CHAPTER 118

Climatic and sociodemographic factors stand out in the cities of Ceará with the highest incidence of arboviruses transmitted by Aedes aegypti

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Ana Carolina Rocha de Melo Leite
ORCID: https://orcid.org/0000-0002-9007-7970
Universidade da Integração Internacional da Lusofonia Afro-Brasileira, Brasil
E-mail: acarolmelo@unilab.edu.br

Angelica Maiara Freires Rabelo
ORCID: https://orcid.org/0000-0002-6044-6106
Faculdade de Farmácia, Centro Universitário Unifametro, Fortaleza, Ceará, Brasil
E-mail: angelicarabelo0@gmail.com

Maria Wanessa Freires Rabelo
ORCID: https://orcid.org/0000-0002-5259-4475
Faculdade de Farmácia, Centro Universitário Unifametro, Fortaleza, Ceará, Brasil
E-mail: angelica.rabelo@aluno.unifametro.edu.br

Breno Holanda Alves
ORCID: https://orcid.org/0000-0002-4354-2550
Faculdade de Farmácia, Centro Universitário Unifametro, Fortaleza, Ceará, Brasil
E-mail: brenohadbv@gmail.com

Leonardo Gomes Oliveira
ORCID: https://orcid.org/0000-0001-5512-0358
Faculdade de Farmácia, Centro Universitário Unifametro, Fortaleza, Ceará, Brasil
E-mail: leonardogoliveira3@gmail.com

Laryssa Maia Pitombeira
ORCID: https://orcid.org/0000-0003-4364-0115
Faculdade de Farmácia, Centro Universitário Unifametro, Fortaleza, Ceará, Brasil
E-mail: laryssa_maia@hotmail.com

Marcos Victor Pinheiro Reis
ORCID: https://orcid.org/0000-0003-0679-7930
Faculdade de Farmácia, Centro Universitário Unifametro, Fortaleza, Ceará, Brasil
E-mail: Mvictoreis@gmail.com

Lucimary Leite de Pinho
ORCID: https://orcid.org/0000-0001-6673-4507
Faculdade de Farmácia, Centro Universitário Unifametro, Fortaleza, Ceará, Brasil
E-mail: lucimary.pinho@aluno.unifametro.edu.br

Larissa Cavalcante
ORCID: https://orcid.org/0000-0001-6673-4507
Faculdade de Farmácia, Centro Universitário Unifametro, Fortaleza, Ceará, Brasil

Rodolfo de Melo Nunes
ORCID: https://orcid.org/0000-0003-1428-4502
Department of Internal Medicine, Federal University of Ceará, Fortaleza, Ceará, Brazil.
E-mail: rodolfo_k6@yahoo.com.br

ABSTRACT
According to the literature, environmental, demographic and socioeconomic factors have contributed to the maintenance of high rates of dengue cases in Ceará. In addition, the introduction of viruses such as Chikungunya and Zika in 2014 worsened the endemic scenario. Thus, in view of the favourable conditions for endemics and the permanent need for new studies to understand the dynamic role of arbovirus infections in Ceará, the objective of this study was to evaluate factors related to the highest incidence of arboviroses in Ceará cities in 2021.This is a study based on data released by the Health Secretariat of the Government of the State of Ceará (SESA). Among the 184 municipalities of Ceará, the ten cities with higher and lower incidence of arboviroses transmitted by Aedes aegypti in 2021 were selected, generating two groups and, therefore, the variables population density, rainfall, temperature, human development index (HDI), education, income, infant mortality, health facility, number of doctors, availability of drinking water, sanitation and household waste collection were analyzed. The data collected were analysed in the PRIZMA programme. The results revealed that the ten municipalities with the highest incidence of cases of arbovirosis present significantly higher population concentration, average and minimum temperatures, HDI, income, infant mortality, number of health establishments, number of physicians, sanitation rate, and solid waste collection when compared with the ten municipalities with the lowest incidence. However, there was no difference between the groups when maximum temperature and rainfall were evaluated. Therefore, we suggest that agencies and secretariats related to dengue control, as well as the community intensify their actions not only during the rainy season, but also act throughout the year, since other factors contribute to the increase in cases of arbovirosis in the cities of Ceará.

Keywords: Dengue; Arboviruses; Aedes aegypti; Ceará.

1 INTRODUCTION

At arboviruses, taken as a problem in health public worldwide emerging (Vilibic-Cavlek et al., 2021), represent infections viral propagated for the sting in arthropods hematophagous, especially O Aedes aegypti and Aedes albopictus (Porto et al., 2019). In addition to encephalitis and West Nile viruses, among the arboviruses of medically important, dengue virus (DENV), Chikungunya (CHIKV) and Zika (ZIKV) virus (Vilibic-Cavlek et al., 2021). Those, in addition of virus gives fever Yellow, present, as vector primary, O ae. aegypti (Olson et al., 2021).

According to the literature, about half of the world population lives in urban arbovirus risk areas. transmitted by Ae. Aegypti (Olson et al., 2021). In particular, DENV is present in 123 countries, with around 3.9 billion in individuals in risk in infection and attacking about 390 millions in subjects (world Health Organization – WHO, 2022). For O CHIKV, O number in cases gives illness registered annually at the world It is in lathe in 3 The 5 million (Sharif et al., 2021).

At the Brazil, you records show The occurrence, us last years old, in fur any less nine arbovirus promoters in infection, mainly those of the Flaviviridae family (DENV and ZIKV) and Togaviridae (Porto et al., 2019). For CHIKV, the first confirmed cases in the country occurred in 2014 (Porto et al., 2019). In 2021, the incidence rates in Brazil of dengue, Chikungunya and Zika were respectively 250.7, 44.9 and 2.9 cases per 100,000 inhabitants. In particular, in that year, in the Ceará, Those numbers corresponded The 389.6, 14.2 and 4.2 cases per 100 thousand population, respectively (System in Information in grievances in Notification - SINAN, 2022).

You challenges and at problematic at the confrontation of arboviruses transmitted fur ae. aegypti second Brazil (2009) permeate the organization of dengue prevention and control actions, the classification of risks in health services, the promotion gives assistance proper to patient, O Enhancement gives surveillance epidemiological, ensuring notification, investigation of cases and monitoring of viral serotypes, always in a timely manner, standardization of supplies necessary strategies, the definition of strategies to reduce the force of transmission of the disease, through the control of the vector and its breeding grounds, support for the training of health professionals and managers, the systematization of mobilization and communication, improvement of the analysis of the epidemiological situation and organization of the care network for guide decision-making, strengthening the articulation of different areas and services, aiming at the integrality of actions for confrontation gives dengue. Per The end, O reinforcement at actions in articulation intersectoral in all at spheres in management.

In historical terms, in Ceará, the first description of arboviruses, as well as their transmitting agent, occurred in 1851, the year in which there was an epidemic of yellow fever transmitted by the mosquito Ae. aegypti (Cavalcanti et al., 2018). After the control of this epidemic, in August 1986, the state again registered new cases of arboviruses (Monteiro et al., 2019).

In this period, were notified countless cases in dengue, you which if propagated From centers urban for at peripheries and zones rural, affecting almost all you counties Ceará At the same time, in 2015, were found two new arbovirus, CHIKV and ZIKV (Cavalcanti et al., 2018). Currently, in the epidemic scenario of Ceará, there are four serotypes of virus gives dengue, called in DENV-1, DENV-2, DENV-3 and DENV-4, in addition of CHIKV and ZIKV.

With regard to risk factors for arboviruses, the literature mentions demographic, environmental and meteorological conditions, as well as socioeconomic conditions and urbanization (Oloson et al., 2021). Among the environmental factors, high rainfall, high average and maximum temperature, high relative humidity and tropical and subtropical climates are cited. (Silva et al., 2020). As for the socioeconomic and demographic aspects, they include the reduced per capita income and schooling rate, high population density, disorderly population growth and difficult access to water drinking, sanitation basic, service in health and home (Alves; Araújo; Silva, 2021).

In Ceará, environmental, socioeconomic and sociodemographic factors are responsible for the persistence of the state as an epidemic region for arboviruses (Brazilian Institute of Geography and Statistics – IBGE, 2020, Institute of Research and Strategy economic of Ceará – IPECE, 2021). In fact, you studies demonstrate one Association in between Those factors and you cases of dengue or estado (Morais; Farias, 2021; Sousa et al., 2017; Carabali et al., 2021; MacCormack-Gelles et al., 2018; do Carmo et al., 2020, Braga etc etc., 2019).

However, works investigating Chikungunya or Zika, as well as arboviruses in general, are limited, since notification of these diseases started in the state in 2015 (Braga et al., 2019; Cavalcanti et al., 2019; Silva et al., 2020).

Given the importance that arboviruses assume on the world stage and the need for recent studies that portray their risk factors in the state of Ceará, especially the climatic and sociodemographic ones, this research aimed to investigate The influence of those factors us counties ceará with larger or smaller incidence of those illnesses at the year in 2021.

2 METHODOLOGY

2.1 DRAWING OF STUDY, PLACE AND POPULATION

It is a study epidemiological observational analytical driven in state of Ceará, O third most population of the Northeast Region of Brazil, consisting of 184 municipalities, spread over an area of 148,894,442 km2 (IPACE, 2021; IBGE, 2020). In terms demographics, in 2021, The I estimated in your population and density consisted in 9,240,580 population and 62.06 inhab./km2, respectively (IPACE, 2021).

Your diversity landscape if characterizes mainly per areas country people marked for the semi-arid justifying the predominance of a hot tropical semi-arid climate, in addition to mountainous regions, with better climatic conditions, and coastal, characterized per temperatures most moderate and bigger fees

rainfall (IPACE, 2020).

In the economic context, according to Lustoza et al. (2019), the mesoregions of Northwest Cearense, Jaguaribe and Norte Cearense stood out in 2015 for their agricultural activity, while the Metropolitan Mesoregion of Fortaleza stood out. stood out for the development of the sector in trade and construction.

2.1 PERIOD OF STUDY AND CRITERIA IN INCLUSION AND EXCLUSION

Of the 184 municipalities, ten municipalities with the highest incidence of arboviruses in 2021 were included in the study, equal to among those with the lowest incidence, according to the epidemiological bulletin of arboviruses (Table 1). therefore, incidence data, number of confirmed cases, number of reported cases and confirmation rate, respectively dengue, Chikungunya and Zika/control vector, second O County in residence, Ceará, 2021 (Table two).

Table 1. Data in incidence in arboviruses, second O County in residence, Ceará, 2021.

City	Larger Incidence*	City	Smaller Incidence*
Quixeré	6826.5	Grace	6.9
itaiçaba	5736.6	Aurora	4.1
iracema	5651.5	copy	3.7
russes	3904.4	towering	0
straw	3824.8	carius	0
Tianguá	2615	Congressperson Irapuan Pine	0
Lovely Cross	2508.5	Ipaumirim	0
aratuba	2422.6	Young east	0
jaguar	2287.5	soap dish	0

*Incidence in Arboviruses: cases notified in dengue, Chikungunya and Zika, Divided for the population of the municipality, per 100,000 population.

Source: Secretary in Health of Government of state Ceará (SESA)

Table two. Data in incidence in dengue, Chikungunya and Zika/control vector, second O County in residence, Ceará, 2021.

	Larger Incidence* **(N=10)**	Smaller Incidence* **(N=10)**	**P**
Incidence in arboviruses	3803 ± 537.3	1,470 ± 0.7923	P<0.0001
Number in cases Notified			
Dengue	952.6 ± 284.0	0.3000 ± 0.1528	0.0018
Chikungunya	56.20 ± 27.84	0.1000 ± 0.1000	0.0296
Zika	35.00 ± 20.14	0.1000 ± 0.1000	0.0501
Pregnancy	0.8000 ± 0.3266	0.1000 ± 0.1000	0.0276
Number of cases Confirmed			
Dengue	487.7 ± 192.2	0.1000 ± 0.1000	0.0103
Chikungunya	7,400 ± 4,650	0.1000 ± 0.1000	0.0670

Zika (Pregnant women)	-	-	-
Rate in Confirmation (%)			
Dengue	47.60 ± 5,083	10.00 ± 10.00	0.0018
Chikungunya	07.13 ± 4,053	10.00 ± 10.00	0.3898
Zika (pregnant women)	-	-	-

*Incidence in Arboviruses: cases notified in dengue, Chikungunya and Zika, Divided for the population of County, per 100,000 population; (-) Absence in Dice.

Source: Secretary in Health of Government of state Ceará (SESA)

2.3 COLLECT IN DICE

Data collection was carried out from information on the incidence of arboviruses in the municipalities of the state of Ceará, published at the report card epidemiological in arboviruses (dengue, Chikungunya and Zika) gives Secretary in Health of Government of State of Ceará (SESA), in the period of january to december 2021.

You Dice referents The density demographic and Index in Development Human (HDI) were extracted of census from the IBGE 2010. As for the information on temperature and rainfall, these came from the Climatempo website, available in the website https://www.climatempo.com.br/ .analysis From Dice

The data collected were on the website: https://www.saude.ce.gov.br/download/boletins/ , tabulated and organized in the Microsoft office excel 2019 and analyzed at the program GraphPad Prism, version 6. You Dice were espresso as frequency absolute, mean and standard error of the mean. For comparison between groups, Analysis of Variance (ANOVA) was applied. then by the test in Tukey. admitted $P<0.05$.

2.5 ASPECTS ETHICAL

The project was not evaluated by the Ethics Committee in Research with Human Beings, as it is a research, whose data are freely accessible and without patient identification, according to the Resolution of the National Health Council in 466/2012 (Brazil, 2012). Nonetheless, all you precepts ethical were followed.

3 RESULTS

As observed in Table 3, the population density of the ten municipalities in Ceará with the highest incidence of cases in arboviruses he was significantly higher of what The From ten counties in smaller incidence (45.05 ± 8,110 vs. 27.14 ± 4,490 inhab/km2, p= 0.0393).

Table 3. Data sociodemographic second The larger or smaller incidence in arboviruses, Ceará, 2021.

	Counties		
	Larger Incidence (N=10)	**Smaller Incidence (N=10)**	**P**
Density (inhab/km²)	45.05 ± 8,110	27.14 ± 4,490	0.0393
HDI	0.6374 ± 0.006348	0.5940 ± 0.004650	P<0.0001
Rate in schooling	98.01 ± 0.2442	97.48 ± 0.3479	0.1142
IDEB – Years initials	6,470 ± 0.1106	6,380 ± 0.3684	0.4088
IDEB – Years finals	5,530 ± 0.1248	5,370 ± 0.3052	0.3167
GDP per capita [2019]	12,560 ± 1207	8,200 ± 233.7	0.0012
Wage medium monthly	1,720 ± 0.06799	1,560 ± 0.06182	0.0494
percentage with income in up until 1/2 wage	50.82 ± 1,314	55.81 ± 0.7910	0.0022

*Incidence of Arboviruses per 100,000 inhabitants; demographic density (inhabitant/km²); development index Human; GDP per capita [2019]; wage medium monthly From workers formal [2019]; percentage gives population with Yield nominal monthly per capita in up until 1/2 wage Minimum [2010]; rate in schooling in 6 The 14 years old in age [2010]; IDEB – Years initials and finals of teaching fundamental (Network public) [2019]

Source: Own author

With regard to the HDI, the data showed a significantly higher value among the ten municipalities Ceará with the highest incidence of arbovirus cases and the ten with the lowest incidence (0.6374 ± 0.006348 vs 0.5940 ± 0.004650, p<0.0001).

As for education, there was no significant difference between the value recorded among the ten municipalities in Ceará with highest incidence of arbovirus cases and the ten with the lowest incidence in relation to the schooling rate from 6 to 14 years of age. age (98.01 ± 0.2442 vs 97.48 ± 0.3479, p=0.1142), as well as IDEB scores for the initial years (6.470 ± 0.1106 vs. 6,380 ± 0.3684, p=0.4088) and finals (5,530 ± 0.1248 vs. 5,370 ± 0.3052, p=0.3167) of teaching fundamental gives Network public.

However, for the economy, the ten municipalities with the highest incidence of arbovirus cases had GDP per capita and salary monthly average of formal workers significantly higher When compared at ten municipalities with lower incidence, respectively (12,560 ± 1207 vs 8,200 ± 233.7, p=0.0012) and (1,720 ± 0.06799 vs 1,560 ± 0.06182, p=0.0494). In addition, the percentage of the population with a nominal monthly per capita income of up to 1/2 salary minimum was significantly lower when compared to the ten municipalities with the lowest incidence (50.82 ± 1,314 vs 55.81 ± 0.7910, p=0.0022).

In health, Table 4, the ten municipalities with the highest incidence of arbovirus cases presented numbers of SUS health establishments and doctors per 1,000 inhabitants significantly higher when compared to the ten municipalities with the lowest incidence, respectively (21.80 ± 5,599 vs 10.90 ± 1,841, p=0.0404) and (1,003 ± 0.1130 vs 0.7633 ± 0.05749, p=0.0383). Still, The rate in mortality childish he was significantly high When compared to the tem counties in smaller incidence (14.95 ± 2,650 vs. 8,986 ± 1,834, p=0.0491).

Table 4 . indicators in health second The larger or smaller incidence in arboviruses, Ceará, 2021.

	Counties		
	Larger Incidence (N=10)	**Smaller Incidence (N=10)**	**P**
Mortality Children [2019]	14.95 ± 2,650	8,986 ± 1,834	0.0491
Health Establishments SUS [2009]	21.80 ± 5,599	10.90 ± 1,841	0.0404
doctors per 1,000 hab. - 2018	1,003 ± 0.1130	0.7633 ± 0.05749	0.0383

Source: Own author

As for the maximum temperature, Table 5, there was no significant difference between the value recorded between the ten counties ceará with larger incidence in cases in arboviruses and you ten in smaller incidence (31.83 ± 0.4886ºC vs. 31.90 ± 0.3339°C, p=0.4593). However, for the average temperature, the ten municipalities with the highest incidence of arboviruses showed a significantly higher value when compared to the ten municipalities with the lowest incidence (27.92 ± 0.2204°C vs 27.06 ± 0.3018°C, p=0.0186). The same was observed between the minimum temperature of the ten municipalities with the highest incidence and you ten counties in smaller incidence (23.78 ± 0.2392ºC vs. 22.22 ± 0.2719ºC, p=0.0004).

Table 5 . indicators climatic and hydrosanitary according The larger or smaller incidence in arboviruses, Ceará, 2021.

	Counties		
	Larger Incidence (N=10)	**Smaller Incidence (N=10)**	**p**
Minimum	23.78 ± 0.2392	22.22 ± 0.2719	0.0004
Temperature oC Media	27.92 ± 0.2204	27.06 ± 0.3018	0.0186
Maximum	31.83 ± 0.4886	31.90 ± 0.3339	0.4593
Precipitation Yearly (mm)	782.7 ± 55.25	841.6 ± 24.95	0.1816
Consumption medium (l/inhab./day)	144.8 ± 7,038	136.6 ± 5,586	0.1901
Attendance total in Water %	41.83 ± 5,535	34.10 ± 3,358	0.1307
Attendance total in sewage %	25.84 ± 10.84	6,340 ± 1,707	0.0301
Rate in RDO	84.33 ± 5,681	58.30 ± 3,579	0.0014
Pasta collected (kg/inhabitant/day)	0.8260 ± 0.1149	1,313 ± 0.2222	0.0256

*Incidence in arboviruses per 100,000 population; waste household (RDO), pasta collected total (kg/inhabitant/day). Source: Author himself

For rainfall, the average per capita water consumption and total water service, the ten municipalities in Ceará with the highest incidence of arbovirus cases showed values similar to those obtained by the ten municipalities of lower incidence, respectively, for rainfall (782.7 ± 55.25 vs 841.6 ± 24.95, p=0.1816, the average consumption per water capita (144.8 ± 7,038 vs 136.6 ± 5,586, p=0.1901) and total water service (41.83 ± 5,535 vs 34.10 ± 3,358, p=0.1307). Nonetheless, with relationship to the waste, you ten counties

with larger incidence in cases in arboviruses presented total sewage service in % and coverage rate of household waste collection (RDO) significantly higher when compared to the ten municipalities with the lowest incidence, respectively (25.84 ± 10.84 vs 6,340 ± 1,707, p=0.0301) and (84.33 ± 5,681 vs. 58.30 ± 3,579, p=0.0014). At the however, The pasta collected total (kg/inhabitant/day) he was significantly bottom When compared to the ten counties in smaller incidence (0.8260 ± 0.1149 vs. 1,313 ± 0.2222, p=0.0256).

4 DISCUSSION

Population density is an essential parameter when studying arbovirus epidemics, as high rates of incidence gives illness generally are observed in regions most populous.

In these places, the breeding, proliferation and transmission of these infections are more frequent due to the disorderly growth of urban centers, informal settlements and slums, places where living conditions housing, health, education and sanitation are precarious. As a result, the development of breeding grounds for the mosquito and O larger Contagion, one turn what you individuals are more next From foci in streaming (Cato, 2011, Chahad- Ehlers et al., 2013, kind et al., 2013, Rodrigues et al., 2016, barcellos et al., 2014).

In this research, the lower population density was associated to a lower incidence of arboviruses among evaluated municipalities. This finding can be easily understood based on the above. although not here analyzed, according to do Carmo et al. (2020), densely populated municipalities have an incidence rate of arboviruses almost 2 times bigger of what those ones with any less population.

The human and municipal development index takes into account three factors: life expectancy, income and literacy index. In Brazil, these variables are taken into account when calculating the HDI and IDHM, and they are generally related to a higher incidence of dengue cases. According to some studies, low purchasing power and low index in literacy found in many different regions Brazilian are predictive gives incidence in dengue (OK et al., 2015; Baia, 2014; de Castro et al., 2018, Rodrigues et al., 2016; Arantes, 2017; Ferreira, 2017; Pinto et al., 2016). In this way, the factor socioeconomic he can to be determinant for The Epidemic in arboviruses. Nonetheless, some studies has revealed positive correlations between the HDI and the number of dengue cases, between the incidence rates of chikungunya fever and the MHDI, as well as positive correlations between the incidence rate of Zika and MHDI (Costa et al., 2018, de Castro et al., 2018). Therefore, there are records in the literature of a high incidence of arboviruses both in areas with low MHDI and in those regions. in IDHM high.

Our results revealed a high IDHM in the municipalities with the highest incidence of arboviruses, thus corroborating with other studies that showed a greater number of arbovirus cases in cities with higher IDHM. One possible justification for the data shown above is that the high IDHM reflects the urbanization process, the economic development, improved infrastructure and greater access to health services and doctors, as well as contributing to the higher notification rate of arbovirus cases. On the other hand, the high IDHM also favors the multiplication From foci in development, reproduction and streaming gives

Epidemic inside and outside in House, one turn what at areas with IDHM high present reduction gives vegetation native, increase gives density populational and, per The end, increase of use and the waste of drinking water and rain, contributing to the multiplication of outbreaks. Therefore, cities with IDHM high, in some cases, they can increase The rate in notification From cases The proportion what create conditions favorable for multiplication of them.

Temperature is one of the climatic variables investigated when studying the incidence of arboviruses (Massad et al. al., 2011; Mutheneni et al. 2017; Vezzani, Velásquez & Schweigmann, 2004), because as the temperature increases, the mosquito Aedes aegypti and O virus present periods most short in development (Tseng et The., 2016; nakhapakorn et al., 2005; ha et al., 2011; tong et al., 2016; Choi et al., 2016; hi et al., 2012; Bhatt et al., 2013; Teurlai et al., 2015). In addition from that, temperature increase of approximately 3°C, higher temperatures (28°C and 32°C) and small daily fluctuations in temperature also they can increase The reproduction of mosquito and The replication of virus and per therefore increase at fees in streaming of arboviruses (Teurlai et al., 2015; Araujo et al. al., 2015; tong et al., 2016).

The climate of Ceará is tropical hot semi-arid with average temperatures varying according to each region of the state, being what at the Coast, The average It is in 27°C; in the saws The average It is in 22°C; at the Sertão The average It is in 29°C, or be, O state it presents temperature heterogeneity. According to Honório et al. (2009), the average monthly temperature above 22-24°C is related to the abundance of Ae. aegypti and consequently a higher risk of disease transmission. Corroborating with the Dice previously presented per honorary et al. (2009), at City of River in January, in between 1986 The 2003, he was observed what one of the risk factors associated with dengue epidemics was the average minimum temperature above 22°C (Câmara et al., 2009). Also in wake up with Favier et al. (2006), in a study accomplished at the District Federal, the number medium in pupae per container increased in proportion as the average temperature increased above 22°C. Therefore, the temperature regions equal to or below 22ºC would not favor the development of the mosquito or the virus, which would reduce the streaming of arboviruses. Against from that, we suppose what The temperature minimum in 20ºC, so as The temperature average Yearly smaller found us counties ceará with smaller incidence in arboviruses be factors responsible for the decrease of number in cases in these cities, for how much no there was difference in between at temperatures maxims.

Results similar about The larger incidence in arboviruses in regions in temperature most high were reported in a study that investigated the relationship between climatic variables and the incidence of dengue in Brazil, for the years 2008 to 2011 in all Brazilian municipalities that had at least one case of dengue (Monteiro et al. 2020). According In this study, the higher temperature had a positive influence on dengue cases, that is, the hotter the more cases of dengue. dengue. On the other hand, the minimum temperature variable has a negative, albeit weak, effect on the number of cases of dengue. Also Monteiro et al. 2009, to analyze you cases gives dengue at City in Teresina, capital of Piauí, in between you years old from 2002 to 2006, observed that the incidence of dengue was higher in periods with higher temperatures. Nonetheless,

It is worth mentioning that it is not always possible to demonstrate this link between high temperatures and an increase in the incidence of cases of arboviruses at region North East. Per example, in cities gives Paraíba, also located at region North East of Brazil, The analysis of dengue cases in three cities revealed that the temperature, regardless of average, maximum or minimum, does not present association with dengue cases. The authors suggested that one of the possible factors for the absence of a relationship between the variables was the low thermal amplitude found throughout the state, in this way, the mosquito and the virus find temperatures most uniforms for you their developments to far away of year independent gives region (Almeida &Silva, 2017), Likewise, in the study by Morais & Farias, 2021, carried out with 184 cities in Ceará, it was also not possible to to demonstrate relationship in between The incidence in dengue and The rain in between you years old in 2013 and 2018

As this limitation is known when using the 184 cities, two mathematical tricks were made here in this study, first the analysis using only the twenty cities with the highest and lowest incidence of arbovirus cases, as well as the temperature was divided into maximum, average and minimum, so it is possible that these devices have facilitated the study of variables and The demonstration of difference in between they.

THE unavailability in access The Water treated and piped It is a factor that increases The incidence in arboviruses, one turn that its accumulation in containers, such as buckets, pots, basins and water tanks, without proper care, favors reproduction, mosquito development and disease transmission. Thus, it was possible that cities with a high incidence of arboviruses presented low average per capita water consumption and percentage of total water service when compared with cities with a lower incidence of arboviruses. However, it was not possible to observe a statistically significant difference significant difference between the groups in relation to these two variables: average per capita water consumption and percentage of attendance total in Water.

Similar to treated and piped water, rainwater is also a risk factor for arboviruses, however, it is not the lack of access to rainwater, but rather its storage in tires, pots, bottles, scraps, abandoned swimming pools, construction debris and garbage during the rainy season. Therefore, cities with high annual rainfall present bigger scratchs in incidence in arboviruses as he was demonstrated in studies performed in counties and States

Northeast and North regions, which pointed to a relationship between the intensity of rainy conditions and the incidence of arboviruses (in Castro et al., 2018; saints et al., 2019; Silva et al., 2016; of Birth et al., 2020). Nonetheless, The resemblance of the average per capita water consumption and the percentage of total water service, it was not possible to observe a difference statistically significant in between you groups with relation to precipitation average Yearly.

Particularly, it can be assumed that the similarity between the values referring to precipitation between the municipalities of larger and smaller incidence he can be related to fact in what, although you counties ceará possess one block rainy most intense us months in February, March, April and May, at information here collected involved all you months of year, or be, you results obtained express average

Yearly. In addition from that, O volume in observed rains at the Ceará in 2021 he was reduced up until us months in larger intensity. AND per last, you counties ceará in 2021 no presented one homogeneity in rainfall data, which may have interfered by increasing the standard deviation and reducing the difference between the means. Per On the other hand, according to Morais & Farias (2021), the demonstration of this relationship between the incidence of dengue and rainfall in Ceará was possible due to the fact that the study was carried out between 2013 and 2018, that is, portraying a longer period of time, in addition of what in that period at rains were in some years old most intense of what in 2021, intensifying at differences in between at averages in precipitation. Also Valley point out what at the study in morals & Farias, 2021 only were evaluated you cases in dengue. On the other hand, our study addressed the incidence of arboviruses in general as well as individual, including dengue, zika and Chikungunya.

As It is known, O trash generated inside From households, so as that one produced per City, When no collected and properly disposed of within a solid waste management plan, they can become positive deposits for Aedes. According to Rodrigues (2020), Ceará is the northeastern state with the highest per capita production of solid waste per day - 1.06 kg. In addition, of the 2.4 million tons of garbage produced in the year, about 1.3 million (55.2%) is irregularly discarded. This means that, although the ten cities with a high incidence of arboviruses have a high coverage rate of household waste, reaching an average of 84.33%, well above the average of 58.30% presented by the other ten cities, they are far from reaching the ideal collection, which would be 1.06 kg per day, while, they have only 0.82 kg per day. On the other hand, the ten cities with the lowest incidence of arboviruses, even with low coverage rate, they still have an average per capita collection of 1.3 kg, well above 1.06 kg per day produced in average by the Ceará

5 CONSIDERATIONS FINALS

You results revealed as at arboviruses they are widespread in the cities Ceará, visa what From 184 counties only 7 had no cases of the epidemic. In addition, they showed that cities with the highest incidence of arboviruses are those with better socioeconomic and health indicators, as well as average and minimum temperatures most high, at the however, with relationship to the indicators in education, so as temperature maximum, no were found differences between groups. Therefore, we suggest that national, state and municipal public policies, as well as the agencies and departments linked to dengue control intensify their actions not only during the rainy season in Ceará, but act also during all O year, visa what others factors as IDHM, density demographic, income, infant mortality, number of health facilities, number of doctors, sanitation and waste collection rate solids may be linked to the increase in arbovirus cases in Ceará's cities. In addition, new studies are necessary in order to identify the strengths and weaknesses of each region, as well as contribute to the forecast of endemic diseases, since even with an increase in reported cases and a reduction in the number of positive locations for the Epidemic, some evidence still point for a potential epidemic growing of arboviruses in regions tropical, influenced in Good part by conditions weather, demographics and socioeconomic favorable found at region North East.

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