

Descriptive profile of the occurrence of arboviruses in Governador Valadares, Minas Gerais, Brazil

Estudo descritivo da ocorrência de arboviroses em Governador Valadares, Minas Gerais, Brasil

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Abstract

Objective: The objectives of this study were to analyse the clinical-demographic profile of arbovirus cases in Governador Valadares, Minas Gerais, Brazil, between 2015 and 2016, and the incompleteness of notifications. **Methods:** A descriptive and cross-sectional study of arboviruses was performed using secondary data. All reported autochthonous probable cases (confirmed and suspected) of Dengue, Chikungunya and Zika were included. **Results:** In total, 4,207 cases (dengue), 3,310 (zika) and 130 (chikungunya) were reported; the annual incidence rates (per 100,000 inhabitants) were 752.1 cases (dengue), 24.3 (chikungunya) and 591.8 (zika). February was the month with the highest notification for 3 arboviruses and female individuals were the most frequently affected. The most frequent age range for dengue was between 21 and 30 years old (20.3%), for chikungunya was over 50 years old (23.5%) and for zika was under 10 years old (28.6%). The most incident symptoms in dengue were fever (3.2%), headache (2.9%) and myalgia (2.6%), in chikungunya were arthralgia (46.6%), exanthema (37.5%) and myalgia (29.4%); for zika, the symptoms weren't reported in the notification form. Very poor or poor completeness were verified in 77.4% (dengue), 34.6% (chikungunya), 22.2% (zika). **Conclusions:** The clinical-demographic profile of arboviruses in Governador Valadares is represented by women, aged between 21 and 40 years old, with complaints of fever, headache, myalgia and, particularly in chikungunya, arthralgia. The high percentage of unfilled fields in notification forms for 3 arboviruses is a serious limitation for public health actions against them.

Keywords: Arbovirus Infections. Disease notification. Health status. Epidemiology, Descriptive. Preventive health.

Resumo

Objetivo: Os objetivos deste estudo foram analisar o perfil clínico-demográfico dos casos de arboviroses em Governador Valadares, Minas Gerais, Brasil, entre 2015 e 2016, bem como a incompletude das notificações. **Métodos:** Foi realizado um estudo descritivo transversal sobre arboviroses utilizando dados secundários. Todos os casos prováveis autóctones notificados (confirmados e suspeitos) de Dengue, Chikungunya e Zika foram incluídos. **Resultados:** No total, 4.207 (dengue), 3.310 (zika) e 130 (chikungunya) casos foram notificados; as taxas de incidência anual (por 100.000 habitantes) foram 752,1 casos (dengue), 24,3 (chikungunya) e 591,8 (zika). Fevereiro foi o mês com maior notificação para as 3 arboviroses e indivíduos do sexo feminino foram os mais afetados. A faixa etária mais frequente para dengue foi entre 21 e 30 anos (20,3%), para chikungunya superior a 50 anos (23,5%) e para zika inferior a 10 (28,6%). Os sintomas mais incidentes na dengue foram febre (3,2%), cefaleia (2,9%) e mialgia (2,6%), na chikungunya foram artralgia (46,6%), exantema (37,5%) e mialgia (29,4%); para zika, os sintomas não foram relatados na ficha de notificação. Completude muito pobre ou pobre foi verificada em 77,4% (dengue), 34,6% (chikungunya), 22,2% (zika). **Conclusões:** O perfil clínico-demográfico das arboviroses em Governador Valadares é representado por mulheres, entre 21 e 40 anos, com queixas de febre, cefaleia, mialgia e, principalmente na chikungunya, artralgia. O alto percentual de campos não preenchidos nas fichas de notificação das 3 arboviroses é uma grave limitação para as ações de saúde pública.

Palavras-chave: Infecções por Arbovirus. Notificação de Doenças. Nível de Saúde. Epidemiologia Descritiva. Serviços Preventivos de Saúde.

INTRODUCTION

The recent outbreaks of arboviruses are a warning to global public health¹. In the current Brazilian scenario, Dengue (DEN), Zika (ZIK), Chikungunya (CHIK) and Yellow Fever are expanding and gaining prominence². Despite the Brazilian epidemiological transition experienced in the last 50 years, with a significant reduction in the prevalence of infectious diseases, they are recently presenting an emergent and re-emergent process³. This fact, which is not unique to Brazil, keeps infectious diseases in the list of Global Health Priorities³.

In the past years, the emergence of some arboviruses, especially ZIK and CHIK, has been observed⁴. The World Health Organization (WHO) estimates an additional 1.6 million cases of DEN in the Americas in the first months of 2020, reinforcing the need to intensify surveillance and control actions during the Sars-Cov-2 (Severe acute respiratory coronavirus 2) pandemic⁵. According to Waldman and Sato (2016), among the infectious diseases that have re-emerged in Brazil since the end of the 20th century, DEN deserves the most attention³. The vector

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of the disease, *Aedes aegypti*, eradicated from Brazil in 1955 through yellow fever control measures, was reintroduced to the country in 1976, causing the first outbreak of DEN in 1981 and, posteriorly, several national epidemics³. In 2007, the vector was spread in approximately 70% of Brazilian municipalities³ and in 2020, until Epidemiological Week (EW) 22 (05/16/2020 to 05/24/2020), the incidence of probable cases of DEN reached 381.6 cases per 100 thousand inhabitants⁶.

CHIK, initially isolated in Africa and Asia, gained worldwide attention in 2007 when it reached the Indian Ocean⁷. In 2013, cases were registered in the Caribbean and, in 2014, it expanded to the rest of the Americas⁷. The first Brazilian autochthonous case was confirmed in September 2014 and, thereafter, outbreaks began across the Brazilian territory⁷. In 2018, until EW 7, the incidence of probable cases of CHIK reached 3.6/100,000 inhabitants⁸. In the same period, 615 probable deaths from DEN were recorded.

ZIK has gained worldwide repercussions since outbreak reports in Oceania in 2007¹. In April 2015, the autochthonous transmission of the virus was confirmed in Brazil, in Bahia state⁹. The possible association of ZIK with congenital malformations and neurological complications highlighted the international repercussion of the disease³. According to the Brazilian Ministry of Health, until EW 20, the incidence of ZIK was 1.7 cases per 100 thousand inhabitants, with the Northeast region having the highest rate (3.6)⁶. There was no record of deaths in this period.

The re-emergence of the four DEN serotypes, as well as the emergence of CHIK and ZIK in Brazil, makes the clinical and diagnostic approach of arboviruses a challenge for health professionals, given the similar clinical presentations associated with laboratory diagnosis limitations². According to Waldman and Sato (2016), once they return to global public health priorities, arbovirus control activities should be more complex, integrating an "effective network of basic health services and a timely surveillance system"³. Epidemiological surveillance systems, based on their primary role in disease control, should be able to identify trends and areas, as well as population groups that should be prioritized in prevention activities in situations where there are changes in the epidemiological profiles of disease¹⁰.

Governador Valadares is a city located in the eastern region of Minas Gerais State, Brazil, endemic to DEN. Studies on incidence rates and the clinical and demographic profiles of DEN, CHIK and ZIK are scarce in the region, which demonstrates the need to develop projects that include arboviruses as the object of study, given the recent re-emergence and emergence of these diseases as a municipal, national and global public health problem.

DEN, CHIK and ZIK are diseases of compulsory notification in Brazil¹¹. The notification forms completed by health professionals from the three levels of government are added to the Online Notification Disease Information System database

(Sinan-Net), allowing the "dissemination of data and providing information for analysis of the population morbidity profile"¹¹. However, the use of this database is limited as the analysis of data completeness quality is still an unexplored dimension in Brazil¹².

The objectives of this study were to analyse the clinical-demographic profile of arbovirus cases in Governador Valadares, Minas Gerais, Brazil, between 2015 and 2016, as well as the incompleteness of notifications.

MATERIAL AND METHODS

A descriptive study on arboviruses (DEN, CHIK and ZIK) was carried out using public domain secondary data found in databases and available on the SINAN-Net Information System, which is provided by the Municipal Health Department of Governador Valadares of the municipality of Governador Valadares, Minas Gerais, Brazil.

Governador Valadares, with a territorial area of 2,342.325 km², had reached a population of 263,689 inhabitants¹³. The population estimate for 2019 was 279,885 inhabitants¹⁴. The city is comprised of around 127 public health facilities, of which 89 are municipal, and 108 are private units. In addition, there are 13 health posts, 48 basic units, three polyclinics, two emergency care units and six general hospitals¹³.

All reported autochthonous probable cases (confirmed and suspected) of DEN, CHIK and ZIK from the municipality of Governador Valadares, during the period from January 1st, 2015 to December 31st, 2016, were included in the analysis. All non-autochthonous notified cases in the municipality and whose laboratory results were negative were excluded.

The following variables were studied: general data (month and year of notification), individual notification (age, sex, race/colour, schooling, pregnant), residence data (municipality, district), epidemiological history and clinical data (symptoms) and conclusion (final classification, evolution).

Descriptive statistics (frequency and proportion analysis) were used to analyse the data. The analyses were performed using software EpiInfo™ (version 7.2) and Microsoft Excel® (version 2016).

The incidence of each arbovirus per year (2015 and 2016) was calculated by the ratio of the sum of the new cases of disease occurring in the period to the resident population for the same period (per 100,000 inhabitants). The resident population used was defined by the municipal projections adopted by IBGE for the municipality in 2016¹⁴.

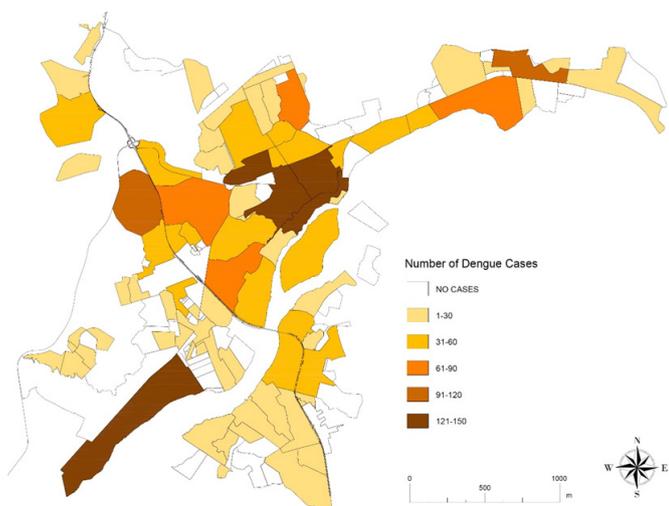
The digital cartographic base used in the elaboration of the maps was obtained from Governador Valadares city hall and analyzes were performed by area of the probable cases notified by the district. The municipality has 141 districts registered by

the city hall.

The completeness of filling was analysed in 124 fields for DEN, 81 for CHIK and 45 for ZIK. The DEN and CHIK forms are equal and have 72 variables, because a notification form, which was standardized by the Ministry of Health of Brazil, was used. The incompleteness of variables is the proportion of field data found to be blank or completed as “ignored”¹⁵. The variables were evaluated according to the proportion of incompleteness, using the following classification proposed by Santos (2012): excellent (less than 5%); good (5–10%); regular (11–20%); poor (21–50%); and very poor (51% or more)¹⁵.

The study did not require Research Ethics Committee (CEP)

Figure 1. Spatial distribution of Dengue cases in Governador Valadares, 2015-2016.



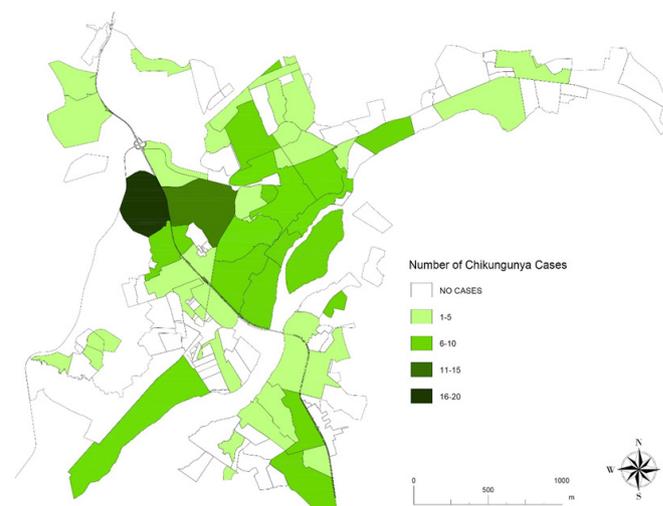
Source: Sistema de Informação de Agravos de Notificação, Secretaria Municipal de Saúde de Governador Valadares.

approval as non-nominal public domain secondary data were used, according to Resolution N^o. 510/2016 of the National Health Council, Ministry of Health of Brazil (CNS/MS)¹⁶. However, throughout the study, the ethical determinations from Resolution N^o. 466/12 of CNS/MS¹⁷ and from International ethical guidelines for epidemiological studies: Geneva were respected¹⁸.

RESULTS

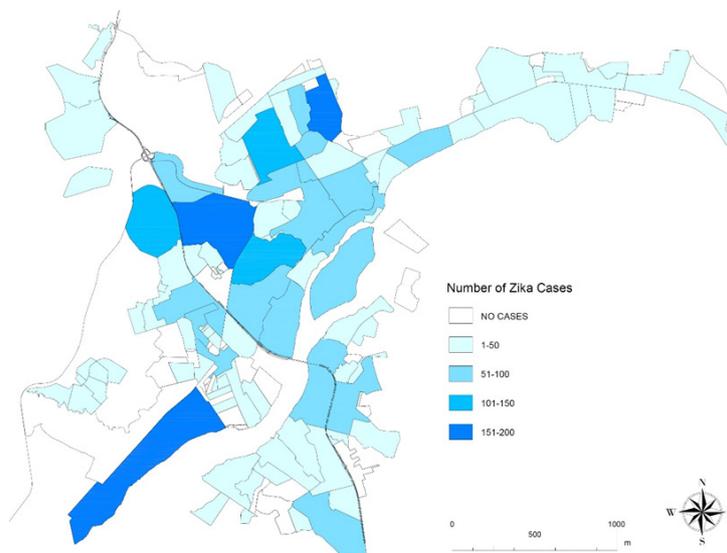
In Governador Valadares, 4,207 probable cases of Dengue, 136 of Chikungunya and 3,310 of Zika Virus were reported in the period from 2015 and 2016, totalling 7,653 suspected cases of arboviruses (Figures 1, 2 and 3).

Figure 2. Spatial distribution of Chikungunya cases in Governador Valadares, 2015-2016.



Source: Sistema de Informação de Agravos de Notificação, Secretaria Municipal de Saúde de Governador Valadares.

Figure 3. Spatial distribution of Zika cases in Governador Valadares, 2015-2016.



Source: Sistema de Informação de Agravos de Notificação, Secretaria Municipal de Saúde de Governador Valadares.

The annual incidence per 100,000 inhabitants in Governador Valadares was 752.1 cases for DEN, 24.3 cases for CHIK and 591.8 cases for ZIK. Most of the cases occurred in females (61.6% DEN, 82.4% CHIK, and 65.9% ZIK) and February was the month with the highest number of reports (21.9% DEN, 38.2% CHIK, and 54.8% ZIK). The most frequent age groups affected were between 21 and 30 years old for DEN (20.3%), over 50 years old for CHIK (23.5%) and younger than 10 years old for ZIK (28.6%) (Table 1). The race and education level variables showed a high frequency of fields completed as "ignored" for the three arboviruses (73.1% DEN, 41.9% CHIK and 55.2% ZIK for race and 87.5% DEN, 75.0% CHIK and 61.2% ZIK for education) (Table 2).

Table 1. Cases of Dengue, Chikungunya and Zika Virus according to gender, age group and symptomatology in Governador Valadares, 2015 to 2016.

Variables	Arboviruses					
	Dengue (n)		Chikungunya (n)		Zika virus (n)	
	n	%	n	%	n	%
Gender						
Feminine	2590	61.6	112	82.4	2180	65.9
Masculine	1613	38.3	24	17.6	1130	34.1
Unknown/Unfilled	4	0.1	0	0	0	0
Age Range						
<1	82	1.9	7	5.1	130	3.9
1-10	557	13.2	3	2.2	818	24.7
11-20	716	17.0	5	3.7	405	12.2
21-30	856	20.3	30	22.1	610	18.4
31-40	785	18.7	31	22.8	551	16.6
41-50	559	13.3	28	20.6	382	11.5
>50	652	15.5	32	23.5	420	12.7
Symptomatology*						
Fever	133	3.2	29	21.3		
Myalgia	111	2.6	40	29.4		
Headache	123	2.9	35	25.7		
Exanthema	88	2.1	51	37.5		
Arthralgia	73	1.7	63	46.3		
Conjunctivitis	26	0.6	14	10.3		
Petechiae	36	0.9	1	0.7		
Retro-Orbital Pain	71	1.7	12	8.8		
Unknown/Unfilled	3674	87.3	52	38.2		
Total Cases	4207		136		3310	

*The Zika Virus notification sheets have no field for symptomatology

Source: Departamento de Vigilância em Saúde de Governador Valadares.

Table 2. Classification of the incompleteness of the variables included in the notification sheets for Dengue, Chikungunya and Zika Virus in Governador Valadares, from 2015 to 2016.

Variables	Arboviruses					
	Dengue		Chikungunya		Zika virus	
	n	%	n	%	n	%
Gender	4	0.1	0	0	0	0
Age	18	0.4	0	0	0	0
Education	3,681	87.5	102	75.0	2,027	61.2
Race	3,077	73.1	57	41.9	1,828	55.2
Pregnant	221	5.3	50	36.8	857	25.9
District name	59	1.4	2	1.5	99	3.0
Classification	0	0	0	0	6	0.18
Evolution	260	6.2	2	1.5	13	0.39
Symptomatology *						
Fever	1,851	44.0	0	0		
Myalgia	1,851	44.0	0	0		
Headache	1,851	44.0	0	0		
Exanthema	1,851	44.0	0	0		
Arthralgia	1,851	44.0	0	0		
Conjunctivitis	1,851	44.0	0	0		
Petechiae	1,851	44.0	0	0		
Retro-Orbital Pain	1,851	44.0	0	0		

* The Zika Virus notification sheets do not present a field for symptomatology.

**Ranking: <5% excellent; 5-10% good; 11-20% regular; 21-50% poor; >50% very poor.

Source: Departamento de Vigilância em Saúde de Governador Valadares.

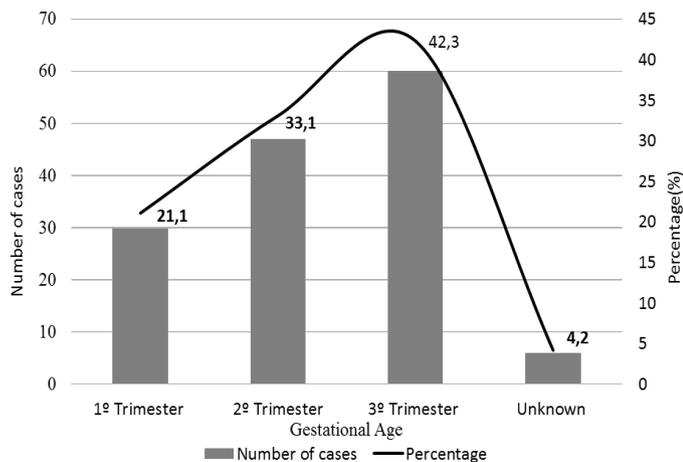
The most frequent symptoms in DEN were fever (3.2%), headache (2.9%) and myalgia (2.6%), whereas in CHIK there were reports of severe arthralgia (46.3%), exanthema (37.5%) and myalgia (29.4%). There was no symptom information available for 87.3% and 38.2% of the DEN and CHIK notification records, respectively (Table 1). The ZIK notification form included no information on clinical signs and symptoms.

A total of 142 suspected cases of ZIK were reported in pregnant women, in which the majority occurred in the third trimester of pregnancy (42.3%) (Figure 4); infection was confirmed in 43 cases (30.3%), of which 17 used laboratory criteria and 26 clinical-epidemiological criteria. There were no cases of ZIK congenital syndrome.

All neighbourhoods recorded cases of the three arboviruses; however, Santa Rita (7.6% DEN, 5.1% CHIK, and 5.4% ZIK) and Turmalina (4.7% DEN, 14.7% CHIK, and 4.4% ZIK) were the most affected by the three arboviruses (Figures 1, 2 and 3). The district name variable showed a high frequency of fields completed for the three arboviruses (95.0% on average) (Table 2).

In terms of incompleteness of variables for DEN, 96 fields (77.4%) were classified as very poor or poor completeness and 28 (22.6%) were classified as good or excellent. For CHIK, 28 fields (34.6%) presented very poor or poor completeness and 53 (65.4%) were classified as good or excellent. ZIK presented very poor or poor completeness in 10 fields (22.2%) and good or excellent in 35 fields (77.8%).

Figure 4. Cases of Zika Virus in pregnant women according to gestational age in Governador Valadares, 2015 to 2016.



Source: Departamento de Vigilância em Saúde de Governador Valadares.

DISCUSSION

In the studied period, Brazil recorded more than 3 million dengue cases, especially in the Southeast region, which accounted for 60.1% of the total cases. The average annual incidence for the Southeast was 1,095.95 cases per 100,000 inhabitants and in Minas Gerais it was 1,703.55¹⁹. The capital of Minas Gerais, Belo Horizonte, presented a rate of 6,265.7¹⁹. Governador Valadares presented lower incidence rates than regional, state and capital values. According to Araquan (2014), the incidence of DEN in the city of Belo Horizonte increased from 2005 to 2013, due to the "increase of the urban/peripheral network in number and size", which, associated with low conditions of population infrastructure contributed to the increase in the vectors number²⁰. This scenario can be extended to other regions of the state, including the Eastern region, where the municipality of Governador Valadares is the main city.

Concerning to Chikungunya, Governador Valadares presented an average annual incidence of 24.3 cases per 100,000 inhabitants during the same period. At the same time, 299,852 suspected cases were reported in Brazil, with an average annual incidence of 73.3 cases¹⁹. Although Governador Valadares' average annual incidence was much lower than the national average, its value was higher than the state average, which was 3.2 cases per 100,000 inhabitants. In fact, the municipality average was closer to the Southeast number, which was 14.0 cases per 100,000 inhabitants¹⁹.

Concerning to Zika, only from April 2015 was autochthonous

transmission by arbovirus confirmed in Brazil. Furthermore, unlike the DEN and CHIK notification forms, the ZIK form does not have fields for signs and symptoms so far. In 2015 and 2016, the municipality of Governador Valadares notified 3,310 probable cases, presenting an average incidence rate of 591.8 cases per 100,000 inhabitants, which was well over the national, Southeast and Minas Gerais averages. In 2016, up to EW 49, Minas Gerais presented an incidence of 72.9 cases per 100,000 inhabitants; the Southeast region contributed 43.2% of the notifications, with an incidence of 105.7 cases per 100,000 inhabitants¹⁹. In addition, 211,770 probable cases were recorded in Brazil, with an incidence of 103.6 cases per 100,000 inhabitants¹⁹. One of the hypotheses that justifies the high number of cases in Governador Valadares is that the city was experiencing a ZIK epidemic during the period studied, aggravated by the rupture of the Samarco dam in November 2015²¹. This incident created a severe water shortage due to contamination of the city's main river by heavy metals, prompting residents to stock water at home²¹.

In this study, all of the arboviruses had a greater incidence in women. A systematic review study in the period from 2000 to 2016 reported a predominance of females and confirmed that this incidence was due to the greater exposure of women to the vector, due to longer stays in residences²². Furthermore, a meta-analysis from the international database (including Brazil) on ZIK showed the female gender to be the most affected, probably due to the higher demand by women for health care²³.

In the present study, the most prevalent age groups varied according to the arboviruses analysed. Regarding DEN, the result of this study can be confirmed by others. For example, in the systematic review already mentioned, the highest number of cases of DEN was also observed in the age range between 21 and 30 years old²². Therefore, there is a predominance of DEN morbidity in the economically active population, generating possible losses to the local economy, as stated by Pedroso and Moura (2012)²⁴.

Regarding CHIK and ZIK, some studies have different conclusions from this study about the age group most affected. For instance, in a study conducted in Bahia state, the median age of patients that tested positive for ZIK was 28 years old². Also, a descriptive study between 2014 and 2016 showed that, in Brazil, the population most affected with CHIK was between 20 and 39 years old (35.8%)²⁵. Nevertheless, Fuller et al. (2017), in a study conducted in Rio de Janeiro, between 2015 and 2016, states that the incidence of Chikungunya in their study was higher in individuals older than 40²⁶. The probable rationale for this pattern is that middle-aged and elderly people are more able to seek health care, are more exposed to the *Aedes* mosquito due to longer stays in residences without air-conditioning, or because their health is worse, making them more susceptible to virus infection²⁶.

All arboviruses presented a higher incidence in the summer, especially in February. Oliveira and Dias (2016) highlighted that

the highest number of DEN cases was observed in the rainy season (February to June), with a decrease in incidence during the dry season²². In addition, the study conducted in Rio de Janeiro already mentioned, showed that heavy rainfall precedes arbovirus cases by three weeks, becoming a predictor of potential outbreaks. Therefore, an early warning system based on weather that predicts these outbreaks could provide policy-makers and clinicians a warning to prepare countermeasures²⁶.

In this study, the most incident symptoms to DEN were fever, headache and myalgia. A study conducted in Rio Grande do Sul, between 2014 and 2016, showed that the most reported symptoms were also fever, myalgia and headache, presented in 90%, 70% and 60%, respectively, of the patients with DEN²⁷. A retrospective study of 5,450,000 cases of DEN conducted in different regions of Brazil, between 2000 and 2014, found that fever was present in 95–97% of patients and headache in 90%²⁸. At the same time, the most frequent symptoms of CHIK in Governador Valadares were severe arthralgia, exanthema and myalgia. According to Silva et al. (2018), in Brazil, between 2014 and 2016, the main acute symptoms of chikungunya infection were fever (90.2%), arthralgia (76.3%), headache (66.1%) and myalgia (65.1%)²⁵.

The limitations of the present study were the use of secondary data and the high percentage of unfilled fields for some variables, such as race, schooling and case confirmation. The use of data from health information systems is embracing and often used by health decision making. Thus, considering the recent entry into the country of the Zika and Chikungunya viruses and the fact that Governador Valadares is experiencing a dengue epidemic during the research period, the data analysed allowed us to provide information about the clinical-demographic profile of probable cases of DEN, CHIK and ZIK for local health services. However, data integrity and quality must be guaranteed to identify suitable evidence-based interventions.

CHIK and ZIK presented very poor or poor information completeness in more than 20% of the variable filler fields, while this value reached more than 75% in DEN. A study about the completeness of the Malaria Notification Data

Sheets in Brazilian Amazon, between 2003 and 2012, showed that poor completeness might be related to the lack of commitment of the notifiers to not perceive the importance of the information and its impact on public health actions²⁹. Therefore, a study conducted in Rio de Janeiro, between 2011 and 2013, affirmed that the qualification of the technical teams is essential to sensitize health professionals to the importance of notifications³⁰. At last, the previous study also concluded that the incompleteness of the data was a limiting factor for its research and that other studies about the incompleteness of variables are necessary to the improvement of the surveillance systems in the country³⁰.

It is concluded that the clinical-demographic profile of arboviruses in Governador Valadares is represented by female gender, aged between 21 and 40 years, with complaints of fever, headache, myalgia and, particularly in CHIK, arthralgia. It is also concluded that the high percentage of unfilled fields in notification data sheets for all arboviruses is a serious limitation for public health actions and that the Notifiable Diseases Information System (SINAN) must be improved to provide qualified data to identify suitable evidence-based interventions. Finally, further epidemiological studies are needed to improve knowledge about DEN, CHIK, ZIK and their risk factors for the local population.

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AUTHORS' CONTRIBUTION

JFPA: wrote the manuscript and worked on the critical revision of the text; WAA: planned the study, wrote the manuscript and performed the statistical analysis.

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