v. 4, n. 69, 2024

International Journal of Health Science

EPIDEMIOLOGICAL PROFILE OF DISEASES CAUSED BY AEDES AEGYPTI IN THE HEALTH DISTRICTS OF SÃO LUÍS (MARANHÃO) FROM 2007 TO 2017

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Abstract: Goals: To describe the epidemiological characteristics of the Health Districts of São Luís; Maranhão, Brazil, from 2007 to 2017, focusing on the three diseases transmitted by Aedes aegypti: dengue, zika and chikungunya. **Methods:** observational, descriptive, retrospective, sectional study, based on the analysis of data recorded by the Disease Information and Notification System (SINAN), provided by the São Luís Municipal Health Department (SEMUS). **Results:** In 2011, there was a greater notification of dengue, with 5,378 cases. The female gender predominated and the age group with the highest number of notifications was 20 to 39 years old. Reports of zika virus and chikungunya began in 2015 with an epidemic peak in 2016. The Bequimão Health District, the second most populous, reported the highest number of cases. **Conclusion:** The prevalence of diseases caused by Aedes aegypti presents in the three arboviruses, endemic variation related to population density and local sanitary conditions, which, in this article, will focus on the study of the capital of Maranhão, where there is a lack of sanitary infrastructure and supply of water, deserving the attention of health authorities and permanent action by the population.
Keywords: Public Health, Sanitation, Aedes aegypti, Health district.

INTRODUCTION

Aedes aegypti is an urban mosquito, transmitter of dengue, chikungunya, zika and urban yellow fever, having a close relationship with humans, and proliferates in areas with higher population density, mainly in metropolitan regions. Typical to tropical and subtropical regions, it does not withstand low temperatures or high altitudes, particularly in intertropical regions. It is a byproduct of the disorderly urbanization that occurs in countries with emerging economies. Its vector, *Aedes aegypti,* is highly adapted to urban life and its spread is privileged due to modern consumerist habits arising mainly from the process of accelerated urbanization.

Aedes aegypti spread the dengue virus throughout Brazil, which led to the occurrence of several epidemics in all its regions, including the most urbanized and consequently most populous regions. Significant growth occurred in the 1990s, reaching a higher level in 1998, when around 530 thousand cases were officially registered. (MINISTRY OF HEALTH, 2015).

There was a sharp reduction in 1999, at the beginning of the century, in 2002 an increase in the incidence of dengue was recorded, reaching 794,219 reported cases. In Brazil, in 2008, the incidence of the disease reached approximately 800 cases per 100 thousand inhabitants. (MINISTRY OF HEALTH, 2015).

The United Nations (UN, 2015) warns that currently around 25% of the world's population living in cities live in absolute poverty, which allows these cities to be true gateways for infection. Large-scale population mobility has enabled the emergence of new microorganisms and the return of previously controlled organisms.

The role of cities in promoting health is emphasized by urbanization, which affects 70% of the global population living in urban areas and lacking adequate sanitary conditions to inhibit the emergence of epidemics.

Of the Brazilian regions, the Northeast Region is one of the most affected by DEN V and the population of all nine states presents a very high risk of infection. Of the states that comprise it, Maranhão is one of those that has presented the highest number of cases. of dengue. (MINISTRY OF HEALTH, 2016).

The city of São Luís has characteristics that make it an endemic zone for diseases caused by *Aedes aegypti*, including compatible climatic factors contributing to the proliferation of

mosquitoes, serious deficiencies in sanitation, and a deficit in water supply, which generates large water storages. inadequate and low population awareness about the vector. (FERNANDES et al, 2013).

Brazil, at the end of 2014, began a new phase of diseases caused by *Aedes aegypti*, characterized by the increasing expansion of the occurrence of the four serotypes of the Dengue virus and two new infections, the Zika virus and the Chikungunya virus.

The Zika virus stands out for its association with cases of neurological abnormalities such as microcephaly, a malformation that causes babies' brains to not develop properly. Furthermore, the disease is also related to Guillain-Barré Syndrome, which causes muscle weakness and muscle paralysis. During epidemics, several forms of central nervous system (CNS) involvement associated with ZIK V infection were reported, such as meningoencephalitis and acute disseminated encephalomyelitis. (MINISTRY OF HEALTH, 2016)

Chikungunya has been identified in more than 60 countries in Asia, Africa, Europe and the Americas. Chikungunya mosquitoes have spread throughout Europe and the Americas in recent decades. In infection with the chikungunya virus, the most relevant aspect is the involvement of the joints with progression to disabling chronic arthritis. Chikugunya fever is a disease caused by the chikungunya virus, of the Alphavirus genus, and its vector is the *Aedes aegypti* mosquito.

In Brazil from 2015 onwards, with the recognition of the autochthonous circulation of the Zika virus, the country began to count on the possibility of simultaneous outbreaks and epidemics caused by the three viruses.

In the municipality of São Luís do Maranhão, the Dengue situation is no different from the national context. In the last decade the number of cases has grown, with São Luís being among the 16 capitals in Brazil that are on alert for an outbreak of the three diseases transmitted by the *Aedes aegypti* mosquito, as shown in SE Bulletin number 45, (BRAZIL, 2015).

Analyzing how the dissemination and dispersive process of vectors such as *Aedes aegypti* occurs is relevant for the control and treatment of diseases transmitted by it. This work aimed to observe the distribution of diseases caused by *Aedes aegypti* in health districts, relating the characteristics of the neighborhoods with the highest notification rates in the period studied and how health and urbanization characteristics can contribute to favoring the proliferation of the mosquito vector, and consequently of diseases. transmitted by him. It is necessary to study the dynamics of diseases caused by *Aedes aegypti* in the city of São Luís (Maranhão), with a view to contributing to planning and research into vector control, making it possible to reduce the magnitude of epidemics and, mainly, deaths from these diseases.

METHODOLOGY

Descriptive, retrospective, sectional observational ecological study, with the object of study being the diseases caused by the *Aedes aegypti* mosquito: dengue, zika virus and chikungunya in the seven Health Districts of São Luís, State of Maranhão. Secondary data recorded in the databases of the Notifiable Diseases Information System (SINAN) was used, the main source of information related to diseases in the country and the Coordination of the National Dengue Control Program of the Ministry of Health, relating to epidemiological and of the occurrence and distribution of cases of the three arboviruses, from 2007 to 2017 for dengue and 2015 to 2017 for Zika and Chikungunya. Socio-demographic data (district population, health district poverty index, water supply, sewage network and district garbage collection) were obtained from secondary databases such as:

IBGE, (2010) and website: www.nossasaoluis.org.br. (Kairos, 2014).

The information collected using the instrument used was analyzed and grouped separately into categories using Microsoft Excel version 2010 software, with data analysis and presentation using descriptive statistics.

The Municipal Secretary of Health (SEMUS) of São Luís-Ma, carries out Dengue control activities through epidemiological surveillance of the Municipal Dengue Control Program (PMCD), in addition to Zika and Chikungunya, using the regionalization policy of the Unified System of Health (SUS), which divides the municipality into seven Health Districts (DS), six in the urban area (DS Centro, DS Bequimão, DS Cohab, DS Coroadinho, DS Tirirical, DS Itaqui-Bacanga) and one in the rural area (DS Vila Esperança).

RESULTS AND DISCUSSIONS

The *Aedes aegypti* mosquito was introduced in 1969, in São Luís, it was only in 1995 that health agencies detected the first cases of classic Dengue in the Cohab-Anil neighborhood. Activities aimed at combating the vector were implemented without satisfactory results. According to data from the São Luís Municipal Health Department, the first dengue epidemic occurred in 1996 with 4,641 reported cases. According to GONÇALVES NETO & REBÊLO, (2004) In 1996, a serum epidemiological survey was carried out estimating that 41.40% of the studied population was sensitized by DENV-1. In 2001, the DENV-2 serotype was isolated.

In 2007, there was an increase in cases of Dengue Hemorrhagic Fever (DHF), possibly due to the circulation of the three serotypes – DENV-1, DENV-2 and DENV-3 – in the municipality of São Luís -MA. As of May 2010, the incidence of dengue increased by 709% in São Luís, compared to the same period of the previous year. The dengue epidemiological surveillance system, in 2011, identified that until the 52nd epidemiological week there was the presence of a new serotype circulating in the state of Maranhão, DENV-4.

In the period from 2007 to 2017, 25,124 cases of dengue were reported in the municipality of São Luís -MA, and in 2011, 5,378 cases were reported, contributing to around 53% of cases in the state of Maranhão, probably due to the presence of new circulating serotypes, with 14 deaths, standing out in relation to other years. In 2016 there was a new epidemic peak, with almost 5 thousand cases.

Observing figure 1, the years 2007, 2011 and 2016 recorded the highest notification rates in the period studied, with 3,524; 5,368 and 4,804, according to secondary data recorded in the databases of the Notifiable Diseases Information System (SINAN) in São Luís, MA. These results coincide with the results found by other authors in the same period. (PINHO, 2016)

In the period of 2009, a decrease in dengue incidence rates was observed, possibly due to failures in the notification system, in addition to the possibility of the disease being trivialized by the population who would already be aware of Dengue treatment, not seeking care in health units. Furthermore, the incidence of dengue cases fluctuates according to climatic conditions and is associated with factors such as increased temperature, rainfall and relative humidity. (VIANA & IGNOTTI, 2013).

FIGURE 1: Historical series of the number of dengue cases reported in São Luís, MA from 2007 to 2017.
Source: BRAZIL (2019).

The figure 2 shows the notifications by age group, a higher incidence was observed in the range of 20 to 29 years old with 5149 cases approximately (21%) of the affected population, it is observed that these data basically keep corroborating with other authors NETO & REBÊLO, (2004); Pinho, (2016), noting that this age group is represented by the economically active population, being the most circulating public.

The age group from 5 to 9 years was the second most reported with 3,858 cases, the largest number of cases in this age group occurred in 2007, 2010, 2011 and 2013, probably due to the presence of three serotypes and the appearance of a new serotype DENV 4 in 2011, the increased incidence in children corroborates BRANCO ET AL (2014) which highlights the severity and lethality in children under 15 years of age. The age group from 39 to 59 reported 3351 cases, being the third, the incidence decreases significantly from the age of 60, although it is the age group where the risk of death associated with dengue is higher, especially when it presents comorbidities, which tends to worsen. of the clinical picture.

The structuring of SD arises with municipalization, functioning as a basic operational unit of the National Health System and a strategy supported by the World Health Organization (W.H.O.), to improve the health conditions of populations in developing countries.

In table 1, it is observed that at the beginning of the period studied, the largest number of cases occurred in the Itaqui-Bacanga and Coroadinho DS. DS Itaqui-Bacanga has an urban area with 17 neighborhoods and an area of 36 km² and a rural area with 44 neighborhoods and an area of 93 km² Total of 123,203 inhabitants (IBGE, 2010). Coroadinho DS is made up of an Urban Zone with an area of 75 km² and a rural zone with an area of 36 km², and a total of 45 neighborhoods with 134,736 inhabitants, respectively peripheral areas of the city with a low-income population and little infrastructure.

After 2009, the DS of Bequimão reported a greater number of cases, a district made up of 64 neighborhoods, all located in the urban area of São Luís with approximately 247,474 inhabitants and an area of 135 km², the third most populous district, with better per capita income, greater number of class A and B neighborhoods, all with surrounding suburbs and without the necessary basic infrastructure, especially with regard to health, with divergent situations in the social, demographic and health sectors. This district has important characteristics to be evaluated: socially the population is quite heterogeneous where the poorest class clusters around large condominiums, far from public health units, making access difficult.

As it was seen in figure 3, at the beginning of notifications (2015) the DS with the highest notification was Coroadinho, with 65 cases, contributing to 45% of cases. In 2016 and 2017, DS Bequimão had the highest notification rates, respectively, averaging 28% and 43% of cases.

We observed distinct characteristics in the two SDs, the first with a large number of rural locations, low infrastructure, peripheral areas of the city, enabling the proliferation of breeding sites and consequently the beginning of transmission of a new arbovirus such as chikungunya. Another relevant issue in the Coroadinho DS is the water supply, which is served by a water pipe network that serves an average of 87% of household units. The rest of the population has access to the public supply network in addition to wells and springs, however in the neighborhoods that make up this district the regularity of water supply is quite precarious as a result of the intermittent supply, water storage is a common procedure, providing breeding grounds potential and increasing the incidence of diseases caused by Aedes Aegypti.

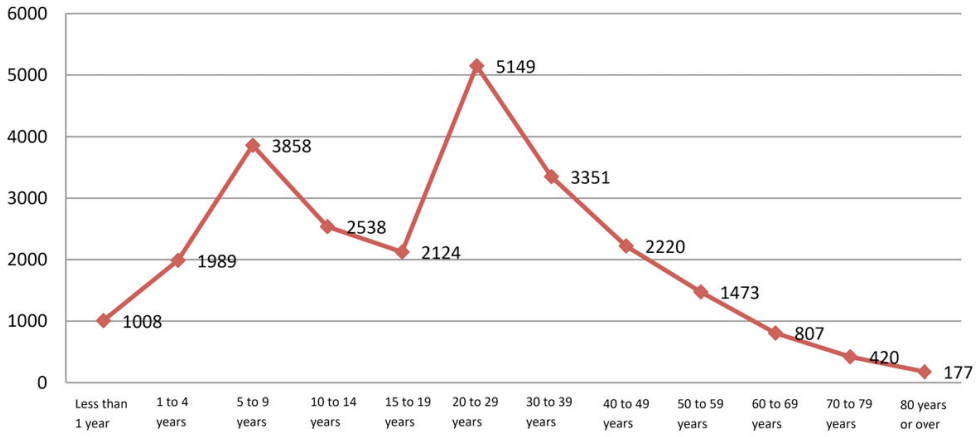

FIGURE 2: Distribution of Dengue by age group in the period 2007 - 2017
Source: Brazil (2019)

HEALTH DISTRICT	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
DS Tirirical	206	117	69	427	915	190	176	124	420	579	124
DS Centro	180	243	31	231	513	111	107	86	349	532	89
DS Coroadinho	223	299	84	469	730	230	148	154	272	503	66
DS Vila Esperança	85	66	22	136	199	84	94	61	81	186	22
DS Bequimão	201	169	53	746	1530	336	372	299	522	1.715	296
DS Cohab	169	127	43	494	1011	237	108	124	682	983	372
DS Itaqui-Bacanga	595	215	36	342	432	72	106	97	93	194	44

TABLE 1: DISTRIBUTION OF DENGUE CASES BY HEALTH DISTRICT
Source: Brazil (2019)

In 2016 and 2017, the DS that reported the most was Bequimão, with the highest number of cases in the São Francisco neighborhood, the most populous in the DS. Females reported (124) 65% in 2015 and males reported 66 cases. In 2016, females reported 2,481 cases, 67%, and 1,230 males. In 2017, even with the reduction in notifications, females prevailed with 164 cases, around 69%.

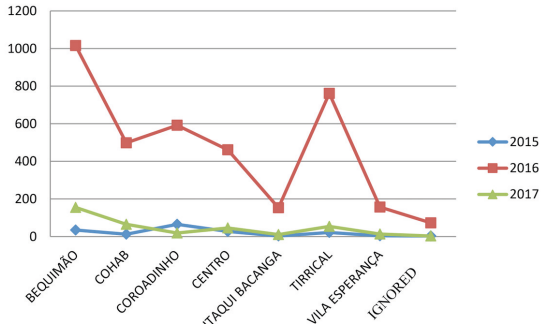

FIGURE 3: Distribution of Chikungunya cases in Health Districts from 2015 to 2017.
Source: Brazil (2019)

Zika is an arbovirus transmitted by the Aedes aegypti mosquito through the virus (ZIKV), belonging to the Flaviviridae family, the same as the viruses of dengue, Chikungunya fever, Nile fever and yellow fever, among others. The first cases in Brazil occurred in the Northeast.

The figure 4 shows the annual distribution of zika virus cases, in São Luís, the introduction of the zika virus with 37 reported cases began in 2015, it is observed that (43%) of the cases occurred in the DS of Bequimão, the neighborhood of São Francisco, reported 12 cases (75%) of the cases. The year 2016 was the period of highest notification of the Zika virus, the DS of Bequimão was where the highest number of cases occurred (771), highest notification in the neighborhood of São Francisco 460 (16%), followed by the DS of Cohab (622). DS Tirirical, despite having the

largest population, reported (487) cases. The DS that recorded the lowest number of cases were Vila Esperança with (136) and DS Itaqui Bacanga with (178) cases, they are the second and third DS with the smallest population. DS Centro, with the smallest population, reported 261 cases of the Zika virus.

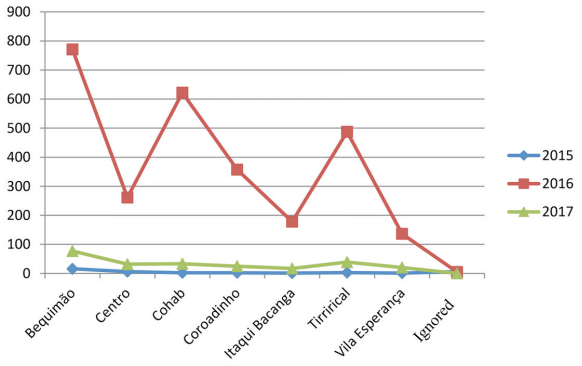

FIGURE 4: Distribution of zika virus by DS in the period 2015-2017

Source: Brazil (2019)

The figure 5 shows the infection of pregnant women, which is one of the main risks of the Zika virus, due to its relationship with microcephaly, a malformation that causes babies' brains to not develop properly and other neurological anomalies. During the period studied (584) pregnant women contracted ZIK V infection, with 2016 being the highest notification (525 cases). In the first trimester of pregnancy (100 cases), the period of neural tube formation. Cestudo Pregnancy Outcomes after ZIKA Infection in French Territories in the Americas states: "an indisputable risk of neurological abnormality when a woman develops the infection during the first trimester of pregnancy", This is the period of greatest risk, leading to 3.7% of cases to severe microcephaly in the baby.

A total of 283 pregnant women were reported in the second trimester of pregnancy and (133) in the third trimester. In 2017, (58 pregnant women) contracted ZIKV infection, (14) in the first trimester, (39) in the second and (5) in the third. In the first year of notification, only one pregnant woman was infected in the first trimester of pregnancy.

In 2015, there was a considerable increase in the prevalence of congenital Zika syndrome. This evidence corroborates the recognition of the relationship between reported cases and the Zika virus. These data on ZIKV vertical transmission are under investigation. The Ministry of Health has developed specific guidelines for assistance to pregnant women and newborns with microcephaly, in addition to constant epidemiological surveillance actions. (CUNHA et al., 2016).

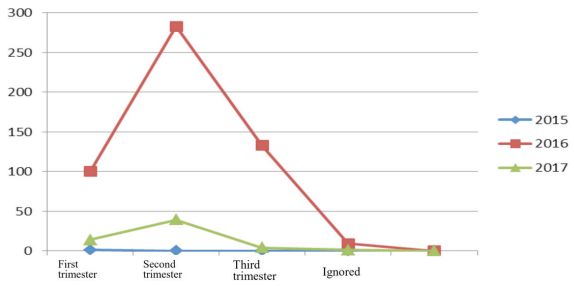

FIGURE 5: Cases of Zika virus in pregnant women, by trimester of pregnancy.

Source: Brazil (2019)

FINAL CONSIDERATIONS

In the present study, the epidemiological survey of the historical series of diseases caused by *Aedes Aegypti* from 2007 to 2017, reveals that the city of São Luís, capital of Maranhão-Brazil presented representative characteristics, and continues to be an endemic area for pathologies: dengue, zika and chikungunya, mainly due to the city's urbanization process, which presents numerous health deficiencies, in addition to climatic influences.

The lack of basic sanitation has resulted in an increase in the number of potential mosquito reservoirs, especially when it comes to the issue of regular collection of solid waste, precarious sewage network, irregular water supply, promoting inadequate storage, which leads to an increase in reproduction. of

the vector. Among the characteristics of the seven SDs studied, the most important factor found in the increase in reports of dengue, zika and chikungunya was population density associated with precarious sanitary conditions for the mosquito outbreaks, enabling their reproduction, we have as an example the DS of Bequimão.

The study proposes the need to subsidize control strategies by health authorities, promoting health education, improving prevention conditions for the population most susceptible to diseases caused by *Aedes aegypti*, enabling the continuity of actions to combat the vector that must be carried out with the conscious action of the population.

THANKS

We would like to thank SEMUS - Municipal Health Department of São Luís, the Municipal Dengue Control Program for their support in carrying out the research and the ``*Universidade Estadual do Maranhão*`` for financial support in the development of the work.

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