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Epidemiological Profile of Dengue in Northeast Brazil Between 2010 and 2019

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Abstract

Dengue is an arbovirus of worldwide relevance. It has a pathology with a broad clinical picture but is potentially fatal. The incidence is higher in countries with poor housing and hygiene conditions, as well as climatic and environmental conditions that contribute to the spread of vector insects. In the same reasoning, the scarcity of preventive measures and educational actions in health helps the permanence of this situation, which perpetuates the occurrence in vulnerable populations. The objective is to carry out an epidemiological study on the influence of sociodemographic and clinical variables on the incidence of dengue cases in the Northeast region of Brazil, between 2010 and 2019. This is an observational study, predominantly descriptive, transversal and quantitative referring to confirmed cases of dengue in Northeastern Brazil, in the time frame from 2010 to 2019. For this, the data collection was carried out in the Information System of Diseases and Notification, SINAN, linked to the Department of Informatics of the Unified System of Health, DATASUS of the Brazilian Ministry of Health. Data referring to sociodemographic variables related to sex, age, race, education and area of residence were tabulated, as well as clinical data on diagnostic confirmation criteria and the final classification of dengue. Graphs and tables were prepared using Microsoft Office 2013. Descriptive analysis was performed using BioEstat version 5.3, using Pearson's chi-square test at a significance level of 5% ($p < 0.05$). In the time frame of the study, 1,821,934 cases of dengue were reported throughout the Brazilian Northeast, and the year 2015 had the highest incidence rate. Most reported cases were about females (57.4%). There was a predominance of individuals aged between 20 and 39 years (38.1%), Pardo ethnicity (47.9%), and residents of urban areas (77.5%). The main confirmation criterion used was the clinical-epidemiological (49.4%) and the final classification as dengue (35.2%). The mean annual incidence was 323.8/100,000 inhabitants. The fight against dengue requires the joint action of government authorities and the population. For this, it is essential to adopt preventive measures to combat the vector and educational actions, which enable the reversal of this public health problem.

Keywords: Epidemiology. Aedes aegypti. Arboviruses. Health Education. Collective health

Introduction

Dengue is one of the most significant arboviruses in the world [1,2]. It is a disease caused by an arbovirus of the Flavivirus genus, linked to the Flaviviridae family, which also includes Zika, Yellow Fever, Japanese Encephalitis and West Nile Virus, transmitted by the vectors Aedes aegypti and Aedes albopictus [2]. The infection presents a broad clinical picture, which includes severe and non-severe symptoms. Usually, the pathology is characterised by weak manifestations. However, it can present two complication phases: dengue hemorrhagic fever (DHF), also known as critical febrile phase, and shock syndrome (DSS) [3-5].

Regarding the epidemiological aspects of dengue, it is known that approximately 2.5 billion individuals are

susceptible to infection with this disease [1]. Data from the World Health Organization indicates that half of the population is prone to infection, given the growing global incidence 4. Much of this number is located in tropical and subtropical regions, where climatic, political and social factors favor the contagion and development of the pathology [1].

In view of this, it is noted that the epidemiological situation of dengue worldwide is alarming and requires studies that provide effective actions to control the spread of A. aegypti, since this dispersion is directly related to the spread, not only from dengue cases, but also from other diseases related to this vector [3]. In Brazilian territory, all states are vulnerable to dengue. In this sense, the number of cases of the disease has increased rapidly in recent years [4]. There are records that highlight the first occurrence of dengue in the country in the colonial period. In 1950, after mosquito control programs, A. aegypti was eradicated, but returned in the 1980s [5].

Dengue has no specific treatment [4]. Thus, the uncontrolled proliferation of the vector influences the increase in cases. It is a mosquito, whose life cycle depends on places with stagnant water, for laying eggs 8. Because of this, housing conditions in the country contribute to the continued proliferation of the vector. All of this is due to the rapid growth and lack of planning in urban areas, where more than 85% of the population lives, to a large extent, with precarious basic sanitation systems and lack of information on health [6-8].

Several institutions describe dengue as a neglected disease, as it not only prevails over populations in poverty conditions, but also perpetuates inequalities [9,10]. Furthermore, studies have shown the strong relationship between the life cycle of vectors, reservoirs, and the hosts with the environmental dynamics of the ecosystems where they exist [9].

From this perspective, the objective is to carry out an epidemiological study on the influence of sociodemographic variables, including sex, age group, race, education and area of residence and clinical variables related to the confirmation criteria and the final classification on the incidence of dengue cases in the Northeast region of Brazil between 2010 and 2019.

Methodology

It concerns an observational study, predominantly descriptive, cross-sectional and quantitative, referring to confirmed cases of dengue in Northeastern Brazil, in the period from 2010 to 2019. With regard to the Northeast region of the country, it appears that this had an estimated population of 57,883,049 inhabitants in 2019, occupying 1,554,000 km² of national territory [11].

In view of this, a survey of confirmed cases of Dengue was carried out, which were collected from the Information System for Diseases and Notification, SINAN, linked to the Department of Informatics of the Unified Health System, DATASUS, and managed by the Ministry of Health. For data evaluation, the investigation of sociodemographic variables related to sex, age group, race, education and area of residence was applied. In addition, clinical data about the diagnostic confirmation criteria and the final classification

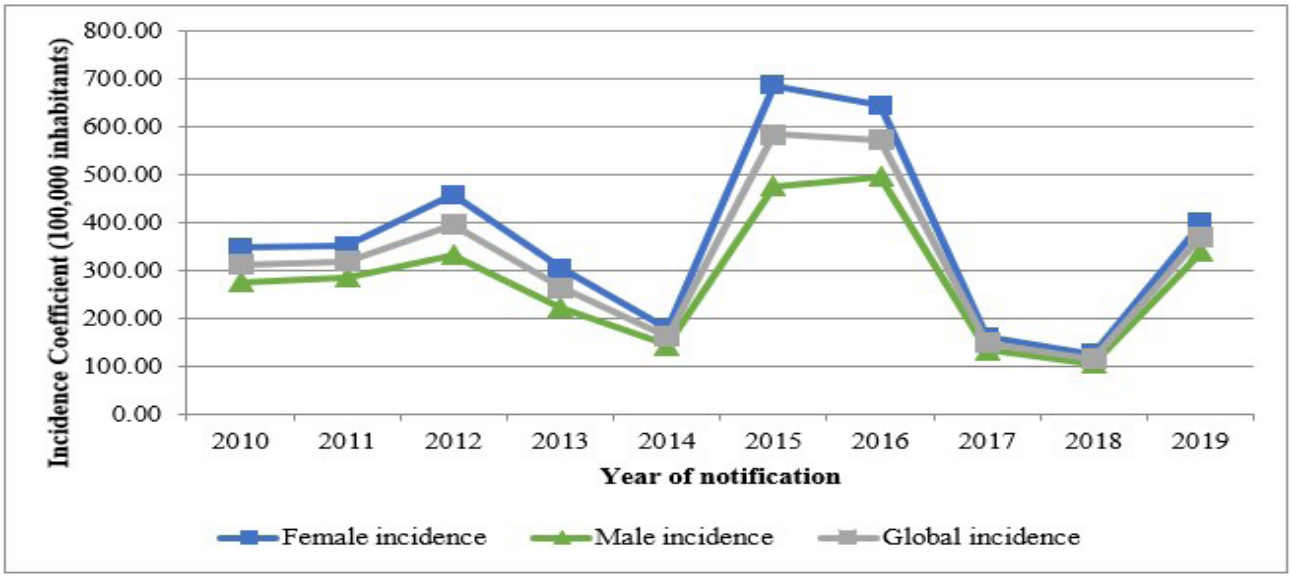

Figure 1: Time series of the dengue incidence coefficient in Northeast Brazil, from 2010 to 2019.

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Table 1: Sociodemographic variables of dengue cases from 2010 to 2019 in Northeastern Brazil.

Variables	N	%	DF	X^2	p*
Sex					
Female	1045422	57,4	2	970146,990	< 0.0001
Male	774819	42,5			
Blank answers	125	0,0			
Ignorad	1568	0,1			
Age Range					
Under 1 year old	40243	2,2	11	2907762,358	< 0.0001
1 to 4 years	77802	4,3			
5 to 9 years	127997	7,0			
10 to 14 years	161950	8,9			
15 to 19 years	190628	10,5			
20 to 39 years	694211	38,1			
40 to 59 years	378600	20,8			
60 to 64 years	50033	2,7			
65 to 69 years	37260	2,0			
70 to 79 years	44013	2,6			
80 years or more	17632	1,0			
Blank answers	1440	0,1			
Race / Color					
Black	59775	3,3	4	2329289,944	< 0.0001
Pardo ethnicity	871857	47,9			
Yellow	11440	0,6			
White	210704	11,6			
Indigenous	4872	0,3			
Ignored	663286	36,4			
Schooling					
Illiterate	18793	1,0	9	355390,081	< 0.0001
1ª to 4ª incomplete series of E.S.	83018	4,6			
4ª complete serie of E.S.	44048	2,4			
5ª to 8ª incomplete series of E.S.	104758	5,7			
Complete elementary school	52102	2,9			
Incomplete high school	66706	3,7			
Complete high school	127609	7,0			
Icomplete university education	16517	0,9			
Complete university education	27072	1,5			
not applicable	182877	10,0			
Ignored	1098434	60,3			
Residence Area					
Urban	1412540	77,5	2	2039182,386	< 0.0001
Rural	244265	13,4			
Periurban	7733	0,4			
Ignored	157396	8,6			

of dengue were also tabulated.

Regarding the average annual incidence coefficient for the Northeast region, data corresponding to this epidemiological indicator were obtained, since it is the dengue indicator designated by the National Council of Health Secretaries, CONASS [12]. Therefore, we used as numerator the average number of new cases in each state and, for the denominator, the estimated average population in the year being studied multiplied by 100,000. It is should be noted that, also in this regard, the annual population under study was based on data from the Brazilian Institute of Geography and Statistics, IBGE [11].

The preparation of graphs and tables was performed using the Excel software Microsoft Office 2013 program.

Table 2: Clinical Variables of dengue cases caused in the period 2010 to 2019 in Northeast Brazil.

Clinical Variables	N	%	DF	X^2	p*
Confirmation Criteria					
Laboratory	315796	17,3	2	886896,052	< 0.0001
Clinical-Epidemiological	899207	49,4			
Under investigation	53293	2,9			
Ignored	553638	30,4			
Final Classification					
Classic dengue	585514	32,2	7	2974768,619	< 0.0001
Dengue with complications	592	0,0			
Hemorrhagic fever	2822	0,2			
Dengue shock syndrome	134	0,0			
Dengue	641356	35,2			
Dengue with warning signs	8177	0,4			
Severe dengue	1188	0,1			
Inconclusive	579969	31,9			
Ignored	2.182	0,1			

From that, there was the tabulation of these data in the BioEstat version 5.3 program. Descriptive analysis was performed with the data obtained and, except in ignored cases, the Pearson's chi-square test was used for this purpose at a significance level of 5% ($p < 0.05$).

It is noteworthy that the study has ethical protection by Resolution No. 510/2016, which exempts the submission to the Research Ethics Committee (CEP) studies carried out based on secondary data referring to information in the public domain and which, therefore, do not entail risks arising from the methodological procedures applied.

Results

During the study period, 1,821,934 cases of dengue were reported across Northeastern Brazil. According to the data obtained, the occurrence of the disease prevailed over females (57.4%). It was found that, in most cases, there was a predominance of involvement by the disease in individuals aged between 20 and 39 years (38.1%), followed by those aged 40 to 59 years (20.8%), with ignored schooling (60.3%), Pardo ethnicity (47.9%), and residents of urban areas (77.5%) (Table 1).

Regarding the clinical characteristics, it is possible to observe that the clinical-epidemiological confirmation criterion stood out (49.4%). Furthermore, regarding the final classification, the pathology was classified as dengue (35.2%) in most cases, followed by the classic dengue (32.2%) and inconclusive (31.9%) categories, respectively (Table 2).

From the analysis of the incidence coefficient, it is possible to visualize a large asymmetry in the levels of cases observed in the time scale referred to in the graph. A decrease in the number of notifications can be seen in 2014, followed by a significant increase in cases, especially in 2015, which stands out as the year in the time scale studied that had the highest incidence coefficient of dengue. In 2016, there is a small reduction, which becomes more evident in the years 2017 and 2018. Finally, it can be seen that in 2019, the incidence of dengue in the Northeast of Brazil increased. The female incidence stands out in relation to the male and global incidence throughout the entire study period (Graph 1).

The value obtained for the mean annual incidence in the time frame used was 323.8/100,000 inhabitants. It is noted, however, that the years 2015 and 2016 were far from the average obtained, as they presented, respectively, an average incidence of 581.6 and 572.9 cases per 100,000 inhabitants, while the years 2014 (161.1/100,000 inhabitants), 2017 (148.2/100,000 inhabitants) and 2018 (115.6/100,000 inhabitants) had the lowest rates (Graph 1).

Discussion

Dengue is currently in Brazil as one of the pathologies of greatest concern regarding public health6. Thus, according to the analyzes carried out and the results obtained, it was possible to observe that the female gender is the most affected. This event was similar to the study by Silva and Machado (2018)1. However, research by Queiroz (2016) indicates that mortality prevails in males [13]. By analyzing several studies, it is possible to observe that the relationships between incidence and mortality in relation

to different locations are controversial. Therefore, it is not possible to conclude that any biological factor has a direct relationship with the contamination and development of dengue [13,14]. Despite this, as measured by Oliveira, Araújo and Cavalcanti (2018), this finding can be justified, not only because it is a pathology whose transmission is predominantly at home, but also because women seek health services and care more than men [15]. Regarding age group, individuals aged 20 to 39 years were the most affected. Thus, these values are related to the study by Silva and Machado (2018) who presented the age group 10 to 49 years as the most affected. Thus, it should be noted, once again, that individual aspects seem to exert little influence on the occurrence of dengue [1].

As for the level of education, according to the data analyzed, those that were ignored predominate. A relevant fact about the aforementioned variables is the occurrence of incomplete information in the surveillance forms. A study by Guimarães and Cunha (2020) highlighted some reasons that justify this lack of data [16]. Regarding the completion of information by sex and age, the authors found that the provision of information was better for females, simultaneously with a reduction with advancing age for both sexes [17]. Therefore, it is noted that the existence of policies for health care for women has contributed to better health care.

Data collection is negatively impacted firstly by older aged patients not understanding how to give the information correctly, or being able to give the information, but then is compounded by healthcare professionals not understanding the importance of collecting such information, or having the necessary training to to recognise the importance of working to gather this information to assist in the fight against the disease [16].

Along with this, it is possible to relate the precarious level of education with the greater involvement of low-income populations, who, in turn, live in unstable and risky environments, with difficult basic sanitation and a great predominance of sources of standing water. This justifies the spread of the vector in these places, since the availability of water, septic tanks and open sewers are essential factors for the formation of breeding sites and for the spread of the transmitting mosquito. 1.3

Likewise, the low level of education is directly linked to the increased incidence of dengue, as it can present a barrier to the ability to understand the risk of this pathology. Thus, morbidity and mortality increase due to deprivation of accessibility to diagnosis and treatment services, in addition to limiting access to information on important factors, such as the etiology and prophylaxis of dengue [14].

Furthermore, like the study by Queiroz (2016), this research demonstrates the highest incidence in Pardo individuals. However, even in the face of these notes, race is not proven as an influencing factor for the onset of dengue, since in other countries and nationalities the incidence in other races prevails [13]. It is noted that this data can be justified by the composition Brazilian population, since according to the National Continuous Household Sample Survey in 2012, 45.3% identify as Pardo, while in 2019, this percentage jumped to 46.8%, of which 62.5% lived in the Northeast of Brazil [18].

The urban area had the highest incidence with 77.5% of reported cases. Some aspects of population dynamics over the years indicate this trend, as described by Rodrigues, Pereira and Lima (2016) there was a high proliferation of vector mosquitoes in cities, mainly due to the intense migratory movement in the country, in such a way that today more than 80% of the population lives in cities [7].

Along with this finding, the association with other relevant variables is identified, since this urban agglomeration, added to the demands that emerged and were not met by government authorities, have resulted in problems that favor the development of dengue outbreaks, for example, the supply irregular water supply concomitant with inadequate basic sanitation and garbage collection, which are aspects that favor the proliferation of the vector and, consequently, of the disease [7]. Thus, life habits, climate change [5], housing conditions, infrastructure, sociocultural relationship and risk factors are conditions for the occurrence of dengue [6,7].

In the time interval adopted by the study, the criterion for confirmation of greater use was the clinical-epidemiological one. As for this variable, because dengue presents with broad symptoms similar to other arboviruses, such as Zika and Chikungunya, which, during this period, presented co-circulation with dengue cases, it is clear that the diagnosis became even more difficult and, therefore, we understand the need for a differential diagnosis for confirmation [15].

The World Health Organization (OMS) has recommended criteria for both classification and confirmation of the disease since the 1970s19. Nevertheless, it is noted that the clinical-epidemiological criterion is widely used in endemic regions, which is a finding similar was done by Macedo (2014), who proposed to investigate such classification in Rio de Janeiro and noted that among the groups studied, one of them had only 38.3% of laboratory confirmation, precisely because it is a region in which many cases did not

meet the criteria required by OMS [19,20].

Furthermore, regarding the final classification, there was a higher percentage related to dengue, followed by classic and inconclusive dengue. These data coincide with the classification established by the OMS in 2009, as dengue, severe dengue and dengue with alarm signs [19]. However, the high percentage given as inconclusive should be noted, which highlights the difficulty of existing confirmation, due in part to factors such as similarity to other pathologies and the type of confirmation criteria used, since without serology and concomitant with other arboviruses, there may be failures in this process.

Such findings indicate a prevalance of issues of under-diagnosis and under-reporting. It is undeniable, therefore, that several factors mentioned confirm such an occurrence, which emphasizes that the rates and data obtained may underestimate the real condition of occurrence of dengue in the Northeast region of the country [21]. For all these reasons, it is necessary to emphasize that the research presented here refers to confirmed cases in the public health system, so the actual number of cases is not included, but only registered ones. Thus, there may be a distortion in relation to the registered cases and the number of real cases [1].

Conclusion

The high incidence of dengue in northeastern Brazil between 2010 and 2019 is evident, as an indication of growth in the coming years. The most affected sex was female and the age group was from 20 to 39 years. However, it is noted that such individual aspects exert little influence on the incidence of dengue in these populations. Most cases occurred in the Pardo populations and in urban areas. The clinical variables pointed to the use of clinical and epidemiological confirmation criteria, which is in line with the designation of the World Health Organization, since dengue is similar to other pathologies, making it important to carry out a differential diagnosis. Finally, it was evidenced that there is still resistance to the correct filling out of surveillance forms, which is another barrier in the fight against dengue.

It is inferred, therefore, that the under-reporting of cases contributes to the under-estimation of the real condition of occurrence of this pathology. It is essential that preventive measures are adopted to combat the vector and to promote health education, especially for neglected populations. This is an easily resolved problem, to which the attention of government authorities should be directed, through public policies aimed at directing resources, training surveillance teams and carrying out information campaigns, combined with the population, whose responsibility must be clarified, so that the fight against this public health problem is intensified and produces positive effects.

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