



Dengue in a Municipality with High Human Development Index. SP, Brazil

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Authors' contributions

This work was carried out in collaboration among all authors. Authors LCML, RTJ and WMF designed the study, wrote the protocol, and wrote the first draft of the manuscript. Author LCML performed the statistical analysis. Authors BLSS, CWM, FSG, JRB and TEB did the data collection and managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Aim: Dengue is an important public health problem in the world, typical of tropical regions and has become an urban disease. The incidence of dengue was studied, as the epidemiological and clinical aspects of the patients in an area of SP State in 2015. Design: It was a cross-sectional study.
Subjects: The digital data file of the Special Health Service of Araraquara-SESA of São Paulo University-USP was used, as also was the population data of The Brazilian Institute of Geography and Statistics-IBGE. The demographic and clinical characteristics of the patients were obtained for the year 2015. The incidence was calculated, and the findings are presented in tables and graphs.

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Results: In 2015, there were 8,296 confirmed cases of dengue, with an incidence of 3,660 per 100,000 inhabitants, 99.5% being autochthonous. The majority were female (53.9%), 11.5% of the cases were of less than 14 years of age and 16.1% were elderly. The majority of the patients were white (54.8%), with 1st or 2nd-grade schooling. Fever, headache, retro-orbital pain, and myalgia were the prevalent signs, which appeared in isolation or in association and Den1 was the circulating serotype. There were 9 deaths, the fatality rate being 108 per 100,000.

Conclusion: The demographic and epidemiological pattern of dengue in the city accompanied those of the rest of the country. Despite having a high Human Development Index and almost universal coverage of basic sanitation, the city faced an epidemic with high incidence in 2015.

Keywords: Dengue; Aedes aegypti; epidemiology; incidence.

1. INTRODUCTION

Dengue is a disease caused by an arbovirus of the *Flavivirus* type, of which four immunological varieties are known: Den1, Den2, Den3, and Den4 [1]. It is transmitted to the human being by means of the bite of the female of the *Aedes aegypti* mosquito and can affect children and adults; its development follows the classical path, with or without alarming signs or complications [2]. A case is considered "suspect" if the patient has fever for up to 7 days and presents certain symptoms such as headache, retro-orbital pain, exanthem, prostration, myalgia or arthralgia [3].

The risk factors for its appearance relate to the existence of social and environmental problems in the community, particularly to deficiencies in basic sanitation, which provide conditions favorable to the proliferation of the vector, as well as a lack of urban planning [4]. Its prevention calls for the preparation of adequate public policies which involve the participation of the community for the purpose of eliminating the proliferation of *Aedes*.

At the present, dengue is an important public health problem in the world, an urban disease typical of tropical regions, whose transmission occurs mainly in the center of the localities concerned. Despite the other exanthemic diseases which became rampant, such as Zika and Chikungunya, also being transmitted by *Aedes*, dengue continues to be the most prevalent and dangerous of the three emerging arboviruses, and about 50% of dengue infection are symptomatic [5].

Cases of dengue are concentrated in the hotter months, those of heavier rainfall, when the conditions for the expansion of the vector are more favorable [6]. Thus the prevention of

epidemics must be undertaken in the previous year, during the colder, dry months, when the incidence of cases is smaller, a basic rule that public authorities have not observed for the last 30 years, which explains in great part the persistence of the disease in the country.

Dengue attacks millions of people in the world every year and the World Health Organization-WHO estimates that 2.5 billion people are at risk of contracting it [7]. In the Americas, 78% of all the notified cases are Brazilian [8]. In Brazil, the area of distribution of the disease is undergoing expansion, having presented an increasing incidence since 1986 [9]; in 2015, this growing incidence was discerned in all the country's geographical regions, the highest incidences being observed in the Mid-western and Southeastern Regions of the country, 122.8 and 73.7 cases, respectively, per 100,000 inhabitants in the period of January and February of that year [10]. In 2015 almost a thousand deaths from dengue were reported in Brazil, concentrated mainly in the Southeastern and Mid-western regions.

In the State of São Paulo the incidence has been increasing; in 1995 there occurred slightly more than 6,000 cases, in 2006, more than 50,000 notifications, in 2014, 204,000 cases and in 2015 there were 1,008,465 notifications [11]. In 2015 in the municipality of Araraquara, SP, more cases of dengue were notified than the historical average, thus accompanying the growing tendency of the disease both in the State and in the country as a whole. Despite the constant improvement in the system of notification of cases of dengue [12], one must still take into account the reality of sub-notification which occurs with regard to all the diseases of compulsory notification and which certainly means that the number of cases is in fact still higher.

It is difficult to know how best to confront the disease because of its global character; however, it is the responsibility of health managers to reverse the picture of the spread of the disease by means of the control of the vector as well as the reduction of its lethality. Besides the actions of epidemiological vigilance and of the mobilization of society, the offer of laboratory services plays a fundamental role, with the undertaking of blood tests and IgM antibody research in patients under clinical suspicion [3], as leukopenia and thrombocytopenia are alterations which are compatible with the disease. Notification (SINAN), created in 1990 by the Ministry of Health, permitting one to work with the data of the selfsame municipality, thus making possible the continuous assessment of conditions of obligatory notification and the revision of public policies, which should be permanently up-dated for the taking of decisions to improve the epidemiological situation of dengue [12].

The municipality of Araraquara, SP, situated in the central region of the State of São Paulo, presented in 2010 a Municipal Human Development Index (IDH-M) of 0.815, among the ten highest in the State. This index takes into consideration criteria related to income, education and health to rank the quality of life of the municipalities of the State of São Paulo. Araraquara presents basic sanitary conditions with high indices of water supply coverage (99.5%), of sewage collection (99.3%) and of garbage collection (99.3%), which are the variables associated with the occurrence of dengue. And, by 2003, the municipality already treated 100% of the sewage collected [13].

The municipality has registered a growing number of cases of dengue, which is what motivated the undertaking of this study for the purpose of discovering the incidence of the disease in the period from 2013 to 2015, with a descriptive analysis of the clinical and epidemiological variables of the cases confirmed in 2015.

2. METHODS

This is an epidemiological study, of cross-sectional type, for which the characteristics of the cases were obtained by means of the information of the digital data base of the Special Health Service of Araraquara (SESA), of the University of São Paulo State (USP), the Juarez System –

the Integrated Information and Management System of Public Health.

The digital system receives information from the file cards of the National System of Notifiable Diseases (SINAN), filled out on the basis of the attendance on a suspected case. The information from the system is updated, complete and trustworthy for the cases notified, and contains additional information. Beyond the demographic information, laboratory exams, signs and symptoms are added to the system. Initially, an inter-examiner reproducibility exam of the data obtained from the Juarez system was undertaken, it having been collected on a second occasion, after an interval of 10 days, by the same examiner, the Kappa (κ) statistic having been used for this purpose; $\kappa=1$ was obtained, demonstrating an excellent level of intra-examiner reproducibility.

On the basis of the data collected, a spreadsheet was created on Excel, in a pre-codified model, specific for the variables obtained for the research. With regard to the signs and symptoms, thanks to the repetition of the same shown by the patients, it was decided to work with a random sample of the cases confirmed in 2015 (415).

The statistical planning included the presentation of the findings in tables and graphs. For the calculation of the incidence of dengue per 100,000 inhabitants, data of the occurrence of the disease and IBGE [14,15,16] population data for the municipality of Araraquara were used.

This project was submitted to the Research Ethics Committee of the Medical School of the University of Araraquara (Universidade de Araraquara - UNIARA) and approved in accordance with Technical Report nº 1.514.709.

3. RESULTS

Araraquara presented 10,850 cases of dengue confirmed as the sum of the cases notified in 2013, 2014 and 2015, resulting from annual incidences of 400, 740 and 3.660 per 100,000 inhabitants, respectively. For some few cases the type of the virus was established; Den1 was, however, the predominant serotype throughout the period, being present, in 2015, in 56 cases, Den2 was just observed in 1 patient. The observation of the growing number of cases in the three-year period becomes more evident when observed in the historical series as from 2004:

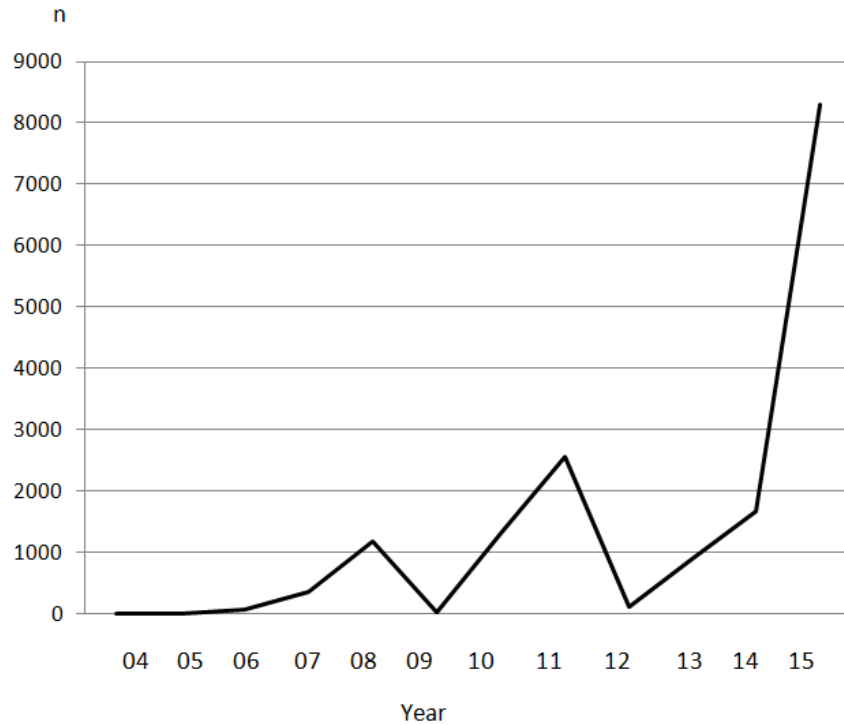


Fig. 1. Number of dengue cases (n) according to year. Araraquara, SP, Brazil, 2004-2015

In the twelve-year period from 2004 to 2015, there were 16,509 confirmed cases, 8,296 of which occurred in the last year of the series, accounting for 50.2% of the total. Of the 8,296 cases registered in 2015, 8,252 were autochthonous, accounting for 99.5%. The demographic characteristics "gender" and "age-group" of the cases of dengue in Araraquara were as follows (Table 1):

The female sex predominated (53.9%), being the tendency observed as from 15 years of age. Approximately 11.5% of the cases were of less than 14 years of age, 16.1% being 60 years of age or more.

As for the characteristics race and schooling, the majority of the patients (54.8%) were white. Regarding schooling, 2,477 (54.5%) had completed 1st or 2nd grade, there being a large number of patients (41.4%) who were unable to give any information on this variable.

The signs and symptoms presented by 415 cases (in accordance with the sample of 5% of the cases) are to be found in Fig. 2.

Fever, headache, retro-ocular pain, myalgia, arthralgia and nauseas were the most prevalent

signs and symptoms presented by dengue patients, whether isolated or in association, the former being present, respectively, in 81.6% and 80.7% of the cases.

Table 1. Distribution of dengue cases according to sex and age. Araraquara-SP, 2015

Age	Sex		Total
	Female	Male	
<1	5	10	15
1 to 4	48	70	118
5 to 9	129	156	285
10 to 14	248	291	539
15 to 49	2,556	2,229	4,785
50 to 59	711	507	1,218
60 and +	773	563	1,336
Total	4,470	3,826	8,296

A fatality rate of 108 per 100,000 cases was observed, there being no knowledge, however, of the serotype of those who died.

4. DISCUSSION

For those cases of dengue notified in 2015 the characterization of the virus was undertaken in just a small number of them, serotype 1

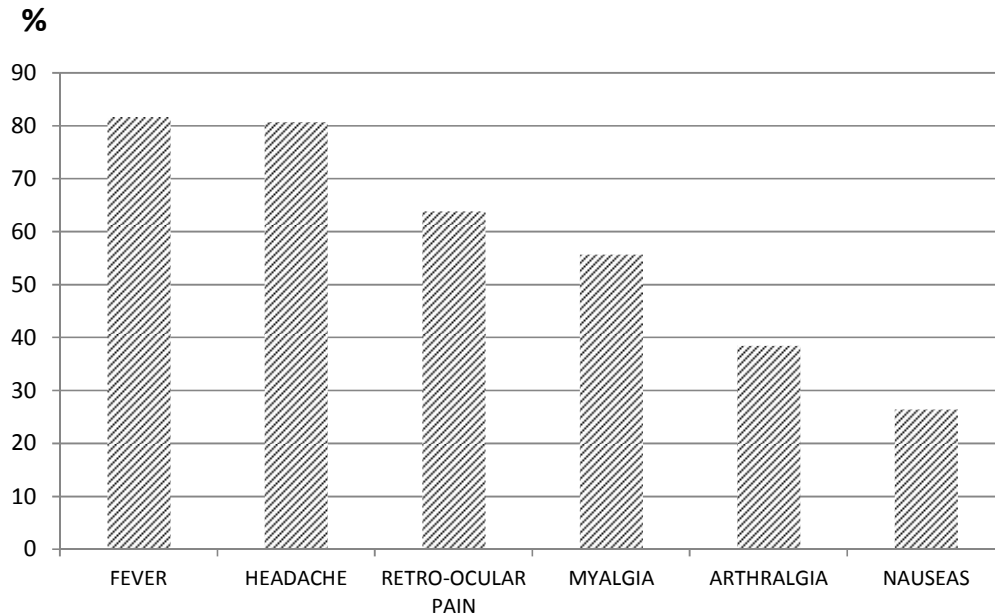


Fig. 2. Symptoms of dengue patients. Araraquara,SP, Brazil, 2015

predominated, in the same pattern generally observed in Brazil, where, for 2015 and 2016, 90% of the cases presented this result. This finding is encouraging, seeing that in some epidemics at the beginning of the XXI century in which serotype 3 predominated, the clinical picture of dengue was more serious; in an epidemic in Rio de Janeiro in 2001/2002 the patients sick with dengue type 3 had a sixfold greater chance of presenting shock and a three times greater one of presenting with abdominal pain [17].

Dengue serotype 1 was introduced into Brazil at the end of the 1980s and the beginning of the 1990s, together with serotype 2. In 2004, types 1, 2 and 3 of the virus were already circulating in 22 States [18], serotype 4 being the last to be reintroduced into the country, in 2014 [19]. Serotypes 1 and 2 are characterized by the low associated occurrence of cases of hemorrhagic dengue fever and other complications; on the other hand, serotype 3, introduced into the country at the beginning of the XXI century, presents higher indices of these complications [20].

In 2014 and 2015 the rates of incidence of dengue in Araraquara were, respectively, 740 and 3,660 per 100,000 inhabitants, values much higher than the national average in 2012, of 301 per 100,000 [21], showing the magnitude of the epidemics which occurred in the municipality. An

incidence of this size leads to negative consequences for the community in various sectors of its social life. The health system is overloaded and the local economy reflects the effects of the problem due to the increase of absenteeism, keeping the individuals affected far from their work-places and overloading both public and private health systems.

The fact that 99.5% of the cases of dengue notified in 2015 were autochthonous shows that the disease vector was benefited by ideal conditions for its reproduction in the municipality, despite the high local IDH-M (0.815 in 2010). On the basis of this result, it may be inferred that there are important failures in the mechanisms used to combat the vector's breeding places, which permit that the disease had developed freely in the municipality. At the present time there are countless innovative strategies for the combat of *Aedes* [21], but the larger part of the municipalities continue to adopt a conservative approach, by the control of the adult forms by means of spraying and the elimination of the breeding places with public campaigns for the collection of garbage and rubble, only after the installation of the cycle of transmission of the disease [22].

The predominance of the female gender (53.9%) among the cases of the 2015 epidemic repeated the pattern found for dengue in other localities in Brazil, such as the State of Goiás, with 55% [19];

indeed, the pattern of Araraquara was similar from that of Ribeirão Preto (1.2:1), a neighboring municipality with similar social and sanitary conditions [23].

Epidemics with a smaller number of cases occurred in 2008 (1,194) and 2011 (2,555), but the real explosive expansion of the disease occurred in 2015 (8,296). The increasing pattern of cases along the historical series permits one to draw the inference that the public policies adopted by the municipality to contain the problem were not efficacious for the control of *Aedes*. The fight against the vectors is the responsibility of the municipal authorities, according to the division of tasks defined by the Unified Health System (SUS), but, in practice, the municipalities have acted as if dealing with an emergency, fighting the disease only during the epidemic outbreaks and relegating to the background the permanent measures indispensable for the effective prevention of the disease. The health education campaigns are few and lacking in content, which helps to explain the slight involvement of the population in the elimination of the breeding places of *Aedes* in dwellings and other private spaces. Collective measures for the elimination of the breeding places, as the public campaigns for the cleaning of residences and the spraying for the elimination of the adult forms, are also not undertaken routinely throughout the year but only when the epidemics are at their peak.

As for the age groups, 57.5% of the total notified in 2015 was of people between 15 and 49 years of age, among whom the complications of the disease which can lead to death are less frequent. It cannot be forgotten however that 16.1% of cases occurred in the group of 60 years of age and above, as well as 5.0% in that from zero to 9 years of age; it is in these groups that the most serious cases of dengue which call for hospitalization occur and are capable of leading to death [19].

Among the signs and symptoms observed in the cases notified in 2015, the most frequent were fever (81.6%), headache (80.7%), retro-orbital pain (63.9%), myalgia (55.7), nausea (26.5%), diarrhea (25.1%), arthralgia (24.1%), and exanthema (19.5%). This list does not include the signs of alarm which occur in serious cases of dengue, such as the persistent vomiting, bleeding and abdominal pain which characterize such cases [19].

In 2015, the mortality among dengue cases was of 108 per 100,000, a value very close to the average for the Southeastern region in that same year, which was of 111 per 100,000 [24]. This suggests that the infra-structure available for the diagnosis and treatment of complicated cases of dengue in the municipality object of this study is no different from the average for the State of São Paulo. The official epidemiological Brazilian bulletin of January 2018 pointed that the incidence of dengue fever remains high in Brazil, and it varies according to the geographical regions [25].

5. CONCLUSIONS

In 2013, 2014 and 2015, the incidences of dengue in the municipality under study increased from 400 to 740 and then to 3,660 per 100,000 inhabitants. Within 12 years as from 2004, 16,509 cases were confirmed, 50.2% of them in 2015, the year of the most intense epidemic in the period.

The majority of the cases in 2015 were autochthonous, white, of between 15 and 59 years of age, with 1st and 2nd-grade schooling. Although the virus was only isolated in a few cases, the circulating serotype which predominated was that of Den1. The fatality rate was 108 per 100,000 cases.

The first vaccine for the prevention of dengue has only recently been approved for use in private clinics in Brazil, but its cost is high and it is of limited effect, which is the reason for its not having been included in the national immunization campaign. Thus we still cannot count on a vaccine for the prevention of dengue for use in public health, and the use of repellent is recommended as prevention against mosquito bites.

Although Araraquara counts on excellent basic sanitary conditions, much above the national level, this did not spare the municipality from suffering a great dengue epidemic in 2015. This fact leads to the reflection that permanent, extensive public policies - whose actions are spread over the whole year and involve the population in the actions of prevention and combat of *Aedes* - are necessary.

CONSENT

It is not applicable.

ETHICAL APPROVAL

As per international standard or university standard, written approval of Ethics committee has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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