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PLANETARY HEALTH, CERRADO, AND SUBSTRUCTURE: DESCRIPTIVE STUDY ON ARBOVIRUS PROLIFERATION AND GEOGRAPHICAL DISTRIBUTION IN GOIÁS

Saúde planetária, cerrado e subestrutura: estudo descritivo sobre proliferação de arboviroses e distribuição geográfica em Goiás

Salud planetaria, cerrado e subestructura: estudio descriptivo sobre la proliferación de arbovirus y distribución geográfica en Goiás

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RESUMO

OBJETIVO: apresentar uma análise da distribuição de casos de dengue, zika vírus e chikungunya nos municípios de Goiás, buscando identificar padrões de distribuição geográfica e possíveis correlações com variáveis socioambientais, como população, distância da capital e infraestrutura de saneamento básico. **Método:** estudo de natureza transversal e descritiva, conduzido por meio de dados coletados através do Tabnet de 2017 a 2022. **Resultados:** fatores como o clima, o bioma Cerrado, a alta mobilidade e a falta de infraestrutura, como rede de esgoto, favorecem a proliferação do mosquito Aedes aegypti e a disseminação de arboviroses em Goiás, especialmente em áreas densamente povoadas, como Goiânia e Aparecida de Goiânia. **Conclusão:** a promoção da educação em Saúde Planetária nos serviços de Atenção Primária à Saúde (APS) é essencial para mitigar esses problemas, pois capacita a população a entender as relações entre meio ambiente, saúde e sociedade, ressaltando que a desarmonia gera doenças, como as arboviroses.

DESCRITORES: Dengue; Zika virus; Vírus Chikungunya; Atenção primaria a saúde; Saúde planetária.

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ABSTRACT

OBJECTIVE: present an analysis of the distribution of dengue, Zika virus, and chikungunya cases in the municipalities of Goiás, aiming to identify patterns of geographic distribution and possible correlations with socio-environmental variables, such as population, distance from the capital, and basic sanitation infrastructure. **Method:** a cross-sectional and descriptive study based on data collected through Tabnet from 2017 to 2022. **Results:** factors such as climate, the Cerrado biome, high mobility, and lack of infrastructure, such as sewage systems, contribute to the proliferation of the Aedes aegypti mosquito and the spread of arboviruses in Goiás, especially in densely populated areas like Goiânia and Aparecida de Goiânia. **Conclusion:** promoting Planetary Health education in Primary Health Care (PHC) services is essential to address these issues, as it empowers the population to understand the relationships between the environment, health, and society, emphasizing that disharmony leads to diseases like arboviruses.

DESCRIPTORS: Dengue; Zika virus; Chikungunya virus; Primary health care; Planetary health.

RESUMEN

OBJETIVO: presentar un análisis de la distribución de casos de dengue, virus del Zika y chikungunya en los municipios de Goiás, con el objetivo de identificar patrones de distribución geográfica y posibles correlaciones con variables socioambientales, como población, distancia a la capital e infraestructura de saneamiento básico. **Método:** estudio transversal y descriptivo basado en datos recopilados a través de Tabnet de 2017 a 2022. **Resultados:** factores como el clima, el bioma Cerrado, la alta movilidad y la falta de infraestructura, como redes de alcantarillado, favorecen la proliferación del mosquito Aedes aegypti y la propagación de arbovirus en Goiás, especialmente en áreas densamente pobladas, como Goiânia y Aparecida de Goiânia. **Conclusión:** la promoción de la educación en Salud Planetaria en los servicios de Atención Primaria de Salud (APS) es esencial para mitigar estos problemas, ya que capacita a la población para comprender las relaciones entre el medio ambiente, la salud y la sociedad, enfatizando que la desarmonía genera enfermedades, como los arbovirus.

DESCRIPTORES: Dengue; Zika virus; Chikungunya virus; Atención primaria de salud; Salud planetaria.

INTRODUCTION

The 2023 Lancet Countdown report on Latin America points out that climate change is contributing to an increase in the frequency and intensity of forest fires, as well as creating more favorable conditions for the proliferation of disease-transmitting mosquitoes, such as arboviruses.[1]

These changes in ecosystems have significantly increased the potential for dengue transmission by the Aedes aegypti mosquito by 54%, when comparing the periods 1951-1960 with 2013-2022. This increase is in line with the recent outbreaks and rise in dengue cases observed throughout Latin America in recent months.[1]

Arboviruses transmitted by the Aedes aegypti mosquito represent one of the main public health problems in the state of Goiás. Between 2019 and 2023, almost 1 million cases and more than 400 deaths were recorded in the state. Since 2017, dengue serotypes 1 and 2 have been circulating, with serotype 2 predominating until 2020, accounting for 99% of cases, and the DENV-1 serotype being responsible for 92.2% of cases in 2023. The Zika epidemic in 2016 resulted in more than 11,000 notifications and 8,028 confirmed cases, including 74 children with Zika Virus Congenital Syndrome by the end of 2023.[2]

In addition, since 2015, cases of chikungunya have been recorded in the state of Goiás, but in the three-year period 2020-2023, there was a significant increase, with an initial outbreak in Bom Jesus de Goiás. Subsequently, the virus was identified in 44 other municipalities in Goiás. In 2023, 83 municipalities confirmed cases, resulting in 7 deaths.[2]

Despite the efforts of health managers in the state and municipalities, the epidemiological situation has led to epidemics over the years. The current scenario of arboviruses in Goiás is characterized by the wide distribution of Aedes aegypti in the 18 health regions, covering the state's 246 municipalities.[2-3]

As a result, there has been an increase in demand for health services, with the emergence of serious cases and deaths, requiring the allocation of specific financial and human resources to mitigate the deleterious impacts on Goiás society, especially those caused by dengue viruses.[4,2-3]

Given this scenario, the following questions arise: what are the geographical distribution patterns of dengue, Zika virus and chikungunya in the municipalities of Goiás? How

do these distributions correlate with socio-environmental variables such as population, distance from the capital and basic sanitation infrastructure?

The aim of this article is to present an analysis of the distribution of dengue, Zika virus and chikungunya cases in the municipalities of Goiás, seeking to identify patterns of geographical distribution and possible correlations with socio-environmental variables such as population, distance from the capital and basic sanitation infrastructure.

METHOD

This is a cross-sectional, descriptive study conducted using data collected through Tabnet. This tabulation tool, developed by the Department of Informatics of the Unified Health System (DATASUS), allows data to be tabulated online and spreadsheets to be generated quickly and objectively from the database of the Unified Health System (SUS).[5]

The data collected refers to the distribution of dengue, Zika virus and chikungunya cases in the municipalities of the state of Goiás. We analyzed the municipalities with the highest distribution of dengue (probable cases) in the state of Goiás between 2017 and 2021, and chikungunya in 2022. Only the year 2022 was considered for chikungunya, as it was the only data available for all municipalities in the state.

The data was then organized into spreadsheets using Excel software from the Microsoft Office package 365® to identify the municipalities in the state of Goiás with the highest distribution of cases of the three diseases. In addition, the data was spatialized, i.e. organized according to geographical location within the map of the state of Goiás, which allowed for a clearer understanding of the trends and patterns present in different regions.

In addition, data was collected from the Brazilian Institute of Geography and Statistics (IBGE)[6] on the population, distance from the capital and basic sanitation infrastructure (sewage system, water system, garbage collection) of the municipalities with the highest distribution of cases of the three arboviruses to enable a socio-environmental comparison.

With regard to ethical aspects, in line with article 1 of National Health Council Resolution (CNS) 510/16, dated April 7, 2016, the provisions contained therein, detailed in the circular letter of the National Research Ethics Commission (CONEP) - Executive Secretariat of the National Health Council (SECNS) - Ministry of Health (MS) N. 17/2022, establish that research using information in the public domain will not be registered or evaluated by the CEP/CONEP system.

RESULTS

Figure 1 shows the spatial distribution of the municipalities in the state of Goiás with the highest distribution of probable cases of dengue (Goiânia, Aparecida de Goiânia, Jataí, Formosa, Senador Canedo) and Zika virus (Trindade, Anápolis, Uruaçu, Aparecida de Goiânia, Goiânia) between 2017 and 2021, as well as chikungunya (Rio Verde, Luziânia, Aparecida de Goiânia, Posse, Bom Jesus de Goiás, Goiânia) by municipality in the state of Goiás in 2022.

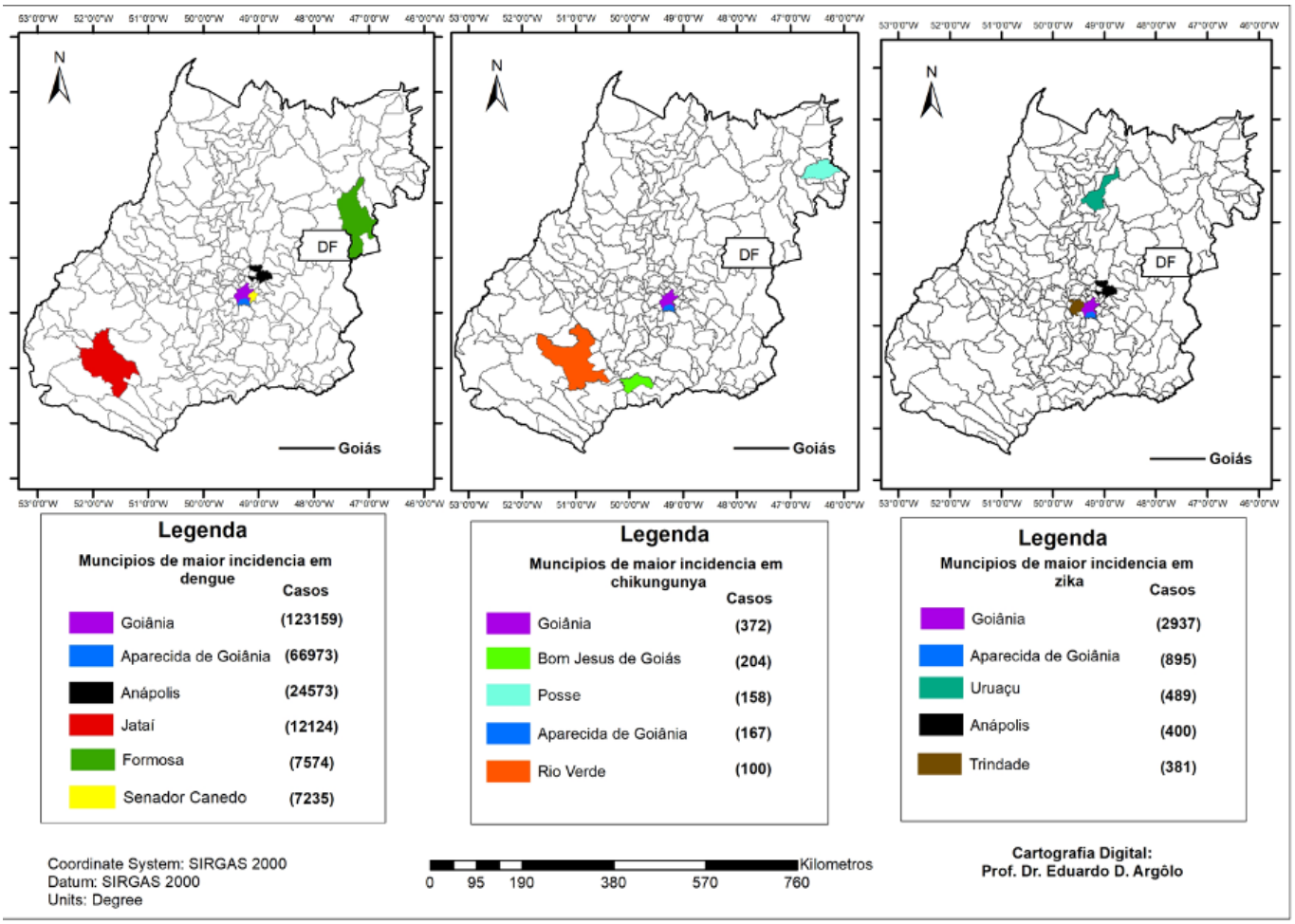

Figure 1 - Areas with the highest distribution of cases of Dengue (probable cases), Zika Virus Goiás between 2017 and 2021 and Chikungunya (2022) by municipality in the State of Goiás. Municipalities of Goiás, Goiás, 2022

Source: Tabnet, 2023

Chart 1 shows the percentage of basic sanitation in the municipalities with the highest distribution of arbovirus cases in the state of Goiás (Cf. IBGE, 2024). It shows low investment in sewage systems, especially in the cities that make up the greater Goiânia area (Senador Canedo 11.33%, Trindade 49.54%, Aparecida de Goiânia 60.76%). Another factor to note is that distance from the capital is not a determining factor for investment in infrastructure, i.e. the geographical location of a city in the state of Goiás, being close to the capital, does not necessarily influence how much investment in infrastructure it receives.

Chart 1: Basic sanitation in the municipalities with the highest distribution of arbovirus cases (n =12). Municipalities of Goiás, Goiás, 2024

Municipality	Population	Distance from the capital	Sewage network	Water network	Garbage collection
Goiânia	**1.437.366**	Capital	79,19%	95,41%	99,78%
Aparecida de Goiânia	**527.796**	19,4 km	60,76%	72,3%	99,61%
Anápolis	**398.869**	57,9 km	65,43%	90,01%	98,98%
Rio verde	**225.696**	240,4 km	84,84%	88,27%	96,11%
Luziânia	**209.129**	196,9 km	25,62%	72,98%	93,31%
Senador Canedo	**155.635**	19,6 km	11,33%	91,35%	99,32%
Trindade	**142.431**	19,4 km	49,54%	87,05%	98,77%
Formosa	**115.901**	277,9 km	77,23%	87,56%	92,23%
Jatai	**105.729**	324,0 km	83,17%	89,49%	95,88%
Uruaçu	**42.546**	277,0 km	58,42%	81,34%	92.2%
Posse	**34.914**	510,4 km	58.1%	83,08%	82,45%
Bom jesus de goiás	**23.958**	217,2 km	88,2%	81,93%	95,82%

Source: IBGE, 2024.

DISCUSSION

The Pan American Health Organization (PAHO) points out that the increased movement of people and goods, combined with the higher population density in municipalities such as Goiânia and Aparecida de Goiânia (see figure 1), favors the spread of the three diseases mentioned. This process of disorderly urbanization results in environmental changes that contribute to the proliferation of the vector, making it difficult to interrupt the chain of transmission and, consequently, increasing the rate of infection with these diseases.[7-8]

In addition, the organization highlights that factors related to urban and social infrastructure create ideal conditions for the proliferation of vectors, such as Aedes aegypti. This scenario is exacerbated by the densification of urban spaces and the irregularity or absence of essential public services, such as waste collection and drinking water supply, as shown in Table 1, referring to the municipalities of Goiás.[6-8]

The results reveal insufficient sewage network coverage in the municipalities most affected by arboviruses, especially in the Goiânia metropolitan region. Examples include Senador Canedo, with only 11.33% coverage; Trindade, with 49.54%; and Aparecida de Goiânia, with 60.76%. These data suggest that low investment in basic sanitation infrastructure contributes significantly to the high distribution of cases of these diseases, regardless of proximity to the capital. This situation highlights the urgent need to improve sanitation infrastructure in order to effectively combat the spread of arboviruses in the state.[9]

In addition, the climate in Goiás also contributes to the proliferation of the Aedes aegypti mosquito. The region's climate is hot and sub-humid, with four to five dry months a year. Approximately 95% of the rainfall occurs between October and April, while the period of lowest rainfall is from May to September. Average annual temperatures vary between 23ºC in the north and 20ºC in the south.[10] However, these climatic conditions are not exclusive to Goiás, but are common in many regions of Brazil, where conditions are favorable for the development of insects due to high temperatures and humidity for most of the year. Several studies confirm a direct relationship between high temperatures (22º-32ºC) and accelerated development of the larval stage of mosquitoes.[11]

According to Radiografia do Agro 2022, the state of Goiás stands out as the fifth largest in the country in terms of Gross

Value of Agricultural Production (VBP), representing 9% of the national VBP. This is relevant for the Cerrado, one of the most biodiverse savannas in the world, which has suffered environmental degradation for decades, largely due to this development. Extensive cattle ranching is prevalent in the state and often uses anthropogenic fires to maintain pasture areas.[12-13]

In addition, these fires create favorable conditions for the proliferation of mosquitoes that transmit diseases such as arboviruses.[1] The Cerrado biome, with its accumulation of dry biomass, low humidity and high temperatures, makes the appearance of fires inevitable at certain times of the year.[1,12]

The Lancet Countdown report warns that global warming could result in longer periods of high temperatures and drought, increasing the risk of fires and damaging air quality. In addition, climate change, combined with fires and greenhouse gas (GHG) emissions, could make certain regions more suitable for mosquito breeding[1], such as the cerrado presented here.

It is therefore essential to prioritize global awareness, considering the interaction between the environment, society and health. In the meantime, Planetary Health has emerged, which seeks to promote a balanced coexistence, sustained by homeostasis between the environment, animals and human beings.[14-15] Planetary Health action is urgently needed to prevent the collapse of the Earth's systems that sustain human health.[16]

It is crucial to promote public policies that encourage sustainable agricultural practices, providing productive, social and environmental benefits for the sustainable intensification of agriculture, such as agroecological practices.[17]

In addition, it is necessary to strengthen health programs to promote, identify, train, track, qualify, demystify, typify and understand the needs of the population in each territory, with a focus on the social determinants of health. This will help mitigate socio-environmental health problems such as arboviruses. Primary Health Care (PHC) services are fundamental to these actions, as they prioritize health prevention, promotion and rehabilitation, being close to homes and accompanying families, assessing risks and potential in the home environment.[18]

In Brazil, PHC services are offered through Basic Health Units (UBS) and Family Health Teams (ESF), which must implement various actions to promote both Planetary Health and human health.[3,18]

Community engagement is essential, as the active participation of the population is crucial for controlling arboviruses. Discussing strategies to increase community collaboration is fundamental for education and awareness-raising, since education campaigns are only effective with ongoing public education. Evaluating the effectiveness of existing campaigns and suggesting improvements with health professionals and the population is vital for improving these factors.[18-19]

Continuous education on the impacts of climate change and environmental degradation on health is urgently needed, especially in family territories. This aims to reduce waste, avoid hyperconsumption of health services, excessive treatments, and minimize deforestation and environmental degradation, as well as preventing the proliferation of vector-borne diseases.[8,20-21]

This set of actions can mitigate the environmental impacts that harm life. It is also important to consider how climate change affects the distribution and prevalence of arboviruses, and to widely discuss with the population how these changes can influence the dynamics of vectors and the incidence of diseases, both now and in the future.[8,20-21]

In addition, it is essential to prioritize the prevention and control of environment-related diseases, promoting an interdisciplinary approach in PHUs and establishing health indicators to monitor the impact of the interventions carried out.[3,22] Early adaptation is necessary to address the underutilization of health services, improve the quality of care and build resilience through comprehensive community health services that respond effectively to climate change. This is in line with Sustainable Development Goal No. 3 (SDG3), which highlights the importance of universal health coverage based on high-quality primary care.[16]

Therefore, recognizing primary care providers as public health advocates can change the mindset of everyone involved in the health system, promoting greater priority for primary care, health equity and protection of the planet's natural systems.[16,23-25]

The study is limited by the fact that it analyzed only one Brazilian federal unit and adopted a descriptive analysis, which does not allow phenomena to be explained or data to be generalized. However, it offers a reflection on the prevalence of arboviruses in Brazil and the importance of training and monitoring the population and communities to mitigate these diseases. It also promotes the appreciation of PHC services throughout the country and alerts public authorities to the importance of these services in environmental education and in mitigating current and future diseases.

CONCLUSION

The study showed that the climatic characteristics, the biome in which the state is located (Cerrado), the intense

movement of people and goods, and the lack of infrastructure, such as the sewage system in the state of Goiás, contribute significantly to the proliferation of the Aedes aegypti mosquito and, consequently, to the spread of the three arboviruses, especially in municipalities with a high population density, such as Goiânia and Aparecida de Goiânia. In this context, the promotion of Planetary Health education in Primary Health Care services is crucial. This approach makes it possible to understand the interconnection between the environment, health and society, transforming PHC services into agents for mitigating environmental impacts and the diseases associated with them. By educating the population, it is possible to clarify this connection and increase the receptiveness of guidelines on health and the environment, making Planetary Health more effectively understood and applied.

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