TRABALHO DE CONCLUSÃO DE CURSO

UNIVERSIDADE FEDERAL DO ACRE
CENTRO DE CIÊNCIAS DA SAÚDE E DO DESPORTO (CCSD)
CURSO BACHARELADO EM MEDICINA

Título: CARACTERÍSTICAS DA DENGUE NA REGIÃO NORTE DO BRASIL DE 2014 A 2018

Dengue characteristics in the Brazil North Region from 2014 to 2018

Orientadora: Cirley Maria de Oliveira Lobato

Discente: Davi Tadashi Carvalho Kiy

Dengue characteristics in the Brazil North Region from 2014 to 2018

Davi Tadashi Carvalho Kiy; Cirley Maria de Oliveira Lobato

Abstract

Dengue is a neglected tropical disease with a high impact and prevalence in Brazil. Brazil has a wide territory, with cultural, climatic, and demographic differences between its 26 federative states; however, these differences are diminished among the states in each of the five Major Regions. With the aim to determine if the distribution of dengue cases and demographic profiles are similar in states that have similar characteristics, the North Region of Brazil, composed of seven federative states, namely Acre, Amapá, Amazonas, Rondônia, Roraima, Pará, and Tocantins, was studied from January 2014 to December 2018. Methods: We used secondary data on dengue cases retrieved from Sinan (Sistemas de Informação de Agravos de Notificação) and population estimates from the Brazilian Institute of Geography and Statistics (IBGE) to calculate the incidence, prevalence, and demographics for each state in the region. Results: The monthly case distribution was similar for each state. The annual incidence showed a decreasing trend only in Acre, remaining steady in the other states.

Keywords: Dengue; North Brazil; Climate.

Resumo: Dengue é uma doença tropical negligenciada com grande impacto e prevalência no Brasil. Este país tem um grande território, com diferenças culturais, climáticas e demográficas entre seus 26 estados federativos; contudo, essas diferenças diminuem entre os estados das cinco grandes Regiões. Com o objetivo de determinar se a distribuição dos casos de dengue e o oerfil demográficos eram semelhante entre estados com

características semelhantes, o Norte do Brasil, composto por sete estados federativos, a sasber, Acre, Amapá, Amazonas, Rondônia, Roraima, Pará e Tocantins, foi estudado de Janeiro de 2014 a Dezembro de 2018. Métodos: Foi utilizado dados secundários sobre os casos de dengue que foram retorados do Sinan (Sistema de Informação e Agravos de Notificação) e e estimativas populacionais do Instituto de Geografia e Estatística (IBGE) para calcular incidência, prevalência e taxas para dados demográficos para cada estado da região. Resultados; A distribuição mensal foi similar para cada estado. A incidência anual mostrou-se em decréscimo apenas para o estado do Acre, permanecendo constante nos demais estados.

Dengue is a neglected tropical disease caused by an arbovirus with a great impact on public health that infects 390 million people around the world every year[1]. In Brazil, *Aedes aegypti* is the virus carrier nationwide, largely associated with urban sprawl and poor sanitation[2]. Dengue has a broad clinical presentation ranging from asymptomatic to life-threatening severe cases that may require mandatory hospitalization or excused absence from work, resulting in a decrease in the quality of life quality loss and a significant socioeconomic impact.

Previous studies in Brazil about the distribution[3,4,5] of dengue attempted to identify the patterns of disease dissemination from a national perspective. Given the large territory and variation in climate between the regions of this country, an analysis of each region is a new angle to this subject. With the assumption that the North Region of Brazil has a more homogeneous climate, (equatorial), this study aimed to determine if dengue occurs regularly and synchronously every year and month in the states of this region and establish its relationship with demographic data, which could be used to further preventive measures.

This observational descriptive study assessed the distribution of dengue over time and its relationship with the demographic variables sex, age group, and race in the North Region's federative states of Brazil, namely Acre, Amapá, Amazonas, Pará, Rondônia, Roraima, and Tocantins, from January 2014 to December 2018. The information was obtained from the Notifiable Diseases Information System (Sinan), an online governmental platform that has registered the number of confirmed cases of nationally notifiable diseases as well as individual data since 2001. The population data was collected from the Brazilian Institute of Geography and Statistics (IBGE); the latest available data were from 2019.

The dengue case distribution per state over time is presented in Figure 1 and Table 1. The former shows the monthly incidence of dengue cases, while the latter displays the annual incidence. The demographic variables were calculated by dividing the demographic parameter by the number of cases, expressed as percentages (Table 2). The definition of race was based on the IBGE classification: Brown. Black, Yellow, White, and Indigenous. Brown and Black represent Afro-descendants, Yellow represents Asian descendants, White represents Caucasians, and Indigenous represents the native people from the Amazon. The age groups were as follows: below 5 years old, between 5 and 9 years old, 10 to 19 years old, 40 to 59 years old, and above 60 years old.

Figure 1 displays the number of cases in each state for the months of the 5-year period. We observed a pattern wherein the apex for each year occurred between the months of January and May, that is, the first five months of the year.
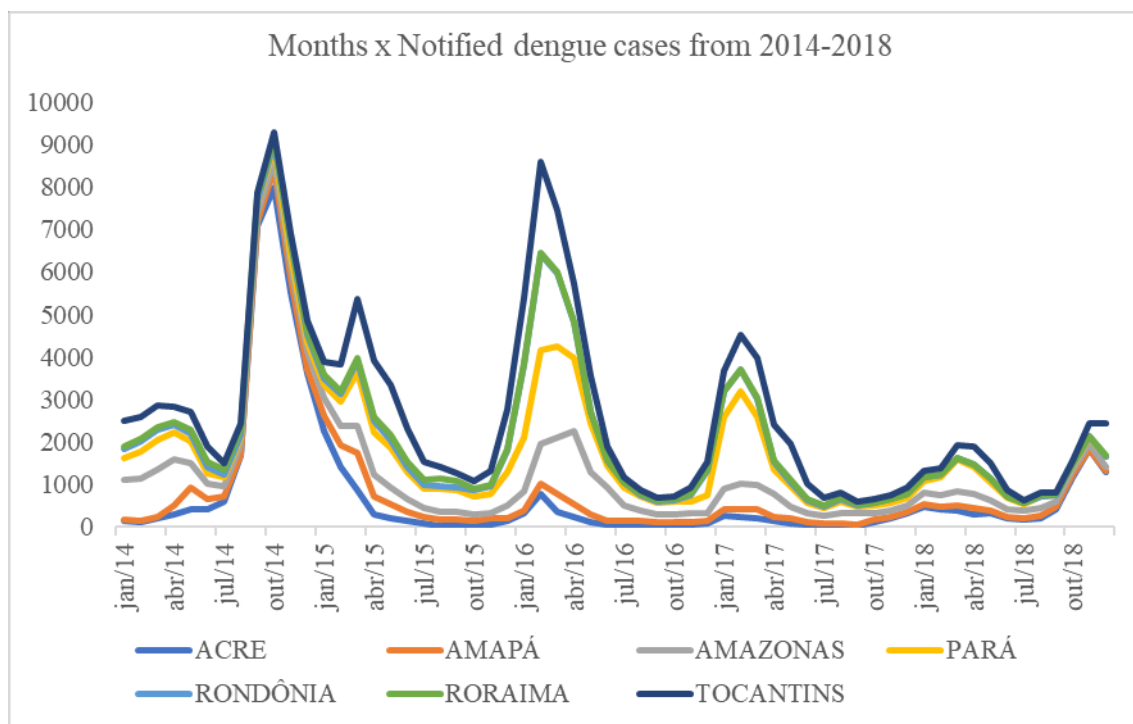
Figure 1 – "Month x Notified Dengue Cases from 2014- 2018"; 14: 2014; 15: 2015; 16: 2016; 17: 2017; 18: 2018; Jan : January; Abr: April; Jul: July; Out: 0ctober;

Incidence	Acre	Amapá	Amazonas	Pará	Rondônia	Roraima	Tocantins	Total
2014	3.730	0	177	0	127	2	3	4.040
2015	744	486	102	100	142	236	565	2.375
2016	289	262	209	139	497	45	562	2.003
2017	245	134	109	100	138	60	350	1.136
2018	957	111	65	48	34	24	202	1.441

Table 1 - Incidence (New cases/total population x 10^5) for each of the seven states of the North Region of Brazil from 2014-2018

Table 1 shows that the overall incidence decreased during the period studied, with the

least growth in 2018. The analysis of each state showed a similar pattern in Acre, in

contrast to most of the northern territory, which showed a constant frequency with

occasional weak-to-moderate hikes, as in Rondônia in 2016.

Table 2- Sociodemographic characteristics of the population of the seven states of the North Region from 2014-2018

Characteristics	Acre	Amapá	Amazonas	Pará	Rondônia	Roraima	Tocantins
Sex (%)							
2014	M(44,3%); F (55,5%)	M(44,7%); F(55%)	M(46,7%); F(53,2%)	M(49%); F(51%)	M(47,8%); F(52%)	M(47%); F(53%)	M(49,5%); F(50,5%)
2015	M(49,3%); F(50,7%)	M(47,7%); F(52,1%)	M(49%); F(51%)	M(44); F(55,7%)	M(45,2%); F (54,7%)	M(46,1%); F(53,6%)	M(48%); F(52%)

2016	M(47,4%); F(52,5%)	M(45,4%); F(54,5%)	M(46%); F(54%)	M(41,2%); F(58,7%)	M(42,6%); F (57,3%)	M(46,7%); F(52,3%)	M(43%); F(57%)
2017	M(46%); F(54%)	M(47,2%); F(52,7%)	M(47%); F(53%)	M(45%); F(55%)	M(46,3%); F(53,7%)	M(51%); F(49%)	M(47%); F(53%)
2018	M(43%); F(57%)	M(44,5%); F(55,5%)	M(49,4%); F(50,5%)	M(43,5%); F(56,4%)	M(47%); F (53%)	M(38,7%); F(61,2%)	M(48%); F(52%)
Age Group (%)							
< 5	7,20%	6%	7,50%	5,50%	7,70%	11,20%	4,50%
5 a 9	5,50%	6%	6,10%	6%	6,20%	8,30%	5,10%
10 a 19	21%	20,20%	18,70%	19,70%	18%	20%	20,50%
20 a 39	39%	38,50%	41%	40,20%	40%	35%	42,10%
40 a 59	18,70%	23%	20,30%	21,40%	26,10%	19,60%	20,60%
≥ 60	7,60%	6,50%	6,30%	7%	8,10%	6%	6,50%
Race (%)							
White	7%	13,40%	4%	12,10%	29,30%	10,60%	15,40%
Black	1,70%	5,20%	0,70%	4,50%	4,00%	2%	5%
Yellow	1,00%	0,50%	0,30%	0,50%	1,00%	0,30%	1,50%
Brown	71,60%	66,60%	73,40%	73,80%	53%	76,40%	74,40%
Indigenous	0,40%	1%	4%	0,20%	0,50%	3,10%	0,30%

F- Female; M - Male

The demographic variables sex, age group, and race rate are displayed in Table 2. Generally, the infection rate was slightly higher among women. Analysis by age group showed that the occurrence of the disease was higher in young adults, whereas the lowest percentages of notified cases of dengue were among children until the age of 9 years and older people above the age of 60 years. Regarding race, Afro-descendants and Caucasians were the most affected, while indigenous people had the lowest notification frequency.

Figure 1 indicates that the highest number of dengue cases occurred in January, February, and March and the lowest in August, September, and October from 2015 to 2018 in the different North Region states. This agrees with previous studies[3,5,6] and can be associated with the peaks that occur in the months with larger amounts of rainfall or after that interval (2 to 4 months later[4,5]), related to increased *A. aegypti* breeding and the subsequent rise in virus transmission. Another study observed higher synchrony in the occurrence of dengue between closer regions, with a directly proportional relation[3]. However, this study

demonstrates that the highest numbers occurred from August to September of 2014, possibly explained by the concurrence of multiple dengue serotypes or the circulation of a specific virus strain with more severe signs and symptoms[6,7,8], increasing seeking of medical assistance, or a new campaign against dengue that raised the diagnosis sensitivity due to population awareness or better-trained health professionals.

A previous study[4] demonstrated that most federative states had a constant incidence of dengue, while the North Region showed a growing trend, and Acre behaved differently to the other states in the region. However, Table 1 shows that the overall incidence was initially high but declined over the period studied and Acre had a mirroring pattern, while the remaining states had a steady frequency with a lower beginning rate. Thus, it is possible to conclude that Acre is mainly responsible for the declining incidence in the North Region and its high beginning number.

The decline may be explained by mosquito birth control that reduced virus transmission or asymptomatic cases or those with milder clinical symptoms that were underreported due to lower seeking for medical assistance or misdiagnosis due to other febrile illnesses[12]. The higher incidences can be attributed to the urbanization of Acre, where most larger cities are located next to the Acre river, with poor sanitation and disorganized infrastructure, variables that are associated with a higher incidence of the disease[2,9,10].

As already discussed in previous studies[4,6,7,8], the age group comprising teenagers and young adults is the most affected by the disease. This group represents the major economically active population[8] that has higher urban mobility and so exposes itself more to the mosquitos' foci. Underreported dengue in children could explain the low number of cases in this category because the infection is usually asymptomatic or mildly symptomatic in this category; besides, the definition criteria are different for children, which makes it difficult to distinguish dengue from other febrile diseases[4].

As found in other studies, the difference in the case frequency between men and women was small[6,7,8], with a higher frequency in the latter. Considering that young people make up the economically active population and both genders participate equally and that dengue virulence does not show a preference related to sex, it is conceivable that men and women have similar exposure and that the small difference is associated with women having a higher tendency to seek medical care[11].

African Americans and White individuals were the groups most affected by the arbovirus, reflecting the population composition of the North Region. As already verified in a previous study, most notified cases of dengue occur in the former group[7,8,13]. On the other hand, indigenous people showed lower notification rates as they live far from the urban areas and dengue is an urban disease[1]; another reason for this could be under-notification due to their having less access to health care.

Along with a homogenous climate, the states of the North Region share demographic and social indicators that reflect its singularity in comparison to the other regions of Brazil. According to IBGE, the urbanization rate of this territory is the lowest in the country; the region places second nationally in the Gini and illiteracy indexes; and the median monthly wage, median years of study, and level of sanitization are in the second lowest in the country, whereas the median number of people per family is the highest. These factors were analyzed previously and associated with increased dengue risk[1,3,12,5,13] and could explain the hypothesis that the North Region would have an increasing incidence pattern.

This study supports a regular pattern of dengue occurrence in light of the virus peak that occurs after the rainy season. However, the overall incidence declined, while most of the states showed a constant frequency during the 5-year period, with exception of Acre. This discrepancy leads to the hypothesis that climate alone is not sufficient to explain the dengue incidence in each state. Therefore, a closer look at each state's conditions instead

of regional studies could lead to a more accurate identification of risk factors, thereby helping to develop more effective preventive measures for the region or states.

The use of secondary data in this study is one of its limitations. Sinan is a platform that is supposed to be accessible in every health care unit and whose information relies on health professionals' ability to identify the disease and training on using the system. These requirements might not be reached by every city and state of the North Region and may therefore lead to a notification bias.

References

1. Bhatt S, Gething PW, Brady OJ, Messina JP, Farlow AW, Moyes CL, et al. The global distribution and burden of dengue. Nature [Internet]. 2013 Apr 25;496(7446):504–7. Available from: https://www.nature.com/articles/nature12060

2. Yin S, Ren C, Shi Y, Hua J, Yuan H-Y, Tian L-W. A Systematic Review on Modeling Methods and Influential Factors for Mapping Dengue-Related Risk in Urban Settings. International Journal of Environmental Research and Public Health. 2022 Nov 18;19(22):15265.

3. Churakov M, Villabona-Arenas CJ, Kraemer MUG, Salje H, Cauchemez S. Spatio-temporal dynamics of dengue in Brazil: Seasonal travelling waves and determinants of regional synchrony. PLOS Neglected Tropical Diseases. 2019 Apr 22;13(4):e0007012.

4. Böhm AW, Costa C dos S, Neves RG, Flores TR, Nunes BP, Böhm AW, et al. Tendência da incidência de dengue no Brasil, 2002-2012. Epidemiologia e Serviços de Saúde. 2016 Oct;25(4):725–33.

5. Viana DV, Ignotti E. The occurrence of dengue and weather changes in Brazil: A systematic review. Revista Brasileira de Epidemiologia [Internet]. 2013 Jun 1;16(2):240–56. Available from: https://www.scielo.br/scielo.php?pid=S1415-790X2013000200240&script=sci_arttext&tlng=en

6. Andrioli DC, Busato MA, Lutinski JA. Características da epidemia de dengue em Pinhalzinho, Santa Catarina, 2015-2016*. Epidemiologia e Serviços de Saúde. 2020 Aug 19;29(4).

7. do Nascimento IDS, Pastor AF, Lopes TRR, Farias PCS, Gonçales JP, do Carmo RF, et al. Retrospective cross-sectional observational study on the epidemiological profile of dengue cases in Pernambuco state,

Brazil, between 2015 and 2017. BMC Public Health. 2020 Jun 12;20(1):923.

8. Cardoso IM, Cabidelle A de SA, Borges P de C e L, Lang CF, Calenti FG, Nogueira L de O, et al. Dengue: clinical forms and risk groups in a high incidence city in the southeastern region of Brazil. Revista da Sociedade Brasileira de Medicina Tropical. 2011 Jul 22;44(4):430–5.

9. Duarte JL, Diaz-Quijano FA, Batista AC, Giatti LL. Climatic variables associated with dengue incidence in a city of the Western Brazilian Amazon region. Revista da Sociedade Brasileira de Medicina Tropical. 2019 Feb 21;52: e20180429..

10. Duarte AF. Climatologia das Chuvas e Efeitos Antrópicos da Urbanização na Bacia do Rio Acre, Amazônia Ocidental. Boletim do Observatório Ambiental Alberto Ribeiro Lamego. 2017 Oct 30;11(1):199.

11. Thompson AE, Anisimowicz Y, Miedema B, Hogg W, Wodchis WP, Aubrey-Bassler K. The influence of gender and other patient characteristics on health care-seeking behaviour: a QUALICOPC study. BMC Family Practice [Internet]. 2016 Mar 31;17(1):38. Available from: https://bmcprimcare.biomedcentral.com/articles/10.1186/s12875-016-0440-0

12. Luna EJA, Figueiredo GM, Levi JE, Campos SRSLC, Felix AC, Souza NS e, et al. A cohort study to assess the incidence of dengue, Brazil, 2014–2018. Acta Tropica. 2020 Jan 9;204:105313.

13. Power GM, Vaughan AM, Qiao L, Sanchez Clemente N, Pescarini JM, Paixão ES, et al. Socioeconomic risk markers of arthropod-borne virus (arbovirus) infections: a systematic literature review and meta-analysis. BMJ Global Health. 2022 Apr 15;7(4):e007735.