in the municipality of São Mateus-ES.



DISCUSSION

In Brazil, dengue is of great concern, due to the increase in incidence in recent years in several Brazilian regions. The incidence is considered high when the number of 300 cases / 100,000 inhabitants is exceeded (Melo, Paulino, Castro, Soccol, & Soccol, 2014). São Mateus is not out of this reality, since among the years 2008, 2010, 2012, 2013 and 2014 presented 7,187 notifications of dengue cases, totaling an average of 1,437 reported dengue cases in 100,000 inhabitants/year. São Mateus does not have great development in the area of health, the epidemiological mapping brought a very different vision of what had already been discussed or traced in research on dengue in the region. It is known that the higher the numbers of inhabitants, the greater the risks of transmission of the disease, mainly due to the great population density (BRASIL, 2015a). Some studies have also shown that the number of mosquitoes transmitting the dengue virus is related to the number of inhabitants (Leite, Fonseca & Braz, 2008), with mosquito numbers being higher in more populated regions (Guzman & Kouri, 2002). In addition, urban areas have regions with greater availability of sites for females to lay eggs, making them more likely to have a mosquito-bred population

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and greater chance of encountering infectious mosquitoes capable of transmitting the dengue virus (Caixeta & Souza, 2007), because they provide an adequate environment for their reproduction (Leite, et al., 2008).

Data obtained at the Municipal Planning Department show that the municipality's infrastructure is satisfactory, approximately 90% of the urban area has a basic sanitation network (water and sewage), and 100% of garbage collection. However, studies show that the favorable condition for habitat development for the vector mosquito (*Aedes aegypti*) as it occurs in the Guriri neighborhood may be a consequence of a failure of structure and supervision by the responsible organisms (Reis, Andrade & Cunha, 2013).

The high number of notifications in the Guriri neighborhood may reflect geoenvironmental factors. Because it is an island, with about 12.000 residents, holiday resort, a time in which the floating population increases dramatically. Being that, in the other months of the year, it has a great number of residences uninhabited. In addition to this factor, the presence of open garbage and waste land used as a garbage dump are also part of the reality of the neighborhood, which facilitates the formation of habitats conducive to the proliferation of mosquitoes that transmit dengue (Reis, et al., 2013).

Beach regions tend to be more susceptible to vector proliferation when compared to other regions (Mendonça, Souza & Dutra, 2009). The houses remain without maintenance, cleaning, housing and care during the year, becoming excellent breeding grounds for the oviparous mosquito and its larvae to develop20. Another factor, which explains the high number of reports and positive cases of dengue in Guriri, is poor neighborhood sanitation. The water for the residents is of poor quality, high number of artesian wells, providing water without adequate treatment and the garbage collection occurs irregularly.

Information such as garbage collection and cleaning were difficult to access not only in the Guriri neighborhood, but in all neighborhoods analyzed. The responsible body informs that the collection is done in all neighborhoods, but the process is differentiated by regions and how this differentiation occurs was not informed.

In addition to the Guriri neighborhood, three neighborhoods stood out for the high number of notifications, being Bonsucesso, Vila Nova and Vitória. These neighborhoods are located in close regions which facilitates the migration of contaminated mosquitoes from one region to

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another (Pastrana, Brito, Nicolino, De Oliveira & Haddad, 2014). Therefore, they have similar socioeconomic and socio-environmental characteristics.

Aroeira district is extremely poor, does not have adequate sanitation to its residents, does not have treated water, sewage networks (the vast majority of them open), the streets are not entirely paved (when it rains, there are puddles). The condition of the housing environment is highly precarious. The vast majority of residents live on agriculture, planting vegetables (digging holes in their backyards and lining them with plastics or tarpaulins), which are surrounded and protected by old tires, tiles, pet bottles and glass bottles that collect standing water . The Aroeira neighborhood stood out for a high number of notifications of 2010. This is due to a problem of underreporting of cases in the year 2008 and absence of notifications in 2009. besides the year 2008, the neighborhood did not have Basic Health Unit, did not receive periodic visits from community health agents and endemic health agents. During 2010, in observing this expressive increase in notifications in the Aroeira neighborhood, the city council, in partnership with other government agencies, carried out awareness campaigns and the hiring of agents for the neighborhood. With this, the neighborhood becomes health coverage and reduces its number of cases in 2012.

Although classified as a democratic disease because it affects people of different social classes, the dengue situation has been modified. In recent years, people of lower income are more vulnerable to the action of the transmitting mosquito. This finding was made in a study on dengue in Belo Horizonte in 2008, where it was shown that income correlates with the distribution of verified cases of dengue (Leite, 2010). The three prominent districts are mostly low-income.

CONCLUSIONS

As the municipality of São Mateus does not have great development in the health area, the epidemiological mapping demonstrated the presence of dengue cases in the region. We observed that data collection failures by the health sectors can compromise the analysis and, consequently, impair preventive measures in the fight against dengue fever, for example. Thus, this study shows that dengue prevailed in areas of greater population density, inhabited by low-income people, in which the sanitation infrastructure is precarious. The presence of common factors such as: inadequate treatment of solid waste, poor water management, low vector control, streets without pavement, densely populated areas, inadequate water reservoirs, basic sanitation and poor garbage collection are factors present in most

neighborhoods analyzed. Contrary to this situation, the areas with higher income and recent occupation, with low densification index, presented less recorded cases of dengue. The research, therefore, was able to specifically delineate the region's most affected by the dengue virus. It is possible to understand the real situation of the dengue virus in the municipality, and to facilitate the decision-making of the managers to raise effective strategies that reflect the reduction of rates of disease.

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