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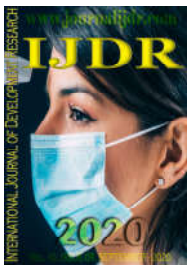

RESEARCH ARTICLE OPEN ACCESS

SPATIAL DISTRIBUTION OF SYPHILIS CASES IN PREGNANT WOMEN IN BELÉM-PA CITY

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ABSTRACT

Objective: establish the spatial distribution of syphilis cases in pregnant women in the Belém-PA city and analyze its incidence, correlating its occurrence with characteristics. **Method**: this study is ecological, longitudinal, descriptive and inferential cross-sectional that was carried out in the Belém-PA city, in the period of 2017 and 2018. We analyzed 8 districts and 71 districts of the of Belém-PA city involving 1,171 pregnant women diagnosed with gestational syphilis between 2007 and 2017 during the prenatal care performed by the Unified Health System, using data from the Sistema de Informação de Agravos e Notificações (SINAN) and Secretaria Municipal de Saúde e Meio ambiente (SESMA) de Belém-PA. **Results**: we observed a heterogeneous distribution of cases over the years, with an important increase starting in 2015. Regarding the sociodemographic profile of pregnant women, the disease affected mainly women aged 19 to 21 years, with low level of education and who started prenatal care in the third trimester of pregnancy. The districts with the highest incidence rates of the disease were Outeiro (20.8 cases/10 thousand women), Entroncamento (19.9 cases/10 thousand women) and Icoaraci (19.0 cases/10 thousand women). The neighborhoods that had the highest incidence rates were Pratinha (236.1 cases / 10 thousand women), Paracuri (74.2 cases/10 thousand women) and Ariramba (70.6 cases/10 thousand women) and had social vulnerability indexes considered high (3.3/3.3) and average (2.8) respectively. **Conclusions**: we must to consider that gestational syphilis is agreat problem, especially due to its high incidence in the districts of the city. This reinforces the need for further studies that detail the local casuistry involved, aiming to help in the implementation of public policies aimed at improving social assistance aimed at women's health in Belém-PA city.

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INTRODUCTION

Syphilis is an infectious disease first described at the end of the 15th century, with rapid spread in the European continent, becoming, at the time, one of the main global diseases[1].Despite the intersectoral actions taken to eradicate it, especially the congenital form, as well as the low cost of tests and treatment, there are still reports and cases of syphilis discovered during pregnancy and, in some circumstances, at the time of delivery; thus concluding that the strategies to eliminate this disease did not reach the expected success in Brazil and in the world[2]. According to the Ministério da Saúde (Ministry of Health) (2015), it is estimated that there are an average of one million cases of syphilis among pregnant women per year. In order to reduce this number, in 2011 the federal project "stork network" was created, aiming to ensure the right to humanized care during prenatal and childbirth, with access to the diagnosis and treatment of syphilis from primary care. Such

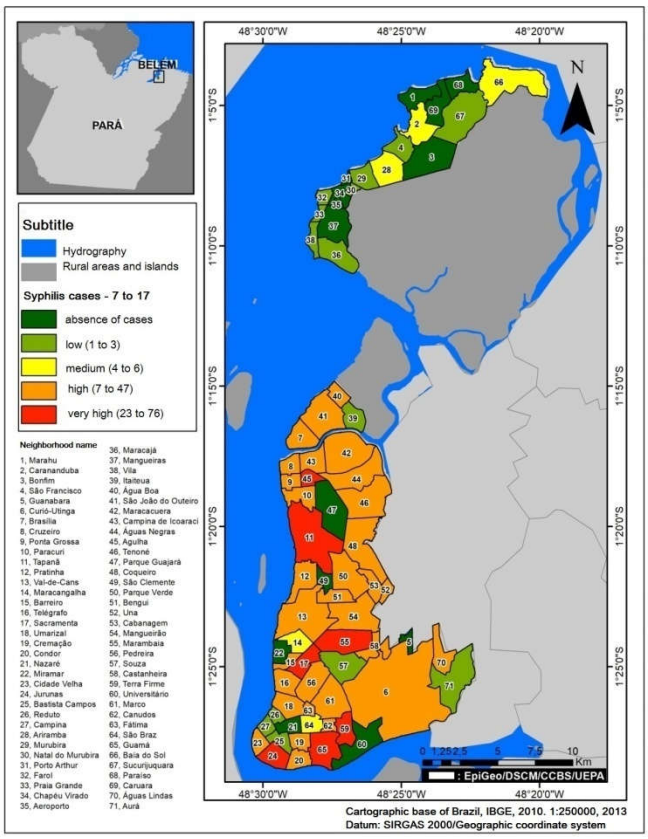
intervention has allowed increasing the number of early diagnoses of the disease[3]. In 2013, there was a considerable increase in the reporting of syphilis cases in pregnant women across Brazil, with the majority of cases diagnosed in the third trimester of pregnancy, with a higher percentage in the northern region (50.9%). High rates of untreated cases were also evidenced in Santa Catarina, Paraná, Espirito Santo, Pernambuco and Roraima, identifying flaws in the quality of prenatal care, leading to an increase in cases[3]. Still in order to reduce this situation, in 2014, the Pan American Health Organization (PAHO) created the regional committee to validate the elimination of maternal-infant transmission of Human Immunodeficiency Virus (HIV) and syphilis, aiming at achieving a congenital syphilis incidence rate of 0.5 cases for every 1000 live births[3]. However, according to the 2017 epidemiological bulletin, in Brazil, this goal is still far from being reached, since 20.4 cases of congenital syphilis were estimated for every 1000 born live in the year 2016[4]. With regard to the northern region, according to the Epidemiological Bulletin of Syphilis 2016, 9,813 cases of syphilis were reported in pregnant women between the years 2005 and 2016, representing 5.78% of the national sample. In addition, the state of Pará was responsible for 4,836 cases of vertical transmission of the disease[5]. According to a second study carried out in Belém on the analysis of cases of congenital syphilis in the period from 2004 to 2008, comparing the cases of congenital syphilis reported in the Diseases and Notifications Information System (SINAN) to those reported in the Mortality Information System (SIM), an underreporting rate of 8.63% was estimated[6]. Given this scenario, it is proposed to perform a spatial analysis of syphilis cases in pregnancy in the Belém-PA city in recent years. This study will be done through the districts and administrative districts of the city. In this way, it is possible to understand the relationship of this condition with sociodemographic and environmental factors, regarding the characteristics of the offers of access to health services and social vulnerability.

METHODOLOGY

This is an ecological, longitudinal, descriptive and inferential, cross-sectional study on cases of syphilis in pregnant women, carried out in Belém-PA from May 2017 to February 2018. The study was carried out in Belém, capital of the state of Pará, a city divided into eight Administrative Districts (DA): DAMOS (Mosqueiro), DAOUT (Outeiro), DAICO (Icoaraci), DABEN (Benguí), DAENT (Entrocamento), DASAC (Sacramenta), DABEL (Belém) and DAGUA (Guamá), which are composed of 71 neighborhoods[8]. In the approach of this study, syphilis in pregnancy was considered all pregnant with reagent serology, with any titration or rapid test or with a positive result of a treponemal test, performed during prenatal care9. Official data from secondary sources in the files belonging to SINAN and the Municipal Health and Environment Secretariat (SESMA) were used, thus allowing the analysis of pregnant women with syphilis from the public network / SUS, for the years 2007 to 2017. After analysis and systematization of data, maps were prepared according to the distributed cases. To classify the social vulnerability index (SVI), the model developed by the Papa João XXIII Foundation (FUNPAPA) was used, being broken down below (1–2); medium (2.1–3.0); high (3.1–4.0); and very high (4.1–5)[10]. Geoprocessing was carried out using two databases (DB), one related to cases of syphilis in pregnant women in the period from 2007 to 2017, from SINAN, and the other containing the family health strategy (FHS) units, provided by SESMA, both DBs referring to the Belém-PA city. After their acquisition, the data of the selected variables was filtered, in order to remove the incompleteness, redundancies and inconsistencies; this debugging process was performed using the TabWin 3.6 program. For syphilis, data in pregnancy cases were distributed by neighborhood and administrative districts in series for every two years, and used for the classification of quartile cases. The classification of the distribution of cases by neighborhood was as follows: 1 to 3, low; from 4 to 6, medium; from 7 to 47 high and above 47 very high. The classification of the distribution of cases by administrative districts was 1 to 4, low; 5 to 14, medium; 14 to 24, high and above 24 very high. The data classified by districts and administrative districts were expressed in the form of thematic maps of the entire historical series. Subsequently, these data were correlated to the specific distribution of the ESF's, with two maps of this correlation, one at the level of the neighborhoods and the other at the level of the administrative districts. Visual expressions through maps were generated using TerraView 4.3.2.1 software. The data obtained were stored in a Microsoft Excel table. To obtain the incidence of syphilis in pregnant women in the period from 2007 to 2017, the 2010 resident population was based on population, according to data from the 2010 IBGE census and the 2010 Municipal statistical Atlas. As this is a study in which secondary and public domain data were used, it followed the guidelines of the Comissão Nacional de Ética em Pesquisa (National Research Ethics Commission) (CONEP), requiring no submission to the local Ethics and Research Committee - Comitê de ética e Pesquisa (CEP).

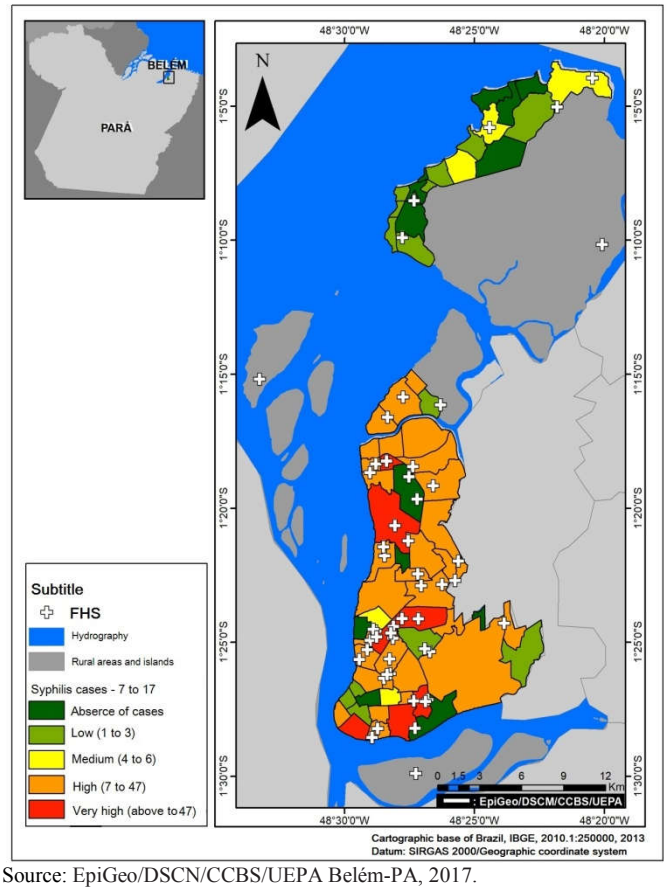
RESULTS

In the analysis of the sociodemographic variables, the notifications showed that the pregnant women with syphilis were more in the age group of 18 to 21 years old (30.7%), with incomplete elementary school (32.2%), the majority being residents in the neighborhoods of Guamá (5.98%), Jurunas (5.89%) and Tapanã (6.75%). It was also observed that the majority had the diagnosis notified in the third trimester of pregnancy (58.5%), using benzathine penicillin G 7,200,000 IU (50.6%). In the 11 years of notification of syphilis during pregnancy in Belém-PA, 1,171 cases were found, coming from the eight administrative districts of the city that, in general, followed the sociodemographic movements of the disease at the national level. However, the importance of the study was to identify the peculiarities of syphilis by district and inter-neighborhood, as shown in Figure 1, which distributes the absolute data of all pregnant women with syphilis in Belém-PA city, in the years of 2007-2017, we classified the neighborhoods as low, medium, high and very high occurrence. Likewise, information within the same pattern as the territoriality of the spatial distribution of health services by neighborhoods was valued, where syphilis cases were diagnosed and reported in the prenatal period (Figure 2). When the same geographical assessment of syphilis cases in pregnant women is seen in relation to the availability of health services in the district perspective, adding up all the cases of the neighborhoods that compose them, a different and more serious situation is observed, according to the situation Figure 3. It was considered important to show these results evaluated every two years with the absolute values of notifications by neighborhoods, with changes in the study period being observed, starting from 2007 to 2008 with most neighborhoods



Source: EpiGeo/DSCN/CCBS/UEPA Belém-PA, 2017

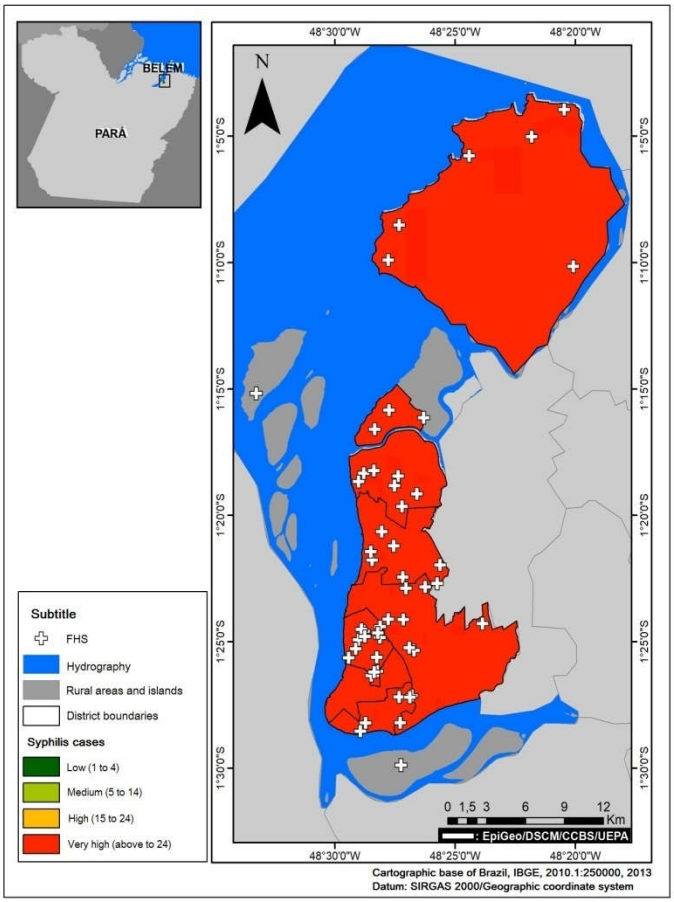
Figure 1- Spatial distribution of syphilis cases in pregnant women by neighborhood, period of2007-2017, Belém-PA



Source: EpiGeo/DSCN/CCBS/UEPA Belém-PA, 2017.
*FHS- Family health strategy

Figure 2. Spatial distribution of syphilis cases in pregnant women and ESF´s by neighborhood, 2007-2017 period, Belém-PA

with no cases (51/71); 2009 to 2010 with almost half of the neighborhoods already reporting cases (33/71); between 2011 and 2012 the pattern remains, but there is a greater number of cases in all districts; with a noticeable reduction between 2013 and 2014; which changes completely between 2015 and 2017, when there were only no notifications in 15/71 neighborhoods, greatly increasing the absolute number of cases.



Source: EpiGeo/DSCN/CCBS/UEPA Belém-PA, 2017

Figure 3. Spatial distribution of syphilis cases in pregnant women by districts of Belém, 2011-2012 period, Belém-PA

Thus, the growing number of cases was noticeable, and more pronounced between 2015 and 2017, with 266, 321 and 190 cases respectively. When detailing the distribution by district, in absolute numbers, there was a higher concentration of cases in Benguí (270) and Guamá (263). On the other hand, relating this number to the general population of women and the age group of reproductive age, higher rates are observed in the districts of Outeiro, Entroncamento and Icoaraci, with 27.8, 26.6 and 25.4 cases in women, respectively between 15 and 45 years for every ten thousand (Table 1). Regarding the distribution by neighborhoods, relating the incidence rate to the female population, the highest rates were identified in the neighborhoods of Pratinha, Ariramba and Paracurí (Table 2).

DISCUSSION

Pregnancy is a time of greater closeness and the demand of women for health services to perform prenatal care, which is an important component of women's health care. Its practice allows greater knowledge about the occurrence of certain diseases, such as sexually transmitted infections, such as syphilis[11].

Table 1. Incidence of Syphilis in Belém-PA, and in the Districts, from 2007 to 2017, based on the population contingent for the year 2010

	Female population	Cases	Cases/10 Thousand	Age 15 to 45	Cases/10 Thousand
DABEL	106 960	64	6.0	80 006	8.0
DABEN	148 009	270	18.2	110 711	24.4
DAENT	66 432	132	19.9	49 691	26.6
DAGUA	164 006	263	16.0	122 676	21.4
DAICO	85 626	163	19.0	64 048	25.4
DAMOS	16 600	29	17.5	12 417	23.4
DAOUT	19 259	40	20.8	14 406	27.8
DASAC	136 228	179	13.1	101 899	17.6
Ignored	---	31	---	---	---
Belém	743 120	1171	15.8	555 854	21.1

Source: Secretaria Municipal de Saúde de Belém-PA, 2017.

Table 2. Incidence rate of syphilis in Belém-PA in the main neighborhoods, in the period from 2007 to 2017, based on the population contingent in 2010

District	Neighborhood	Inciden rate/ Female population to neighborhood
DAICO	Águas Negras	39.9
	Paracurí	74.2
DABEL	Cidade velha	16.7
	Fátima	13.5
DAMOS	Ariramba	70.6
	Murubira	68.2
DAOUT	Brasília	52.9
	São João do Outeiro	18.1
DAENT	Castanheira	20.9
	Marambaia	17.1
DAGUA	Jurunas	20.2
	Terra Firme	18.2
DABEN	Pratinha	236.2
	Benguí	28.6
DASAC	Sacramenta	23.0
	Telégrafo	20.2

Source: Secretaria Municipal de Saúde de Belém-PA, 2017.

The Epidemiological Bulletin of syphilis for the year 2017 registered an increase in the number of cases in the last five years in the country, with the state of Pará showing a rate of detection of the disease in pregnant women of 9.7 cases for every 1000 live births. In addition, in 2005 gestational syphilis started to be considered a disease of mandatory notification, registering 111 cases of the disease in that state. Since then, the disease data system has been strengthened, with a progressive increase in the number of cases reaching 896 in 2011 and 1389 in 2016[4]. This fact is observed in this study as an advance in the registration and notification of cases. In the years 2007 to 2008, the number of records in the Belém-PA city was 53 cases of the disease in pregnant women. Its distribution among the neighborhoods showed that 51 neighborhoods (71.8%) did not have any notified cases of the disease during pregnancy. Between 2009 and 2010, the number of reported cases doubled, to 109 cases, of which only 37 neighborhoods (52.1%) did not report any cases of the disease. In the years, 2011 and 2012, 121 cases were reported, of which only 35 neighborhoods (49.2%) did not report any cases of the disease. Thus, it is observed that even though there has been an increase in the number of cases, this has occurred in parallel with the improvement of public health surveillance policies. Notwithstanding, the increase in the prevalence of the disease throughout the country has been accentuated mainly since the year 2015. In this study, 18 cases of syphilis in pregnant women in 2007 were reported in Belém-PA city, reaching 266 in 2015 and 321 in 2016. It is believed that the event can be attributed to several factors, such as the expansion of access to rapid tests in basic health units, resistance to the application of penicillin by health professionals and a reduction in the use of condoms by the population[4].

In Brazil, the detection rate went through an important increase from 8.9 to 12.4 between the years 2014 to 20164. This fact was also observed between the years 2014 and 2015 in Belém city with the exponential increase in the number of cases. Between the years 2013 to 2014, only six neighborhoods reported between 4 to 6 cases (medium level) and 4 neighborhoods already reported between 7 to 47 cases (high level), this being the highest level of involvement presented in these two years analyzed. Between 2015 and 2016, about 27 districts started to present between 7 to 47 cases (high level), 8 districts started to present between 4 to 6 cases (medium level) and 19 districts started to present 1 to 3 cases. Even those neighborhoods that had no cases detected in all previous years started to present them, even at low levels, once again reinforcing the syphilis epidemic found in this period. This problem could be related to the shortage of penicillin worldwide during this period, making treatment difficult, and a determining factor in combating the spread of the disease. However, few recent studies address the absence of penicillin as a contributing factor. As an emergency measure to try to alleviate the problem, pregnant women became part of the priority group for receiving and accessing medication in the treatment of gestational syphilis, which was not enough to contain their progress[12].

Among the risk factors involved with the occurrence of the disease, there are young age, low education, low income and unstable marital status[13]. In the present study, the ages most affected by pregnant women ranged from 18 to 29 years, corresponding to 70% of the sample, followed by the age group of 13 to 17 years, corresponding to 15.6%, and followed by the age group of 30 to 42 years with 14% of the cases, which revealed compatibility with national data as observed in

the historical series from 2005 to 2017 that most pregnant women, about 51.6%, were in the age group between 20 to 29 years, followed by 24.3% between 15 and 19 years and 20.2% between 30 and 39 years[4]. A study in the region of Sumaré, in the interior of São Paulo, carried out in 2007, presented a median age of 25 years in the affected pregnant women, with 8 years of standard deviation for more or less[14]. In Marabá, 170 pregnant women with syphilis between 2008 and 2010 were analyzed, with an average age of 20 to 34 years among those affected[15]. A cohort study carried out at a national level with 23,894 women between the years 2011 to 2012 also had the findings similar to those described above, with 70.4% of their sample aged between 20 and 34 years[16]. At the regional level, there is a study carried out in the largest public maternity hospital in the north involving 444 parturients with a high prevalence of the disease and who found greater involvement in the second decade of life[17]. Another study in Recife involving 561 pregnant women showed an involvement between 20 and 24 years of age[18], reinforcing the epidemiological harmony among the authors mentioned. Such data indicate a strong correlation with the risk factors already mentioned.

Another factor intimately involved in the casuistry of the disease is adequate access to health, including infrastructure, prenatal care, qualified professionals, materials for procedures and medications. However, scrapping in the basic network of the Municipal Health Units (UMS) has contributed to the low quality of the services offered. Analysis carried out by SESMA de Belém in primary care in 2013, which evaluated the coverage of the Family Health Strategy (ESF) program, found a drop in its coverage in the years 2011 and 2012 compared to the period from 2006 to 2010 Such occurrence compromised health actions, mainly in the neighborhoods that make up the Administrative Districts of Icoaraci,Entroncamento, Sacramenta, Guamá and Belém (DABEL), which have less staff coverage, possibly constituting an important factor related to the increase in cases of gestational syphilis. In the Belém city, despite an increase in the number of prenatal consultations provided in all units over the years, in 2011 a survey by the city government found that 62.28% of pregnant women had seven or more consultations. However, it was noted that there was no reduction in the infant mortality rate in the same period, indicating a low quality and resolution of the prenatal care offered10. Another more current analysis carried out in a reference hospital in Belém-PA, in 2018, found a high number of cases of congenital syphilis in the period from 2004 to 2013, detecting 754 cases, which are reflections of failures in pre- that affect the occurrence of syphilis[19]. The results obtained also showed a higher incidence found in the districts of Icoaraci (DAICO), Entroncramento (DAENT) and Outeiro (DAOUT). The fact that the districts of Belém-PA city have this purely administrative division hinders a real analysis of the problem situation, also needing to identify the rates found in the division by neighborhoods, among which the highest incidence rates were in Pratinha, Paracuri and the Ariramba. Furthermore, it was possible to define that the absolute values of cases found in this study were of secondary importance, since it does not take into account the existing population contingent for each neighborhood and for this reason, they can induce the incorrect interpretation of the data. To understand the prevalence of Syphilis in Belém-PA city, it is necessary to consider all related multidimensional factors, such as social, cultural, environmental, housing, territorial and socioeconomic conditions, which directly correlate with the SVI and the presence of subnormal clusters[20]. The SVI is defined as a set of synthetic indicators that assess individuals who live in situations indicative of exclusion and where the population is most vulnerable due to the low level of social development. Such index can indicate difficulty in accessing public policies, unemployment, ethnic, cultural and sexual exclusion; use of psychoactive substances and victims of violence[21,10]. Among the analysis of the metropolitan regions, Belém presented a 14.3% reduction in the SVI in the period from 2011 to 2015, being below only Salvador with 15.5% [22]. In this sense, it is important to further characterize the subnormal clusters, which consist in irregular and disordered housing units, inferring to these places the lack of basic public services. According to IBGE, more than half of the population residing in Belém lives in these agglomerations, mainly in the neighborhoods of Guamá, Jurunas, Condor and Terra Firme [8,10].

In this study, it was observed that the occurrence of gestational syphilis increased somewhat over the years, despite the improvement in SVI in the years 2015 to 2017. It is worth noting, however, that the neighborhoods with the highest rates of syphilis incidence (Paracurí, Ariramba and Pratinha) are characterized by high rates of inequality, violence and subnormal agglomerations. This completely socio-environmental and demographic profile justifies the explosion of syphilis transmission. Most of the population in these neighborhoods has a monthly income of half to a minimum wage, reflecting their low purchasing power. Both the Paracurí and Pratinha neighborhoods are assisted by the Icoaraci Rehabilitation and Social Assistance Center (CRAS), which has the largest SVI (3.3) found in Belém city. The Ariramba neighborhood, the third highest incidence (70.6), has an SVI considered average (2.8). On the other hand, other neighboring neighborhoods that live with the same reality described did not present any case reported in the eleven years of this study, a fact that is probably related to its extensive territory and the presence of a few FHS, generating failures of surveillance and consequently underreporting of cases in that district[10]. The district of Belém, which consists of eight neighborhoods and has only one FHS, reported 64 cases in the period, with the lowest incidence rate (6.0) in the study. Such data can be explained by the best social indicators of this district, such as better infrastructure, higher education level, better policing and lower crime rate in relation to all others. In addition to the higher socioeconomic levels of the inhabitants, which allows many pregnant women to perform prenatal care and assistance through the private network, not being among the reported cases.

Therefore, it is concluded that there is a heterogeneous spatial distribution of gestational syphilis between the districts and districts of Belém-PA city, with a change in the number of cases over the eleven years analyzed, intensifying after the year 2015, which can be explained by the increase in the number of diagnoses and notifications. In addition, it can be explained by the increase in the number of cases. The highest incidence rates of the disease were found in the districts of Outeiro, Entroncamento and Icoaraci, and in the neighborhoods of Pratinha, Paracurí and Ariramba, with the correlation between the occurrence of syphilis and the social vulnerability indexes being considered, considered as medium and high in the neighborhoods who had a higher number of cases of the disease, demonstrating their relationship with housing conditions and basic sanitat. Thus, it is inferred that the wealth of data found in this research demonstrates the need

to continue the project through more detailed studies to understand the determining factors involved in the occurrence of the disease in pregnant women in each neighborhood and district and, through them, propose improvements in the assistance, educational, social and health spheres aimed at obtaining a reduction in the number of syphilis cases in Belém-PA city.

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