

CHARACTERIZATION OF DENGUE CASES BY LOCATION IN RURAL MATO GROSSO STATE BETWEEN 2007 AND 2016

Débora Aparecida da Silva Santos¹, Anne Caroline Farias Ribeiro Freitas², Érica Regina de Melo Panhan², Ricardo Alves de Olinda³, Letícia Silveira Goulart⁴, Valéria Cristina Menezes Berredo¹

ABSTRACT: Objective: to characterize the reported dengue cases according to location, in Rondonópolis, Mato Grosso, between 2007 and 2016. Method: epidemiological, ecological, quantitative study using a descriptive approach. Secondary source data including sociodemographic and clinical variables and location of dengue cases. Descriptive statistics were used and maps of the quantiles of the cases were presented, as well as the distribution by neighborhoods. Results: there were indications that, although notifications were observed over the entire area, the disease mainly proliferated in Centro, Centros A and B and Villa Aurora, considered populous neighborhoods. It was also observed that areas with greater numbers of cases were located near rivers, streams and areas of environmental protection. Conclusion: the geographic picture of dengue should warn researchers and the health management of the municipality about the behavior of the disease, aiming for efficient planning and implementation of prevention and control actions.

DESCRIPTORS: Dengue; Spatial distribution of population; Arbovirus infections; Health promotion; Primary Health Care.

CARACTERIZAÇÃO DOS CASOS DE DENGUE POR LOCALIZAÇÃO NO INTERIOR DE MATO GROSSO ENTRE 2007 E 2016

RESUMO: Objetivo: caracterizar os casos notificados de dengue de acordo com a localização, em Rondonópolis, Mato Grosso, entre 2007 e 2016. Método: estudo epidemiológico do tipo ecológico de abordagem quantitativa e descritiva. Dados de fonte secundária incluindo variáveis sociodemográficas, clínicas e localização dos casos de dengue. Foi utilizada estatística descritiva e apresentados mapas dos quantis dos casos, bem como a distribuição por bairros. Resultados: há indicativos que, embora seja observada notificação por toda extensão territorial, proliferou principalmente no Centro, Centros A e B e Vila Aurora, considerados bairros populosos e povoados. Também se observou que áreas com maior número de casos estão localizadas próximas a rios, córregos e áreas ambientais protegidas. Conclusão: o retrato geográfico da dengue deve alertar pesquisadores e a gestão de saúde do município sobre o comportamento da doença, a fim de um planejamento eficiente e execução de ações de prevenção e controle.

DESCRIPTORES: Dengue; Distribuição espacial da população; Infecções por arbovírus; Promoção da saúde; Atenção Primária a Saúde.

CARACTERIZACIÓN CASOS DE DENGUE POR LOCALIZACIÓN EN INTERIOR DE MATO GROSSO ENTRE 2007 Y 2016

RESUMEN: Objetivo: Caracterizar los casos notificados de dengue según su localización en Rondonópolis, Mato Grosso, entre 2007 y 2016. Método: Estudio epidemiológico del tipo ecológico, con abordaje cualitativo y descriptivo. Datos de fuente secundaria, incluyendo variables sociodemográficas, clínicas y localización de los casos de dengue. Se aplicó estadística descriptiva, se presentaron mapas por porcentual de casos y de distribución por barrios. Resultados: Se presume que, aunque se observen notificaciones en toda la extensión territorial, proliferó principalmente en el Centro, Centros A y B y Vila Aurora, considerados barrios populosos y poblados. También se observó que las áreas con mayor número de casos están localizadas cerca de ríos, arroyos y áreas ambientales protegidas. Conclusión: El esquema geográfico del dengue debe alertar a investigadores y a la gestión sanitaria municipal sobre el comportamiento de la enfermedad, para una planificación eficiente y la ejecución de acciones de prevención y control.

DESCRIPTORES: Dengue; Distribución Espacial de la Población; Infecciones por Arbovirus; Promoción de la Salud; Atención Primaria de Salud.

¹Registered Nurse. PhD in Natural Resources. Professor of Nursing of the Federal University of Mato Grosso. Rondonópolis, MT, Brazil.

²Registered Nurse. Federal University of Mato Grosso. Rondonópolis, MT, Brazil.

³Pharmacist. PhD in Sciences. Professor of Nursing of the Federal University of Mato Grosso. Rondonópolis, MT, Brazil.

⁴Statistician. PhD in Statistics. Professor of the State University of Paraíba Campina Grande, PB, Brazil.

Corresponding author:

Débora Aparecida da Silva Santos
Universidade Federal de Mato Grosso
Av. dos Estudantes, 5055 - 78735-901 - Rondonópolis, MT, Brasil
E-mail: deboraassantos@hotmail.com

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● INTRODUCTION

Arboviruses represent important diseases that affect humans and can have a great economic impact on society. The most prominent arbovirus in public health in Brazil, due to its high pathogenicity and chances of recurrence, is dengue, with increasing presentation in recent years, and consequently an increase in cases of the severe forms of the disease⁽¹⁻²⁾.

Dengue is a viral disease transmitted by the female mosquito through one of four virus serotypes, known as DEN-1, DEN-2, DEN-3 and DEN-4. It is an acute febrile disease caused by an arbovirus and transmitted by the mosquito of the *Aedes* genus and *aegypti* species. The dengue virus belongs to the *Flavivirus* genus of the *Flaviviridae* family of 73 viruses, of which 40 species are associated with the development of diseases in humans. The mosquito feeds on the blood of infected individuals and if they are in the stage of viremia and the virus lodges in the salivary glands of the mosquito, the virus proliferates and the mosquito infects other people with its saliva⁽²⁻³⁾. The *Aedes* genus contains two species: *Aedes aegypti* and *Aedes albopictus*. *A.aegypti* is the main transmitter of dengue and yellow fever in urban areas and *A. albopictus* represents a secondary vector in the transmission of wild dengue⁽²⁾.

It is important to emphasize that the dynamics of the occurrence of arboviruses are closely related to characteristics such as: the ecological, social, climatic and demographic conditions of a certain region, with a high availability of favorable conditions for the development of the vector in the urban environment, and the inherent characteristics of the vector such as the distribution, competence and specificity of the species. Another factor that needs to be considered is the challenges for the epidemiological surveillance sector, which has to intervene biologically, environmentally (inspection and elimination of reservoirs) and with the population itself (information, education), with the resources made available by the government spheres⁽⁴⁻⁵⁾.

The World Health Organization (WHO) proposes a classification with two categories: severe and non-severe dengue. The occurrence of the different serotypes, associated with the significant increase in cases, as well as the intrinsic characteristics of the infected people, are the main factors related to the severe and lethal forms of the disease. It is believed that the disease is increasing annually, making it a serious health problem throughout the country, with there currently being no sustainable control measures capable of halting its rapid dissemination⁽⁶⁾.

In this context, the study of the characterization of the location of the dengue provides information that would not be visualized working only with tabular data, demonstrating the importance of this distribution when analyzing the geographic location of the dengue foci in endemic periods, aiming to intervene in a way to minimize occurrences and in the search for vector eradication through knowledge of its habitat⁽⁷⁾.

There are few studies that have investigated where these cases are reported in the state of Mato Grosso, however, some authors have studied this theme world-wide, in Brazil and even in the Central-West region⁽⁸⁻¹⁰⁾. Rondonópolis, located in the state of Mato Grosso, has an extensive geographic area, with no published study on the actual spatial distribution of dengue. Therefore, this study is justified in order to better understand the behavior of the disease, which is fundamental for the promotion and execution of measures aimed at controlling and supporting the actions prescribed by the vector and epidemic control programs.

In this context, this study aimed to characterize the reported cases of dengue according to the location, in the municipality of Rondonópolis-MT, from 2007 to 2016.

● METHOD

The study site was the municipality of Rondonópolis-MT with data for the period from January 2007 to December 2016. It should be noted that the selection of this historical series was due to the availability of the data found in the official search sites, which provided a considerable period for a robust data analysis. Notification and the public computerization of the data related to this information

only became compulsory from 2001, with this period of the most recent ten years being delimited.

The state of Mato Grosso has 3,305,531 inhabitants, distributed in 141 municipalities, with heterogeneous social, economic, geographical, demographic, environmental, cultural, and epidemiological characteristics. In its last census in the year 2016, in the municipality of Rondonópolis, there was an estimated population of 218,999 inhabitants. The area of the territory is 4,159.118 km² (with 129.200 km² of urban area and 4,029.922 km² of rural area), with a population density of 258/47.00 inhabitants/km², in which the biome is the cerrado, with a humid tropical climate ⁽¹¹⁾.

This municipality is located between the coordinates of 16°25" and 16°30" S and 54°33' and 54°39" W, approximately 1,440 km (in a straight line) west of the Atlantic Ocean coast. The urban area, with altitudes varying from 200 to 300 meters, topographically occupies most of the valley and low hills of the Rio Vermelho (low course). The physical area extends into a convergent site, with flat to slightly undulating topography at the confluence (left bank) of the Arareau and Red Rivers ⁽¹²⁾.

This position at a morphological lower level or depression has important implications for the local climate, the structure of the urban climate and the rhythm of climatic attributes. The surrounding area (distances between 20 and 100 km) consists of a highland amphitheater (plateaus and mountain ranges) the tops of which vary between 700 and 800 meters. The most important are the Serra da Petrovina to the southeast, the Serra do São Vicente to the northwest, the Campo Verde-Primavera do Leste plateau to the north, and the Serra da Onça to the south (12) (Figure 1).



Figure 1 - Geographic location of the study municipality. Rondonópolis, MT, Brazil, 2017

This was an ecological, epidemiological, quantitative study with a descriptive approach. Data were acquired from a secondary source, related to the data series of the compulsory notification system of the SINAN, specifically regarding dengue, for a period corresponding to 10 years. The investigation file created by this System consists of general (municipality, date of notification and Health Unit), individual (identification, sex, race, schooling), residence (address, urban or rural area) and work data for the final classification of the evolution of the case.

These data are part of the free public access database of the Department of Information of the Brazilian National Health System (DATASUS), which integrates the Strategic and Participatory Management Department, according to Decree No. 8.065, of August 07, 2013, which deals with the Regimental Structure of the Ministry of Health.

The variables studied included: gender (male and female), age (less than 1 year, 1 to 14, 15 to 30, 31 to 54, over 55 years), race (yellow, white, indigenous, brown/black) area of residence (peri-urban, rural, urban), level of education (elementary, high school, higher education and illiterate), and clinical variables: month of notification (January to December), classification (classic, complicated dengue,

hemorrhagic fever), autochthonous cases, severe form and death, in addition to the distribution of the cases according to the residential location of the cases reported in the municipality.

Initially, a descriptive study of the dengue cases reported in the city of Rondonópolis was carried out according to the socio-demographic, clinical and neighborhood variables of the reported cases. Data were collected between November 2016 and January 2017, using as the inclusion criteria all cases of dengue and the variables cited in the study objective, excluding cases with incomplete and inconclusive reporting on the notification form that did not allow the diagnosis of dengue. The cases with unfilled variables, considered as empty/ignored fields, remained in the analysis.

Next, the quantum maps of the reported cases of dengue as well as the distribution of the location by neighborhoods in the previous 10 years were developed. In this analysis, the number of dengue cases per month for each location in the municipality during the study period was considered. These data were distributed in the shapefile provided by the Municipality of Rondonópolis, which represents the geospatial data in vector form used by the Geographic Information System (GIS).

This study is part of the main project entitled "Spatial distribution of notifiable diseases in Mato Grosso" submitted to the Research Ethics Committee of the Júlio Muller Hospital, through *Plataforma Brasil*, and approved under authorization No. 1.571.782.

● RESULTS

A total of 16,653 cases of dengue fever were reported in Rondonópolis (MT) from January 2007 to December 2016, with 2010 being the year with the highest number of cases reported, 4,153 (24.94%), and 2008 with the lowest, 252 (1.51%).

The sociodemographic profile of dengue cases in this study was characterized by the predominance of 8,728 (52.41%) female cases, 5,681 (34.11%) in the age group from 31 to 54 years, 5,810 (34.90%) from the white race, 16,018 (96.20%) residents in the urban area and 3,305 (19.85%) with high school level education (Table 1).

Table 1 - Distribution of the prevalence of dengue cases according to sociodemographic variables, from 2007 to 2016. Rondonópolis, MT, Brazil, 2017 (continues)

VARIABLES	PROFILE	N	%
Gender	Male	7923	47.58
	Female	8728	52.41
	*Empty/ignored	2	0.01
Age group	Under 1 year	588	3.52
	From 1 to 14 years	4230	25.40
	From 15 to 30 years	4444	26.69
	From 31 to 54 years	5681	34.11
	Over 55 years	1709	10.27
	*Empty/ignored	1	0.01
Race	Yellow	159	0.95
	White	5810	34.90
	Indigenous	39	0.23
	Brown/black	5437	32.64
	*Empty/ignored	5208	31.28
Area of Residence	Peri-urban	54	0.32
	Rural	327	1.96
	Urban	16018	96.20
	*Empty/ignored	254	1.52

Level of education	Elementary	3049	18.31
	High School	3305	19.85
	Higher Education.	935	5.61
	Illiterate	120	0.72
	*Empty/ignored	9244	55.51

According to the clinical variables, the months of highest notification were January with 3,495 (21.00%), February with 2,806 (16.85%) and March with 2,231 cases (13.40%). Regarding the dengue classification, 7,708 (46.30%) cases of classical dengue prevailed, however, in 8,690 case (52.18%) this information space was left empty/ignored, which stands out due to being the majority of the notification forms. A total of 255 (1.53%) cases of the form of severe dengue were reported, with 16 (0.09%) deaths and 2,520 (15.13%) autochthonous cases, as shown in Table 2.

Table 2 - Distribution of the prevalence of dengue cases according to clinical variables, from 2007 to 2016. Rondonópolis, MT, Brazil, 2017

VARIABLES	PROFILE	N	%
Month reported	January	3495	21.00
	February	2806	16.85
	March	2231	13.40
	April	1592	9.55
	May	1841	11.05
	June	1153	6.92
	July	584	3.50
	August	389	2.33
	September	289	1.73
	October	382	2.30
	November	597	3.60
	December	1294	7.77
Classification	Classic Dengue	7708	46.30
	Serious form	255	1.53
	*Empty/ignored	8690	52.18
Autochthonous cases		2520	15.13
Death		16	0.09

Considering the location, there was a higher occurrence of dengue in Centro with 990 (5.94%) notifications and Vila Aurora with 530 (3.18%), considered to be populous neighborhoods, confirming the relationship between *Aedes aegypti* and urbanized environments. In Figures 2a and 2b, it is possible to observe that the blue areas have a greater number of cases recorded in the period and are located near rivers and streams, as well as protected environmental areas and with vacant land or uninhabited lots, becoming places with vegetation that are prone to the accumulation of garbage thrown there by the residents themselves.

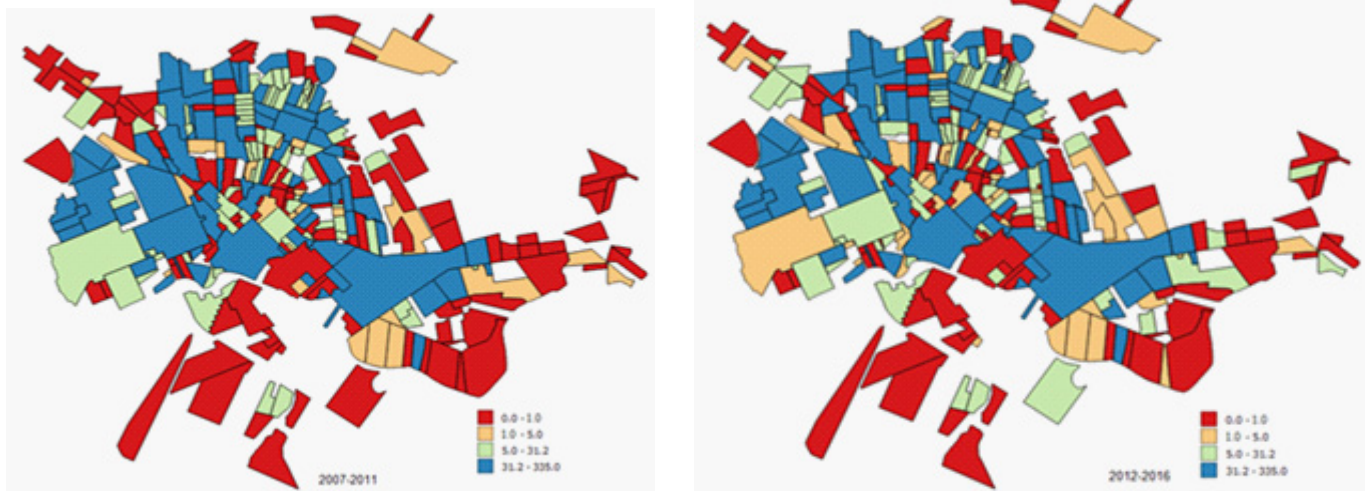


Figure 2-2a - Spatial distribution of dengue for the total number of cases by neighborhood, between 2007 and 2011, according to data retrieved from SINAN. 2b. Spatial distribution of the total number of cases per neighborhood, between 2012 and 2016, from SINAN notifications. Rondonópolis, MT, Brazil, 2017

These cases correspond to 403 (2.42%) in the Conjunto São José neighborhood, 493 (2.96%) in University Park, 342 (2.05%) in Jardim Tropical, 327 (1.96%) in Jardim Iguaçu, 292 (1.75%) in Monte Líbano, 293 (1.76%) in Bairro Santa Cruz, 253 (1.52%) in Vila Operária, 243 (1.46%) in Cidade Alta, 222 in Jardim Carlos Bezerra, 346 (2.07%) in Jardim Liberdade, 217 (1.3%) in Vila Olinda, 210 (1.26%) in Parque Sagrada Família, and 252 (1.51%) in the Serra Dourada neighborhood, among others, as presented in Figure 3. It should be noted that there was no preference for economic class, considering that the neighborhoods of Vila Aurora, Centro and Santa Cruz are those with the highest mean income of the municipality, while the others are classified as peripheral neighborhoods that present a lower income index.

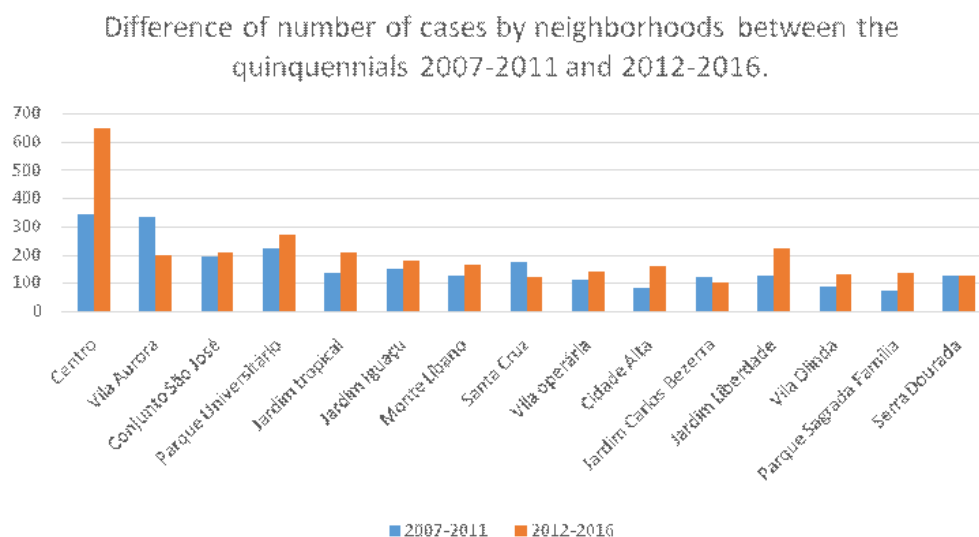


Figure 3 - Comparative distribution of reported dengue cases by neighborhood, between the years 2007 to 2011 and 2012 to 2016, according to SINAN data. Rondonópolis, MT, Brazil, 2017

In Figure 3, it is also possible to observe the increase in the total number of cases comparing the 2007-2011 period to the 2012-2016 quinquennium in some neighborhoods, such as Cidade Alta, with an increase of 75 cases (89.28%) and Jardim Tropical with an increase of 70 cases (51.47%). In other neighborhoods there was a reduction of cases, as in Vila Aurora with 139 fewer cases (41.49%) and Santa Cruz with 53 (30.63%).

● DISCUSSION

In this study, the total number of cases increased by 16.87% during the years 2012 to 2016 when compared to the years 2007 to 2011, with the highest number of cases reported, 4,153 (24.94%), being in 2010. In the years 2000 to 2015, there was a 232.7% increase in the total number of dengue cases in Brazil, throughout the country⁽¹³⁾.

In the Municipality of Santos, São Paulo, a retrospective descriptive study of dengue between 2009 and 2013 reported 18,918 notified cases, of which 9,812 (51.87%) occurred in 2013 and 8,280 (43.77%) in 2010⁽¹⁴⁾. In 2008, 2009 and 2010 there were 3,313 positive cases in the municipality of Colíder-MT, with the lowest index being 175 in 2010 and the highest 2,616 in 2009, which stood out from other years due to an exponential increase, highlighting the temporality in the distribution of cases in that year⁽¹⁵⁾. The characteristics of the environment favor the proliferation of the vector, so there are several factors, including environmental and social aspects, which correlate with the increase in the reproduction and dissemination of the vector and of the disease.

The sociodemographic profile of dengue notifications in Rondonópolis was characterized by the predominance of female cases, the adult age range from 31 to 54 years and the white race. The predominance of the high disease rate among women is related to the greater amount of time spent in the home, the environment preferred by the *Aedes aegypti* mosquito, and the urban characteristic of the vector⁽¹⁶⁾.

Similar results were found between 2007 and 2011 in Cuiabá-MT, with a greater notification of cases in the female sex (53.0%), however, the age range between 5 and 14 years (25.1%) predominated⁽⁸⁾. This disease is not related to sex, therefore divergent results have been found, such as in the study⁽¹⁰⁾ on the clinical-epidemiological profile in Juscimeira-MT from 2009 to 2013, with a predominance of 201 (51.4%) male cases.

Regarding race, white individuals predominated in cases registered in 2010, with 25.7%, however, 61.9% of the case notifications did not report this factor⁽¹⁷⁾. Similarly, in Rondonópolis, a high percentage of unreported ethnicity was found, probably due to the classification of individuals in relation to color being considered a subjective variable, which makes it difficult to adequately complete the notification.

Concerning the education variable, the majority, 9,244 (55.51%), of the notifications were also not completed and the urban residential area predominated, 16,018 (96.20%). Underreporting of infectious diseases, including the level of education variable, is one of the issues that should be discussed by health professionals and managers, considering the importance of the knowledge of this for the correct completion of the data, in order to contribute to intervention measures and control dengue⁽¹⁸⁾.

The dengue vector has become predominantly urban, as recorded in this study, because of its strong relation to man-made objects that serve as breeding sites, not showing a socioeconomic and environmental association. However, outbreaks are usually found in places where there is a lack of public cleanliness, accumulations of solid waste, poor drainage systems, poor sanitation, unplanned displacement of the population, greater quantities of people living in the same household and low levels of education, as well as possible utensils found in houses such as: drums, tanks, tubs, water tanks, plant pots, cisterns and skips, among others⁽¹⁹⁾.

In addition, municipalities with the highest number of dengue cases are those with the highest population concentration, such as Rondonópolis, considering that agglomeration influences the interaction between vector, virus and man⁽⁹⁾. The months of greatest notification were January, February and March, considered the rainy season, which contributes to the increase of longevity of *Aedes aegypti* and the possibility of disease transmission. In Campo Grande, Mato Grosso do Sul,

in 2001, 2002, 2007 and 2010, the incidence of dengue occurred from January to July, however, with a moderate onset in November and December ⁽²⁰⁾.

It is important to highlight that this study revealed cases diagnosed as classic and hemorrhagic dengue, demonstrating the severity of the occurrences and the risk of death from the disease. It should be noted that classic dengue fever first presents with a fever of 39°C to 40°C and is associated with headache, joint and body pain and weakness; in the hemorrhagic type, the appearance of spontaneous or induced hemorrhagic manifestations is observed, due to the decrease of platelets in the blood and loss of plasma into the third space, with the latter type being of greater severity. The risk of the individual presenting hemorrhagic dengue is higher when the second infection is caused by DEN-2. The evolution of classical to hemorrhagic dengue occurs in a small percentage of individuals (0.3% to 4.0%). During epidemic periods, up to 40% of those infected can present an asymptomatic form, only identified by the specific serological assay for dengue virus IgM and IgG antibodies ⁽²¹⁾.

In a study that described the clinical and epidemiological profile of dengue cases in the state of Paraná, there was an alarming increase of 6,000% in cases of death in the 2015/2016 biennium compared to 2011/2012, also observed by the incidence of cases of 22.99/100,000 inhabitants in 2011/2012 to 472.17/100,000 inhabitants in 2015/2016 ⁽²²⁾. In the previous ten years, more than 300 thousand cases of dengue were registered in Goiás, especially in 2011, and in 2013, up to the first half of November, there were 156,620 notifications, which lead to 65 confirmed deaths ⁽²³⁾.

Regarding the location of the notified cases, the address is the only geographical reference in the SINAN database, demonstrating a distribution throughout the territorial area of Rondonópolis, making it possible to identify the neighborhoods with the greatest number of outbreaks of the disease: those of the central, north and west regions of the municipality. Several factors contribute to vector proliferation and virus transmission, among them, population growth associated with unplanned and uncontrolled urbanization, especially in countries with a tropical climate that creates ideal conditions for the proliferation of *Aedes aegypti* ⁽²⁴⁾.

Understanding that the population concentration influences the high incidence of dengue is fundamental to explain the high number of cases, with it being possible to associate it with precarious conditions of sanitation, housing, education and cultural factors. However, it should be noted that the poorer population lives in worse social, environmental and sanitary conditions and has lower access to health in particular, which may contribute to the occurrence of the disease ⁽²⁴⁻²⁵⁾.

Considering that the majority of the registered cases occurred in the central areas (Centro and Vila Aurora), it is important to point out that these neighborhoods do not have Family Health Strategy coverage, the place where actions for the prevention and control of the disease are developed. It is suggested that, in order to control this epidemic, preventive measures should be taken by health professionals, in addition to the hiring of a team trained by managers to develop a service to detect larvae, to combat the disease and raise awareness of the population of the municipality, with its focus and priority in more populous neighborhoods ⁽²⁵⁾. Other characteristics that hamper the fight against dengue in metropolises are the lack of knowledge of the population and the understanding of their social role in this area, as well as the difficulty of access to the residences for the vector control agents, among others issues ⁽²⁴⁾.

A notable fact in Rondonópolis-MT is that some of the populous neighborhoods, with the highest number of cases identified on the map, have poor infrastructure and low socioeconomic levels, such as Vila Olinda, while others have better conditions, such as Centro and Vila Aurora. It should also be emphasized that in the present study the neighborhoods highlighted were close to rivers, streams and areas of environmental protection, according to the analysis of the map of the municipality.

The limitation of this study refers to the fact that some neighborhoods were not included in the shapefile of the Municipality, considering the changes made by managers and neighborhoods notified by professionals and exported to the health information system. In addition, it is necessary to adequately complete the fields available on the forms, to avoid underreporting of the neighborhoods and ensure adequacy of the system, preventing any failures in registering the reported cases. Thus, the intensification of continuous education regarding the reporting of cases for those that work with the data in primary healthcare is suggested.

● CONCLUSION

This study made it possible to identify the outbreaks, showing the geographic picture of dengue, in order to warn researchers and health management of the municipality about the behavior of the disease, as well as proposing and favoring the development of actions aimed at the prevention, control and elimination of cases.

Through the mapping of dengue cases and the knowledge of transmissibility in areas of coverage, efficient access can be provided to the information necessary to carry out surveillance of the cases and to create conditions to evaluate the need for decentralization of the treatment through educational actions for the population and reallocation of human and physical resources. Finally, it is suggested that further studies be performed to include other variables associated with the occurrence of dengue cases.

● REFERENCES

1. Lopes N, Nozawa C, Linhares REC. Características gerais e epidemiologia dos arbovírus emergentes no Brasil. *Rev. Pan-Amazonica Saud*[Internet]. 2014 [acesso em 2018 abr25];5(3). Disponível em: <http://scielo.iec.gov.br/pdf/rpas/v5n3/v5n3a07.pdf>.
2. Secretaria do Estado de Saúde de São Paulo. Diretrizes para a prevenção e controle das arboviroses urbanas no estado de São Paulo. [Internet]. 2017 [acesso em 2018 abr25]. Disponível em: http://www.saude.sp.gov.br/resources/cve-centro-de-vigilancia-epidemiologica/publicacoes/diretrizes2017_arboviroses_esp.pdf.
3. World Health Organization (WHO). Dengue vaccine. WHO position paper. Geneva: WHO; 2016.
4. Terra MR, Silva RS, Pereira MGN, Lima AF. Aedes aegypti e as arboviroses emergentes no Brasil. *Rev. Uninga*[Internet]. 2017 [acesso em 2018 abr25];30(3). Disponível em: <http://revista.uninga.br/index.php/uningareviews/article/view/2028>.
5. Picinato MAC, Grisolio APR, Caselani K, Nunes JOR, Carvalho AAB, Ferraud AS. Dengue: uma visão sobre o vetor urbano Aedes aegypti e a difícil interface do seu controle. *vet. em Foco*. [Internet]. 2015 [acesso em 2018 abr25];13(1) Disponível em: <http://www.periodicos.ulbra.br/index.php/veterinaria/article/view/2132/1982>.
6. Viana DV, Ignotti E. A ocorrência da dengue e variações meteorológicas no Brasil: revisão sistemática. *Rev. bras. epidemiol.* [Internet]. 2013 [acesso em 2017 fev24];16(2). Disponível em: <http://dx.doi.org/10.1590/S1415-790X2013000200002>.
7. Bessa Junior FN, Nunes RFF, de Souza MA, de Medeiros AC, Marinho MJM, Pereira WO. Spatial distribution of dengue disease in municipality of Mossoró, Rio Grande do Norte, using the Geographic Information System. *Rev. bras. epidemiol.*[Internet]. 2013 [acesso em 2015 dez 15];16(3). Disponível em: <http://dx.doi.org/10.1590/S1415-790X2013000300005>.
8. Guollo DSO, Silva RC, Peluzio JM, Carmo Filho JR. Aspectos epidemiológicos da dengue em Cuiabá-MT entre 2007 e 2011. *Estudos* [Internet]. 2015 [acesso em 2017 mar 23];42(4) Disponível em: <http://seer.pucgoias.edu.br/index.php/estudos/article/viewFile/4368/2503>.
9. Fernandes RS, Neves SMAS, Neves RJ. Risco da dengue nos municípios pantaneiros de Mato Grosso, Brasil. *Bol Goiano Geogr*[Internet]. 2014 [acesso em 2017 jan22];34(1). Disponível em: <https://doi.org/10.5216/bgg.v34i1.29317>.
10. Assunção ML, Aguiar AMM. Perfil clínico-epidemiológico da dengue no município de Juscimeira – MT. *Rev Epidemiol Control Infect.* [Internet]. 2014 [acesso em 2017 nov 06];4(4). Disponível em: <http://dx.doi.org/10.17058/reci.v4i4.5605>.
11. Instituto Brasileiro de Geografia e Estatística (IBGE). Estimativa de População 2014. [Internet]. 2014 [acesso em 2017 fev06]. Disponível em: <http://cidades.ibge.gov.br/xtras/perfil.php?codmun=510760>.
12. Prefeitura do município de Rondonópolis. Atualização do plano diretor municipal, leitura técnica

socioterritorial. Plano diretor e revisão da legislação urbanística. Rondonópolis: Prefeitura do município de Rondonópolis; 2017. 281 p. Relatório técnico.

13. Araújo VEM, Bezerra JMT, Amâncio FF, Passos VMA, Carneiro M. Increase in the burden of dengue in Brazil and federated units, 2000 and 2015: analysis of the Global Burden of Disease Study 2015. *Rev. bras. epidemiol.* [Internet]. 2017 [acesso em 2017 jun04];1(20). Disponível em: <http://dx.doi.org/10.1590/1980-5497201700050017>.

14. Cruz CA, Paula EMN, Nogueira CSL, Meirelles-Bartoli RB, Carvalho AAB. Dengue em São Paulo/SP: um estudo retrospectivo dos casos entre 2009 e 2013. *ARS Veterinária* [Internet]. 2015 [acesso em 2017 jan12];31(2). Disponível em: <http://dx.doi.org/10.15361/2175-0106.2015v31n2p37>.

15. Cavalheiro MA. Análise da prevalência de dengue no Município de Colíder-MT nos anos de 2008 a 2010. *FACIDER Rev.Cient.* [Internet]. 2015 [acesso em 2017 mar 23];(7). Disponível em: <http://sei-cesucol.edu.br/revista/index.php/facider/article/view/121>.

16. Gibson G, Souza-Santos R, Brasil P, Pacheco AG, Cruz OG, Honório NA, et. al. From primary care to hospitalization: clinical warning signs of severe dengue fever in children and adolescents during an outbreak in Rio de Janeiro, Brazil. *CadSaude Publica* [Internet]. 2013 [acesso em 2017 maio 06];29(1). Disponível em: <https://www.arca.fiocruz.br/handle/icict/10528>.

17. Assis VC, Amaral MPH, Mendonça AE. Análise da qualidade das notificações de dengue informadas no sistema de informação de agravos de notificação, na epidemia de 2010, em uma cidade polo da zona da mata do estado de Minas Gerais. *Rev APS* [Internet]. 2014 [acesso em 2018 abr25];17(4). Disponível em: <https://aps.ufjf.emnuvens.com.br/aps/article/view/2103>.

18. Silva GA, Oliveira CMG. O registro das doenças de notificação compulsória: a participação dos profissionais da saúde e da comunidade. *RevEpidemiolControllnfect.* [Internet]. 2014 [acesso em 2016 ago23];(4):215-20. Disponível em: <http://dx.doi.org/10.17058/reci.v4i3.4578>.

19. Araujo MR, Desmoulière SJM, Levino A. Padrão espacial da distribuição da incidência de dengue e sua relação com a variável renda na Cidade de Manaus, Estado do Amazonas, Brasil. *Rev Pan-Amaz Saude* [Internet]. 2014 [acesso em 2017 jan21];5(2) Disponível em: <http://scielo.iec.gov.br/pdf/rpas/v5n2/v5n2a02.pdf>.

20. Pacheco ICS, Carvalho AMA, Ponte ERJC, Silva MG. Relação entre condições climáticas e incidência de dengue no Município de Campo Grande, MS. *Multitemas.* [Internet]. 2017 [acesso em 2016 jun15];22(51). Disponível em: <http://dx.doi.org/10.20435/multi.v22i51.1123>.

21. Dalbem AG, Herling JD, Vieira RG, Souza AI. Dengue clássica e febre hemorrágica da dengue: etiologia, fisiologia, epidemiologia e fatores de risco. *RevCiênEstudAcadMed* [Internet]. 2014 [acesso em 2017 jul10];(1). Disponível em: http://www.unemat.br/revistas/revistamedicina/media/files/dengue_classica.pdf.

22. Brigadão GS, Corrêa NAB. Levantamento epidemiológico da dengue no estado do Paraná Brasil nos anos de 2011 a 2015. *Arq. ciências saúde UNIPAR* [Internet]. 2017 [acesso em 2017 jul10];21(1). Disponível em: <https://doi.org/10.25110/arqsaude.v21i1.2017.6075>.

23. Cançado MSM, Oliveira ESF, Teixeira RAG. Educação em saúde para prevenção e controle da dengue: percepção de representantes de um comitê de mobilização contra dengue de uma região do centro-oeste do Brasil. *Invest Qual Educ* [Internet]. 2014 [acesso em 2017 jun10];2(1). Disponível em: <http://proceedings.ciaiq.org/index.php/CIAIQ/article/viewFile/523/518>.

24. Johansen CI, Carmo RL, Alves LC. Desigualdade social intraurbana: implicações sobre a epidemia de dengue em Campinas, SP, em 2014. *Cad. Metrop.* [Internet]. 2016 [acesso em 2018 abr25];18(36). Disponível em: <http://dx.doi.org/10.1590/2236-9996.2016-3606>.

25. Paula FR, Delmondes PH, Roewer SP, Nascimento MVM, Scherer EF. Prevalência dos casos de dengue no Município de Barra do Garças – MT, no período de dezembro de 2008 à dezembro de 2012. *Interdisciplinar: Interdiscip. Rev. Eletrônica UNIVAR* [Internet]. 2014 [acesso em 2017 mar 28];1(11). Disponível em: https://updoc.site/download/prevalencia-dos-casos-de-dengue-no-municipio-de-barra-do_garças.pdf.