



Data quality and arbovirus infection associated factors in pregnant and non-pregnant women of childbearing age in Brazil: A surveillance database analysis

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ARTICLE INFO

Keywords:

Arboviruses
Dengue
Pregnant women
Surveillance
Information systems
Social determinants of health

ABSTRACT

The dengue surveillance system in Brazil has registered changes in the disease's morbidity and mortality profile over successive epidemics. Vulnerable groups, such as pregnant women, have been particularly hard hit. This study assessed the quality of notifications of dengue cases among pregnant women and non-pregnant women of childbearing age in Brazil, in addition to discussing the factors associated with arbovirus infection in the group of pregnant women. We carried out a retrospective study of cases registered in the national arbovirus surveillance system between 2007 and 2017. The indicator for assessing quality was incompleteness. Logistic regression was used to analyze the association between dengue during pregnancy and sociodemographic, epidemiological, clinical, and laboratory variables. The incompleteness of the data in the notification form for dengue cases in women of childbearing age and pregnant women indicates a significant loss of information. Dengue was shown to be positively associated with Social Determinants of Health in both groups, with more severe effects among pregnant women. The incompleteness of the data can limit the quality of information from the notification system and the national assessment of the situation of the disease in women of childbearing age and pregnant women.

1. Introduction

Imposing a potential risk of infection to approximately half of the world population and about 50 to 100 million new cases annually, dengue is deemed to be the arbovirus of enormous international relevance. However, it is estimated that the number of infected people may be much higher due to underreporting [1–3].

Evaluated as the country in the Latin American and Caribbean region with the highest burden of pathologies related to neglected diseases, Brazil also ranks among the nations with the highest number of dengue cases [4]. The combination of environmental conditions conducive to the proliferation of the vector *Aedes aegypti* (rainfall, temperature, relative humidity, deforestation); disorderly occupation of urban areas; deficient health infrastructure; ineffective preventive interventions

favored viral amplification and transmission, making arbovirus endemic in the country [2,3,5,6].

The co-circulation of the four serotypes of the dengue virus, in addition to the possibility of hyperendemicity, also worsened the epidemiological situation of the disease. Epidemic waves have been more frequent and of greater magnitude in recent decades, with an increase in the occurrence of severe forms and deaths, including among children, the elderly, and pregnant women, the most vulnerable population segments [2,6–8].

In pregnant women, the infection has been related to preeclampsia, hemorrhage, and prematurity, in addition to an increased risk of maternal death, possibly due to the greater susceptibility to the hemorrhagic forms of arbovirus [9–15].

In Brazil, dengue cases are included in the list of Compulsory

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<https://doi.org/10.1016/j.oneht.2021.100244>

Received 12 November 2020; Received in revised form 26 March 2021; Accepted 30 March 2021

Available online 2 April 2021

2352-7714/© 2021 The Author(s).

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Notification Diseases, which are investigated by the Ministry of Health's Information System on Notifiable Diseases - SINAN [16]. Given the complexity of its control, it should be able to distinguish changes in the arbovirus profile early through consistent and timely information. Hence assessing the quality of the information provided by the system would provide information about its functioning [17].

Thus, understanding that the transmissibility of dengue is affected by environmental, biological, and social factors; that pregnancy increases the risk of the disease progressing to its most severe forms; and that case reports, particularly in vulnerable groups, should express completeness and quality of information to guide public policies, this study assessed the quality of notifications of dengue cases in women in Brazil, between the years 2007 to 2017, comparing also the information available for pregnant women and non-pregnant women of childbearing age and discussing factors associated with arbovirus infection in these groups.

2. Materials and methods

We conducted an analytical, retrospective, population-based study, using all reports of dengue cases in women of childbearing age (pregnant or not), between the years 2007 to 2017 in Brazil.

The study population was selected from the public database of the Notifiable Diseases Information System (SINAN), a system that compulsorily records all suspected dengue cases for epidemiological investigation. The registration is done in standardized forms (Individual Notification Form), used in all federal units of the country. The selection of the study time took into account the year of inclusion of the condition "pregnancy" as a variable in the notification form (which occurred from 2006) and the end of the period of the last dengue and Zika epidemic.

After initial verification of inconsistencies, the original bank with the registration of all cases was submitted to the application of filters to

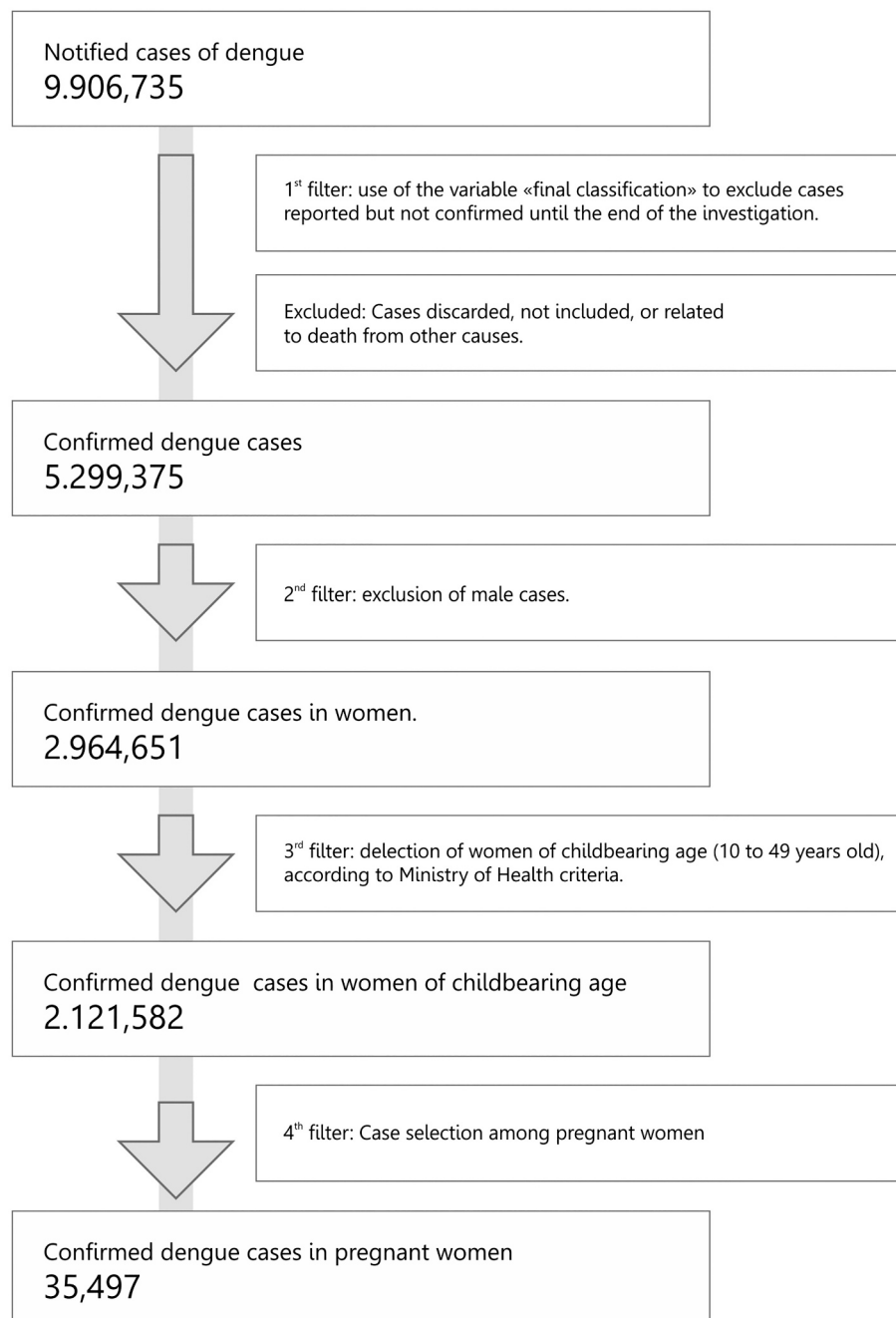


Fig. 1. Flowchart of the selection of dengue cases in pregnant women, Brazil, 2007–2017.

select the group under study (Fig. 1).

The clinical classification of cases follows the proposal of the World Health Organization (WHO), respecting the notification period: first classification in degrees up to Dengue Shock Syndrome [18] and post-review, with a new binary classification differentiating severe and dengue without signs and symptoms of severity (adopted by WHO from 2009 and by Brazil in 2014) [19,20].

To assess the quality of the data, the incompleteness indicator was used, assuming the definition of the Center for Diseases Control and Prevention [21] and used by different authors [17,22–25]: the proportion of data “ignored”, added to the blank fields, concerning the total of notified cases (in percentage). The category “does not apply” was also considered for the calculation of the indicator.

To analyze the incompleteness of the information available in the case notification forms, the mandatory variables were selected: pregnant woman, serotype, final classification, and confirmation/discard criterion. In addition to these, we also opted for the inclusion of essential variables for the investigation of the case or the calculation of epidemiological indicators: race/color, education, area/area of residence, a result of the serological test - IgM, a result of the RT / PCR test, result from immunoenzymatic examination for the detection of NS1 glycoprotein, the evolution of the case, hospitalization. To assess incompleteness we used the following criteria: excellent (incompleteness less than 5%), good (incompleteness between 5.1% to 9.9%), fair (incompleteness between 10% to 19.9%), poor (incompleteness between 20% to 49.9%) and very bad (incompleteness of 50% or more) [23].

In the analysis of differential losses and comparison of data quality between pregnant women and non-pregnant women, we created the category “missing in the system” for all variables, except education, age, and final classification.

The study exposure was “dengue during pregnancy”, defined as all confirmed cases of dengue, regardless of the criteria (clinical-epidemiological, laboratory). As explanatory variables, we used sociodemographic, epidemiological, clinical, and laboratory variables. In Brazil, laboratory confirmation of cases is mandatory in non-epidemic periods but can be performed by clinical-epidemiological criteria (clinical: symptoms such as headache, retro-orbital pain, myalgia, and arthralgia; epidemiological: the first laboratory-confirmed cases) during epidemic periods. Laboratory confirmation is performed by positivity for IgM ELISA, detection of viral RNA via PCR, detection of NS1 viral antigen or positive viral culture [13,15].

For data analysis, we used the SPSS® program (Statistical Package for the Social Sciences) version 20.

We proceeded to the descriptive analysis of the variables employing relative frequency (%) and absolute (N). We estimated the prevalence of pregnant women among dengue cases in women of childbearing age and investigated its association with demographic, epidemiological, clinical, and laboratory characteristics using Pearson’s chi-square test with a significance level of 5%. The strength of the association between the presence of dengue in pregnant women and explanatory variables was assessed by Odds Ratio (OR) and respective intervals with 95% confidence. We used logistic regression to analyze the association between the occurrence of dengue cases among pregnant women and each sociodemographic, epidemiological, clinical, and laboratory variable. We included in the multivariate model the variables that presented $p < 0.200$ in the bivariate analysis. To assess the maintenance of variables in the adjusted model, we used the Backward elimination method by the Wald test. The variables that presented $p < 0.05$ remained in the model. The quality of the fit was assessed by the Hosmer-Lemeshow test.

As the secondary database used in the elaboration of this study is in the public domain and did not contain detailed personal data of the cases, guaranteeing its confidentiality, the evaluation by the Research Ethics Committee is exempted, according to the National Health Council Resolution (CNS) n° 466, of December 12, 2012.

3. Results

The sociodemographic, epidemiological, clinical, and laboratory characteristics of dengue cases in women of childbearing age are described in Table 1. Most cases occurred among adult, white and brown women, living in urban areas and among low schooling. The classic form of dengue or non-serious dengue was the most prevalent (98.4%), with evolution to cure in most cases (92.3%).

In the historical series analyzed, the country experienced three major epidemics (2008, 2010, and 2016) whose effects did not influence the worsening or improvement in the incompleteness indicator or the existence of patterns for data omissions. Although the analyzed group includes women over 10 years of age, for education the category “does not apply” represented 23.4% of the cases. “Ignored” schooling was also high (33.1%). For the confirmation of pregnancy, the category “does not apply”, which should relate to cases of women of non-fertile age or men registered 23.1%, almost the same percentage of ignored cases (24.2%).

The variables “age”, “housing area”, “classification” and “evolution” had a higher percentage of completion. The considerable variation in the percentages of incompleteness compromises the overall quality of the information. Most prevalent omissions occurred in the NS1 antigen (54.9%), hospitalization (60.5%), and serotype (99.4%) variables (Table 1).

Regarding the quality of the data, the analysis per year ranged from good (incompleteness between 5.1 and 9.9%) or regular (incompleteness between 10.0 and 19.9%); however, the same is not observed for the period analyzed as a whole (2007 to 2017). For most of the essential variables, great variability was observed, with classifications ranging from good (incompleteness between 5.1 and 9.9%) to excellent (incompleteness less than 5%), however, regular incompleteness (between 10, 0 to 19.9%). Segmenting by groups, notifications from pregnant women showed less loss of information when compared to women of childbearing age who are not pregnant. The variables race, area of residence, and confirmation criterion (Fig. 2) showed better quality for pregnant women and non-pregnant women, although they have behaved differently over the years analyzed. Serotype was the variable with the worst evolution of the quality indicator, showing significant data loss for pregnant women in 2016 and non-pregnant women between 2010 and 2016, with classification ranging from bad to good (Fig. 2).

The confirmed cases of dengue among pregnant women in the analyzed period corresponded to 1.7% of the total among women of childbearing age. Also among pregnant women, most cases were concentrated among adults aged 20 to 39 years (70.3%), white (32.2%), and brown (43.3%), living in urban areas (84.3%). About 60.2% of the cases were confirmed by clinical-epidemiological criteria and the classic form of dengue or dengue without severity was the most prevalent in the years evaluated (97.4%), evolving to cure in most cases (92, 0%). Data omission was more common among the essential NS1 antigen (58.1%) and RT-PCR (29.8%) variables, in addition to hospitalization (58.3%). The mandatory serotype variable showed the highest percentage of omission (98.9%) (Table 2).

After multivariate analysis, all variables under study remained significantly associated with dengue during pregnancy. In the crude analysis, the outcome “dengue during pregnancy” was positively associated with schooling below eleven years of study, being a young adult (20 to 29 years old), and living in the peri-urban area, constituting a risk factor for arbovirus in pregnant women. Living in a rural area was also associated with the outcome after adjustment. We emphasize that indigenous women were 4 times more likely to be pregnant women infected with dengue. Pregnant women with dengue were 1.6 times more likely to be infected with serotype 2, which can be responsible for the most severe forms of the disease. Regarding the evolution of cases, pregnant women with dengue are almost twice as likely to die than to cure. All of these associations remained significant after adjusted analysis (Table 3).

Table 1
Sociodemographic, epidemiological, clinical and laboratory variables of dengue cases in women of childbearing age ($n = 2.121,582$), Brazil, 2007–2017.

Variables	N	%
Education (years of schooling)		
0–4	128,735	6.1
4–8	287,396	13.5
9–11	392,427	18.5
Higher	113,461	5.3
Ignored	702,544	33.1
Not applicable	497,019	23.4
Age Range		
10–19	515,549	24.3
20–29	615,002	29.0
30–39	551,155	26.0
40–49	439,876	20.7
Race/color		
White	571,596	26.9
Black	81,797	3.9
Yellow (Oriental)	19,173	0.9
Brown	711,652	33.5
Indigenous	5851	0.3
Ignored	498,675	23.5
System omission	232,838	11.0
Pregnant		
1st trimester	9076	0.4
2nd trimester	11,774	0.6
3rd trimester	9101	0.4
Gestational age ignored	5546	0.3
Not pregnant	1,082,212	51.0
Not applied	489,985	23.1
Ignored	513,396	24.2
System omission	492	0.0
Area/area of residence		
Urban	1,832,660	86.4
Rural	92,829	4.4
Periurban	7189	0.3
Ignored	8809	0.4
System omission	180,095	8.5
RT-PCR Dosing (Reverse transcription polymerase chain reaction)		
Positive	6684	0.3
Negative	1904	0.1
Inconclusive	382	0.0
Unrealized	1,433,198	67.6
System omission	679,414	32.0
Serology		
Positive	674,767	31.8
Negative	19,368	0.9
Inconclusive	4147	0.2
Unrealized	1,069,343	50.4
System omission	353,957	16.7
NS1 antigen		
Positive	79,076	3.7
Negative	9975	0.5
Inconclusive	371	0.0
Unrealized	868,116	40.9
System omission	1,164,044	54.9
Serotype		
DENV1	8465	0.4
DENV2	915	0.0
DENV3	689	0.0
DENV4	1941	0.1
System omission	2,109,572	99.4
Case Confirmation/Disposal Criterion *		
Laboratory	751,712	35.4
Clinical-epidemiological	1,352,064	63.7
In research	15,540	0.7
System omission	2266	0.1
Hospitalization		
Yes	59,199	2.9
No	746,271	36.6
System omission	1,234,505	60.5

Table 1 (continued)

Variables	N	%
Final classification (Ministry of Health categorization)		
Classic Dengue	1,413,594	66.6
Dengue with complications	18,878	0.9
Dengue hemorrhagic fever (DHF)	5066	0.2
Dengue Shock Syndrome (DSS)	211	0.0
Dengue	673,624	31.8
Dengue with alarm signs	9459	0.4
Serious Dengue	750	0.0
Case evolution		
Cured	1,957,371	92.3
Death by Dengue or other causes	1287	0.1
Ignored	42,340	2.0
System omission	120,584	5.7

Analyzing specifically the categories involved in data quality (“not applicable”, “ignored” and “missing”), for the variables education, race, RT-PCR dosage, and hospitalization, the chance of notification presentation data omission was lower in pregnant women than among non-pregnant women. On the contrary, the variables evolution, area of residence, serology, NS1 antigen, confirmation criterion, demonstrated to be associated with a greater chance of omission among pregnant women than among non-pregnant women, configuring a risk factor for data quality in the first group (Table 3).

4. Discussion

The loss of information due to the incompleteness of variables in the notification forms for dengue cases implies the underutilization of this system [26], reducing its function of generating reliable information for health planning. This can be particularly important in the presence of multiple epidemics, where qualified information can support decision making, avoiding the evolution to serious forms of diseases, given this the case of the differential diagnosis between Severe Acute Respiratory, COVID-19, and dengue, or distinction between severe dengue and common obstetric conditions such as hemoconcentration [15,27].

Dengue is a multifactorial pathology regulated by micro-disorders caused and maintained by human action (such as irregular urban occupation and lacking health infrastructure) [28]. The environmental conditions that support its transmissions, such as temperature and precipitation, have also been listed among the foremost causes of the emergence of infectious agents whose aggressiveness is increasingly implicated in pandemics [29].

Considering that arbovirus is a disease determined by the interrelation between viruses, vectors, humans, and environmental geographic space [28], the complete notification of cases can produce important directions on the social, environmental, and clinical determinants of the disease. Thus, interoperability and integration between the dengue notification system and other information systems, such as hospitals, such as the Hospital Information System of the Unified Health System (SIHSUS), can favor arbovirus surveillance by reducing underreporting, fragmentation, and dispersion of information about users of the health system in several databases, facilitating access and management of knowledge [30,31].

Although it can be considered a system representative of the country's epidemiological situation [32], incomplete data has been a recurring problem not only for dengue [25,32] but for other diseases (neglected or not) such as Chagas disease [33], tuberculosis [31,34], typhoid [35], cancer [24] and other mortality systems [23,36].

The overload of reporting professionals (especially during epidemics) and the lack of training have been identified as the main determinants of underreporting in information systems [23,35,37]. Socioeconomic variables, necessary for monitoring social inequality in the dominions, have been particularly neglected [23,25,36].

Schooling, associated with a higher chance of dengue death due to its



Fig. 2. Incompleteness (in percentage) of the sociodemographic, epidemiological, clinical and laboratory variables of reported cases of dengue among pregnant women and non-pregnant women of childbearing age, Brazil, 2007–2017.

Table 2

Sociodemographic, epidemiological, clinical and laboratory variables according to the group of pregnant women (n = 35.497) and non-pregnant women (n = 2.086,085) infected with dengue, Brazil, 2007–2017.

Variables	Pregnant				p* value
	No		Yes		
	N	%	N	%	
Education (years of schooling)					<0.001
0–4	126,293	6.1	2442	6.9	
4–8	280,881	13.5	6515	18.4	
9–11	382,400	18.3	10,027	28.2	
Superior	111,137	5.3	2324	6.5	
Ignored	694,234	33.3	8310	23.4	
Not applicable	491,140	23.5	5879	16.6	
Age Range*					<0.001
10–19	508,141	24.4	7408	20.9	
20–29	599,011	28.7	15,991	45.0	
30–39	542,173	26.0	8982	25.3	
40–49	436,760	20.9	3116	8.8	
Ethnic Group*					<0.001
White	560,158	26.9	11,438	32.2	
Black	79,736	3.8	2061	5.8	
Yellow (Oriental)	18,452	0.9	721	2.0	
Brown	696,267	33.4	15,385	43.3	
Indigenous	5413	0.3	438	1.2	
Ignored	494,741	23.7	3934	11.1	
System omission	231,318	11.1	1520	4.3	
Living area/zone*					<0.001
Urban	1,802,724	86.4	29,936	84.3	
Rural	90,809	4.4	2020	5.7	
Periurban	7030	0.3	159	0.4	
Ignored	8710	0.4	99	0.3	
System omission	176,812	8.5	3283	9.2	
RT-PCR Dosage (Reverse transcription polymerase chain reaction)*					<0.001
Positive	6424	0.3	260	0.7	
Negative	1831	0.1	73	0.2	
Inconclusive	373	0.0	9	0.0	
Unrealized	1,408,619	67.5	24,579	69.2	
System omission	668,838	32.1	10,576	29.8	
Serology*					<0.001
Positive	662,368	31.8	12,399	34.9	
Negative	18,898	0.9	470	1.3	
Inconclusive	4014	0.2	133	0.4	
Unrealized	1,052,557	50.5	16,786	47.3	
System omission	348,248	16.7	5709	16.1	
NS1 antigen					<0.001
Positive	77,957	3.7	1119	3.2	
Negative	9655	0.5	320	0.9	
Inconclusive	356	0.0	15	0.0	
Unrealized	854,701	41.0	13,415	37.8	
System omission	1,143,416	54.8	20,628	58.1	
Serotype*					<0.001
DENV1	8196	0.4	269	0.8	
DENV2	859	0.0	56	0.2	
DENV3	675	0.0	14	0.0	
DENV4	1886	0.1	55	0.2	
System omission	2,074,469	99.4	35,103	98.9	
Case Confirmation/Disposal Criterion *					<0.001
Laboratory	737,979	35.4	13,733	38.7	
Clinical-epidemiological	1,330,707	63.8	21,357	60.2	
In research	15,195	0.7	345	1.0	
System omission	2204	0.1	62	0.2	
Hospitalization*					<0.001
Yes	57,270	2.9	1929	5.6	
No	733,849	36.6	12,422	36.1	
System omission	1,214,408	60.6	20,097	58.3	

Table 2 (continued)

Variables	Pregnant				p* value
	No		Yes		
	N	%	N	%	
Final classification (Ministry of Health categorization) *					
Classic Dengue	1,390,581	66.7	23,013	64.8	
Dengue with complications	18,396	0.9	482	1.4	
Dengue hemorrhagic fever (DHF)	4914	0.2	152	0.4	
Dengue Shock Syndrome (DSS)	201	0.0	10	0.0	
Dengue	662,047	31.7	11,577	32.6	
Dengue with alarm signs	9224	0.4	235	0.7	
Serious Dengue	722	0.0	28	0.1	
Final Classification (recategorized) *					<0.001
Dengue	2,052,628	98.4	34,590	97.4	
Dengue with complications	33,457	1.6	907	2.6	
Case evolution*					<0.001
Cured	1,924,719	92.3	32,652	92.0	
Death by Dengue or other causes	1217	0.1	70	0.2	
Ignored	41,543	2.0	797	2.2	
System omission	118,606	5.7	1978	5.6	

* p-values from Pearson's chi-square test.

connection with social disadvantages (Access to information and health services) [38], has not been used in studies due to its high incompleteness throughout the Brazilian territory [23].

Essential for ethnic-racial evaluations, omissions in the race/color variations can transpire because the individual classification is considered to be quite subjective [33,39]. Ethnicity is associated with dengue mortality, especially when considered as a co-determinant of unfavorable socioeconomic conditions, which can be associated with precarious social position and less opportunity to access health services [40,41]. The same reasoning applies to the zone/housing area variable.

Considered among special groups, pregnant women should have their cases confirmed via laboratory by serology or viral isolation in an epidemic scenario [13], which did not occur in this study, where the majority was confirmed only by clinical-epidemiological criteria. The majority of cases confirmed by these criteria - although predicted by the Ministry of Health during epidemic periods [13] - associated with underreporting of laboratory information can make it difficult to understand the local epidemiological situation. The knowledge of the circulating serotype, together with the differentiation of the occurrence of primary and secondary infections via IgM and IgG antibodies, is important for monitoring the spread of the epidemic, as well as for identifying the risks of severe forms of dengue [42], which is particularly important for vulnerable groups. Likewise, the selection of the diagnostic test may reveal evidence of the quality of health care, given that its selection is determined by the time of symptom presentation [13]. In this context, the guarantee of timely monitoring of the case, in addition to preventing the disease from evolving to its severe form, may favor the increase in the capture of the tests by guaranteeing that they are performed promptly and that the notification form in the health units is properly filled out.

Even though it is recognized that pregnant women are more likely to be hospitalized and die as a result of dengue [8,15,43–45], we also find an unfavorable scenario for monitoring cases after notification of infection, with the omission of hospitalization data for approximately half of the cases in both groups evaluated. The immunosuppression inherent in pregnancy, although physiological, seems to be related to the onset of hemorrhagic and severe forms of the disease. The evolution to severe forms can also be related to low-quality prenatal care, since clinical manifestations of dengue can be confused with physiological changes in pregnancy, such as hemoconcentration [9–11,13,14].

As limitations of the study, we can mention the inclusion of

Table 3

Crude and adjusted analysis of sociodemographic, epidemiological, clinical and laboratory factors associated with dengue during pregnancy, Brazil, 2007–2017.

Variables	Crude Analysis		Adjusted Analysis	
	OR (95% CI)	p-value	OR (95% CI)	p-value
Education (years of schooling)		0.000		<0.001
0–4	Reference		Reference	
4–8	1.200 (1.145–1.257)		1.112 (1.060–1.166)	
9–11	1.356 (1.297–1.418)		1.147 (1.096–1.201)	
Superior	1.081 (1.021–1.145)		0.911 (0.859–0.967)	
Ignored	0.619 (0.592–0.648)		0.800 (0.762–0.841)	
Not applicable	0.619 (0.590–0.649)		0.841 (0.799–0.885)	
Age Range		0.000		<0.001
10–19	Reference		Reference	
20–29	1.831 (1.781–1.883)		1.878 (1.825–1.933)	
30–39	1.136 (1.102–1.172)		1.154 (1.118–1.191)	
40–49	0.489 (0.469–0.510)		0.498 (0.477–0.520)	
Ethnic Group		0.000		<0.001
White	Reference		Reference	
Black	1.266 (1.207–1.327)		1.257 (1.197–1.320)	
Yellow (Oriental)	1.914 (1.772–2.066)		1.930 (1.785–2.086)	
Brown	1.082 (1.056–1.109)		1.077 (1.050–1.105)	
Indigenous	3.963 (3.589–4.376)		4.283 (3.863–4.749)	
Ignored	0.389 (0.375–0.404)		0.483 (0.463–0.504)	
System omission	0.322 (0.305–0.340)		0.380 (0.357–0.403)	
Case evolution*		0.000		<0.001
Cured	Reference		Reference	
Death by Dengue or other causes	1.789 (1.384–2.312)		1.789 (1.384–2.312)	
Ignored	1.488 (1.382–1.603)		1.488 (1.382–1.603)	
System omission	1.068 (1.017–1.122)		1.068 (1.017–1.122)	
Living area		0.000		<0.001
Urban	Reference		Reference	
Rural	1.340 (1.208–1.402)		1.123 (1.071–1.176)	
Periurban	1.362 (1.163–1.594)		1.250 (1.066–1.467)	
Ignored	0.684 (0.561–0.835)		1.062 (0.863–1.306)	
System omission	1.118 (1.078–1.160)		1.296 (1.247–1.346)	
RT-PCR Dosage (Reverse transcription polymerase chain reaction)*		0.000		<0.001
Positive	Reference		Reference	
Negative	0.985 (0.756–1.284)		0.923 (0.662–1.288)	
Inconclusive	0.596 (0.304–1.168)		0.699 (0.346–1.414)	
Unrealized	0.431 (0.381–0.488)		0.679 (0.545–0.846)	
System omission	0.391 (0.345–0.443)		0.565 (0.453–0.705)	
Serology		0.000		<0.001
Positive	Reference		Reference	
Negative	1.329 (1.210–1.458)		1.410 (1.275–1.559)	
Inconclusive	1.770 (1.488–2.106)		1.537 (1.277–1.852)	
Unrealized	0.852 (0.832–0.872)		1.024 (0.958–1.093)	
System omission	0.876 (0.849–0.904)		1.198 (1.119–1.282)	
NS1 antigen		0.000		<0.001
Positive	Reference		Reference	
Negative	2.309 (2.036–2.619)		1.923 (1.671–2.212)	
Inconclusive	2.935 (1.745–4.937)		1.916 (1.088–3.374)	
Unrealized	1.093 (1.028–1.163)		1.112 (1.025–1.207)	
System omission	1.257 (1.183–1.335)		1.308 (1.206–1.419)	
Serotype*		0.001		<0.001
DENV1	Reference		Reference	
DENV2	1.986 (1.477–2.671)		1.609 (1.161–2.231)	
DENV3	0.632 (0.367–1.088)		0.601 (0.346–1.044)	
DENV4	0.889 (0.662–1.193)		1.016 (0.748–1.380)	
System omission	0.516 (0.456–0.582)		0.836 (0.684–1.020)	
Case Confirmation/Disposal Criterion		0.000		<0.001
Laboratory	Reference		Reference	
Clinical-epidemiological	0.862 (0.844–0.881)		0.902 (0.846–0.962)	
In research	1.220 (1.095–1.359)		1.046 (0.921–1.189)	
System omission	1.512 (1.174–1.947)		1.296 (1.002–1.676)	
Hospitalization		0.000		<0.001
Yes	Reference		Reference	
No	0.503 (0.479–0.528)		0.582 (0.551–0.615)	
System omission	0.491 (0.469–0.515)		0.533 (0.505–0.563)	

confirmed cases based on clinical and clinical-epidemiological criteria, which although it is an orientation of the Brazilian Ministry of Health during epidemic periods (except for special groups such as pregnant women) [13], did not exclude the possibility of including cases mistakenly classified as dengue.

Therefore as an individual notification data is not available for confirmation, the erroneous inclusion of non-pregnant women notified as pregnant women (women outside the fertile period or even men) or pregnant women notified as non-pregnant women cannot be excluded.

5. Conclusion

Although the quality of notifications of dengue cases in Brazil has shown limitations due to its incompleteness, the factors associated with arbovirus infection in the group of pregnant women show the potential of this system for monitoring the morbidity and mortality of the disease, considering its multifactorial.

The greater vulnerability of pregnant women requires a surveillance system that guarantees the reliability of the available information and the adequate surveillance of changes in the morbidity and mortality profile of arbovirus in this group. Due to the recognized effect of living conditions on the maintenance of maternal health, ensuring improved reporting can increase the importance of this notification system as an instrument of professional intercommunication on the trajectory of women of childbearing age in the health system. Besides, it can also improve this system as a source of monitoring the Social Determinants of Health, directly associated with dengue epidemics.

Thus, it is recommended that periodic evaluations of the information system be carried out, ensuring that its functioning is monitored efficiently and effectively, in addition to the critical and continuous training of all those involved in filling out notifications and in the management of health information.

Acknowledgements

This research was supported by Minas Gerais State Foundation for Research Development (FAPEMIG), Minas Gerais, Brazil (Universal Demand APQ – 02554-18) and Funarbe Research Support Program for Young Faculty Researchers, Federal University of Viçosa, Viçosa, Minas Gerais, Brazil.

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