

ASPECTS OF THE EPIDEMIOLOGICAL DYNAMICS OF ACQUIRED SYPHILIS AND GESTATIONAL SYPHILIS BETWEEN 2010 AND 2021 IN A STATE OF THE NORTHEAST REGION OF BRAZIL

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ABSTRACT: To characterize the epidemiological dynamics of acquired syphilis and gestational syphilis in the state of Maranhão, between 2010 and 2021. Methods: Confirmed cases of acquired syphilis between 2010 and 2021 and of gestational syphilis between 2010 and 2020, in the state of Maranhão, available by the *Sistema de Informação de Agravos de Notificação* (SINAN) were analyzed. Results: The year 2018 had the highest number of reports of acquired syphilis (1.787 cases; $p < 0.0001$). The municipality of Duque Bacelar (East Mesoregion) had the highest incidence rate (285.5 per 100,000 inhabitants), for acquired syphilis, in the triennium 2016 to 2018. Regarding gestational syphilis, the year 2018 also stood out (1,892 cases; $p < 0.0001$) as the one with the highest number of records. The municipality of Buriticupu (West Mesoregion) had the highest detection rate of gestational syphilis (42.4 per 1,000 live births) in the biennium 2019 and 2020. Conclusions: The data presented showed municipalities with higher rates of acquired syphilis and gestational syphilis, concentrating located respectively in the East

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and West Mesoregions of the state of Maranhão. The findings obtained in the present study gather useful information for monitoring areas with a high incidence of the disease, thus contributing to the discussion and implementation of effective strategies to reduce cases.

KEYWORDS: Sexually Transmitted Diseases; Syphilis; Gestation.

ASPECTOS DA DINÂMICA EPIDEMIOLÓGICA DA SÍFILIS ADQUIRIDA E DA SÍFILIS GESTACIONAL ENTRE 2010 E 2021 EM UM ESTADO DA REGIÃO NORDESTE DO BRASIL

RESUMO: Caracterizar a dinâmica epidemiológica da sífilis adquirida e da sífilis gestacional no Maranhão, entre 2010 e 2021. Métodos: Foram analisados os casos confirmados de sífilis adquirida entre 2010 e 2021 e de sífilis gestacional entre 2010 e 2020, no Maranhão, disponíveis pelo *Sistema de Informação de Agravos de Notificação* (SINAN). Resultados: O ano de 2018 teve o maior número de notificações de sífilis adquirida (1.787 casos; $p < 0,0001$). O município de Duque Bacelar (Mesoregião Oriental) teve a maior taxa de incidência (285,5 por 100.000 habitantes), para a sífilis adquirida, no triênio 2016 a 2018. Em relação à sífilis gestacional, o ano de 2018 também se destacou (1.892 casos; $p < 0,0001$) como o com o maior número de registros. O município de Buriticupu (Mesoregião Ocidental) teve a maior taxa de detecção de sífilis gestacional (42,4 por mil nascidos vivos) no biênio 2019 e 2020. Conclusões: Os dados apresentados mostraram municípios com maiores taxas de sífilis adquirida e sífilis gestacional, concentrando-se localizados respectivamente nas Mesoregiões Leste e Oeste do Estado do Maranhão. Os achados obtidos no presente estudo reúnem informações úteis para o monitoramento de áreas com alta incidência da doença, contribuindo assim para a discussão e implementação de estratégias eficazes para a redução de casos.

PALAVRAS-CHAVE: Doenças Sexualmente Transmissíveis; Sífilis; Gestação.

ASPECTOS DE LA DINÁMICA EPIDEMIOLÓGICA DE LA SÍFILIS ADQUIRIDA Y LA SÍFILIS GESTACIONAL ENTRE 2010 Y 2021 EN UN ESTADO DE LA REGIÓN NORESTE DE BRASIL

RESUMEN: Caracterizar la dinámica epidemiológica de la sífilis adquirida y la sífilis gestacional en el estado de Maranhão, entre 2010 y 2021. Métodos: Se analizaron casos confirmados de sífilis adquirida entre 2010 y 2021 y de sífilis gestacional entre 2010 y 2020, en el estado de Maranhão, disponibles por el *Sistema de Informação de Agravos de Notificação* (SINAN). Resultados: El año 2018 tuvo el mayor número de reportes de sífilis adquirida (1,787 casos; $p < 0,0001$). El municipio de Duque Bacelar (Mesorregión Este) tuvo la mayor tasa de incidencia (285,5 por 100.000 habitantes), por sífilis adquirida, en el trienio 2016 al 2018. En cuanto a la sífilis gestacional, también se destacó el año 2018 (1.892 casos; $p < 0,0001$) como el de mayor número de registros. El municipio de Buriticupu (Mesorregión Oeste) tuvo la tasa más alta de detección de sífilis gestacional (42,4 por 1.000 nacidos vivos) en el bienio 2019 y 2020. Conclusiones: Los datos presentados mostraron municipios con mayores tasas de sífilis adquirida y gestacional, concentrándose respectivamente en las Mesorregiones Este y Oeste del estado de Maranhão. Los hallazgos obtenidos en el presente estudio reúnen información útil para el seguimiento de áreas con alta incidencia de la enfermedad, contribuyendo así a la discusión e implementación de estrategias efectivas para disminuir los casos.

PALABRAS CLAVE: Enfermedades de Transmisión Sexual; Sífilis; Gestación.

1. INTRODUCTION

Syphilis is a chronic evolving infection caused by the bacterium *Treponema pallidum* and that is exclusive to the human species (WILLCOX; GUTHE, 1966), presenting several clinical manifestations through the different stages (primary, secondary, latent, and tertiary syphilis) (KIRIENCO; ULIANA; MOREIRA, 2022). Primary phase is mainly characterized by the emergence of a typically single, painless lesion, and secondary phase occurs between six weeks and six months after healing of the initial wound, and is characterized by the appearance of spots on the body (DE SOUSA *et al.*, 2022). The latency period, on the other hand, is an interval in which there are no manifestations of the infection (CAVALCANTE *et al.*, 2019). Without adequate diagnosis and treatment, the infection can progress to the tertiary level (tertiary syphilis), usually with skin, bone, cardiovascular and neurological lesions (neurosyphilis), which can lead to death (KIRIENCO; ULIANA; MOREIRA, 2022).

The infection can be acquired through sexual contact, as one of the most common sexually transmitted infections (STI) during the gestational period, blood transfusion and vertically, configuring congenital syphilis (CS) (CAVALCANTE; PEREIRA; CASTRO, 2017).

The diagnosis of syphilis is made by performing laboratory tests, such as the non-treponemal test Venereal Disease Research Laboratory (VDRL) and rapid tests (treponemal), both are simple to perform. In addition, there is an effective and low-cost treatment, with the use of the benzathine antibiotic penicillin, being used as the main therapeutic method (BRASIL, 2022). Both diagnosis and treatment are provided by the *Sistema Único de Saúde* (SUS) in Brazil (FREITAS *et al.*, 2021).

Despite the available diagnosis and treatment, gestational and congenital syphilis remain a serious public health problem in Brazil, causing serious complications when untreated, such as spontaneous abortion, congenital malformations, stillbirths, and perinatal death (DE SOUSA *et al.*, 2022). In cases where infected children survive, they may present early, when under two years of age, or late manifestations. The most common clinical manifestations such are blindness, deafness, bone, and neurological problems (CAVALCANTE *et al.*, 2019).

According to the 2021 Epidemiological Bulletin of Syphilis, Brazil had 115,371 cases of acquired syphilis, 61,441 cases of gestational syphilis, 22,065 cases of SC and 186 deaths from SC in children under one year old in 2020 (BRASIL, 2021). Among the

Brazilian regions, the Northeast had the lowest detection rate of acquired syphilis (27.2/100000 inhabitants) and gestational syphilis (15.6/1000 live births) in the national ranking (BRASIL, 2021). Maranhão is the state of Brazil that had the highest disability-adjusted life-years (DALYs) of syphilis in Brazil in the years 1990, 2005 and 2019 (BEZERRA *et al.*, 2022). Moreover, according to the bulletin, the state of Maranhão, the second largest state in the Northeast region, obtained a detection rate of 16.8 per 100,000 inhabitants for acquired syphilis, and 11.2 per 1,000 live births for gestational syphilis in 2020 (BRASIL, 2021).

Epidemiological studies carried out in conjunction with spatial techniques are essential for health promotion, as they benefit diseases monitoring and characterization. These techniques allow the identification of regions with high incidence rates and great risk for the disease, as well as special patterns of dispersion. Therefore, the implementation of prevention measures in order to break the chain of transmission can be assertively coordinated by authorities (LAW, 2004).

From this perspective, it is important to know the profile of syphilis involvement, as well as the areas with the highest rates of cases of these infections, and the use of spatial and epidemiological techniques are essential for collecting these data. Given this context, the objective of the present study was to characterize the epidemiological dynamics of acquired syphilis between 2010 and 2021, and gestational syphilis between 2010 and 2020, in the state of Maranhão, Brazil.

2. METHODS

The state of Maranhão is one of the 27 Federative Units of Brazil, located in the Northeast Region. It has an area of 331,937,450 km², with 217 municipalities. Maranhão shares a border with three Brazilian states: Piauí (to the East), Tocantins (South and Southwest) and Pará (West), in addition to the Atlantic Ocean (North). It is the 11th most populous state in the country, with 7,153,262 inhabitants in 2021, and a population density of 19.81 inhabitants/km² in 2010. The capital and most populous city in the state of Maranhão is São Luís. Maranhão is divided into five Mesoregions: North (60 municipalities), West (52 municipalities), Central (42 municipalities), East (44 municipalities) and South (19 municipalities) (IBGE, 2022).

This research is characterized as ecological, descriptive, observational, and retrospective. Data on acquired syphilis from 2010 to 2021, and gestational syphilis from 2010 to 2020, for the state of Maranhão, were analyzed.

The study was carried out by collecting available data on confirmed cases of acquired syphilis and gestational syphilis for the state of Maranhão on the platform of the *Departamento de Informática do Sistema Único de Saúde (DATASUS)*, through access to the sector “*Doenças e Agravos de Notificação – 2007 em diante (Sistema de Informação de Agravos de Notificação - SINAN)*”, from the Ministry of Health of Brazil (BRASIL, 2022). Confirmed cases of acquired syphilis and gestational syphilis were last updated in December 2021, on the aforementioned platform, and were collected on June 9 and 10, 2022.

All confirmed cases of acquired syphilis between 2010 and 2021, and gestational syphilis between 2010 and 2020, in the state of Maranhão, were included in the study. However, all cases that, despite being notified, did not present diagnostic confirmation or that presented inconsistencies regarding its confirmation, were excluded from the analysis.

In this study, the following variables were analyzed: notifications per year and municipality in Maranhão (for acquired syphilis and gestational syphilis); in addition to age range, education, race as well as clinical classification (gestational syphilis). Descriptive analyzes were performed, based on the determination of absolute and relative frequencies for the categorical variables. To calculate acquired syphilis incidence rates per 100,000 inhabitants, the population estimates for Maranhão, made available by IBGE, was used as a reference (IBGE, 2022). Incidence rates were calculated for triennium (2010 to 2012, 2013 to 2015, 2016 to 2018, and 2019 to 2021), by adding the confirmed cases in the three years of each triennium and dividing by the population at risk of becoming ill in the average year of each triennium (2011, 2014, 2017, and 2020, respectively), and multiplying this result per 100,000 inhabitants. For gestational syphilis, to calculate the detection rates per 1,000 live births, information from the *Departamento de Informática do Sistema Único de Saúde (DATASUS)*, was used as references through access to the sector “*Nascidos Vivos – Brasil*”, from the Ministry of Health of Brazil (BRASIL, 2022). Detection rates were calculated for the three-year periods 2010 to 2012, 2013 to 2015, 2016 to 2018; and, for the biennium 2019 to 2020, adding the confirmed

cases in the three or two years, and dividing by the average number of live births in those years and multiplying this result by 1,000.

Data were submitted to the Shapiro-Wilk test of normality. As it did not fit the normal distribution, corresponding non-parametric analyzes were used. To examine whether there was a difference in the medians of confirmed cases of gestational syphilis among study years, age range, schooling, race, and clinical classification, the Kruskal-Wallis (H) analysis was performed. When there was a difference, Dunn's posteriori test was executed (AYRES *et al.*, 2007; SIQUEIRA; TIBÚRCIO, 2011).

The significance level adopted in all analyzes was 5% ($p < 0.05$). Data were managed using Microsoft Excel 2013 (Washington, United States of America) and GraphPad Prism 7 (San Diego, United States of America) softwares.

To calculate the Global Moran Index (I) and Local Indicators of Spatial Association (LISA) of confirmed cases of gestational syphilis, a first-order neighborhood matrix (Queen) was created to verify the relationship of dependence among neighboring areas that border each with shared vertices (MORAN, 1948; ODLAND, 1988).

Similar clusters presented by LISA as High/High may influence neighboring sectors. In this study, the I value that showed positive spatial autocorrelation and all areas of High/High identification in the LISA were classified as the area of greatest priority and control of gestational syphilis in the state of Maranhão.

The representation of LISA indicators for gestational syphilis was performed using Moran's maps organized into trienniums (2010 to 2012, 2013 to 2015, 2016 to 2018 and 2019 to 2021). The maps made it possible to visualize areas with or without statistically significant spatial autocorrelation (MORAN, 1948; ODLAND, 1988).

The I and LISA were plotted using GeoDa version 1.10 (Chicago, United States of America) software and the maps were constructed using QGIS version 3.10 (Bucharest, Romania) software. The base shapefile was taken from the platform of the *Núcleo de Economia Regional e Urbana do Estado de São Paulo* (NEREUS) (NEREUS, 2020).

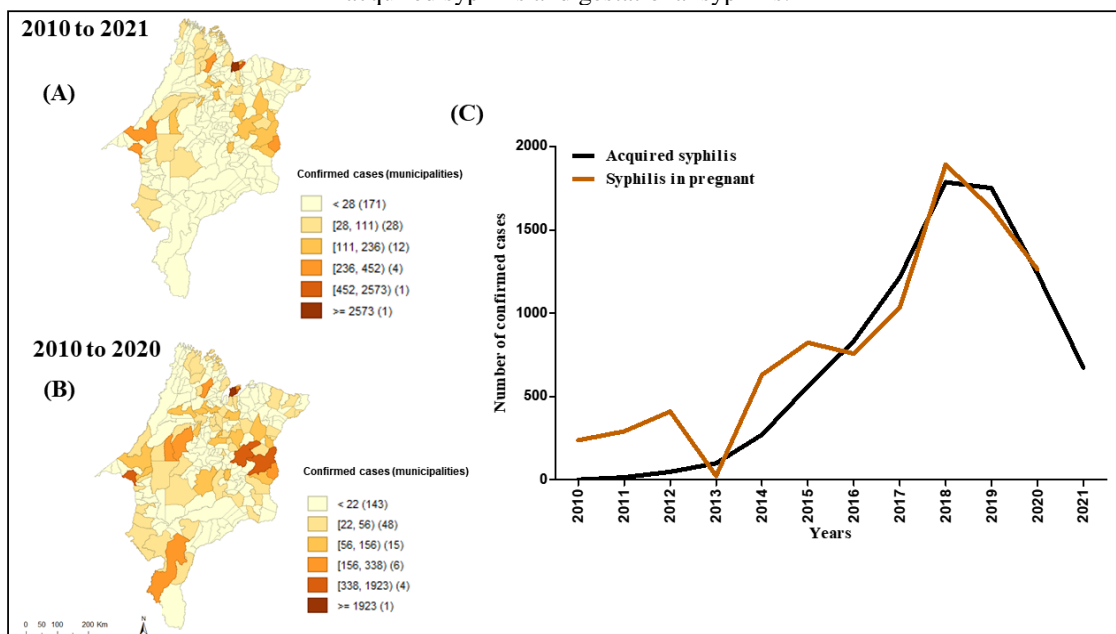
Data presented in this research are characterized by the anonymity of individuals affected by acquired syphilis and gestational syphilis, not including information that allows their identification. For this reason, only secondary public data were included in this study without any individual identification, and the approval of the Research Ethics Committee was unnecessary, according to *Resolução do Conselho Nacional de Saúde* (CNS) No. 466/2012, of December 12, 2012 (CNS, 2012).

3. RESULTS

3.1 Temporal and Spatial Characterization of Acquired Syphilis and Gestational Syphilis

Among the years 2010 and 2021, 8,500 cases of acquired syphilis were confirmed in the state of Maranhão (Figure 1A), being the majority referring to the year of 2018 (1,787; 21.0%; $H = 634.6$; $p < 0.0001$) (Figure 1C). Regarding gestational syphilis, 8,991 cases were confirmed between 2010 and 2020 (Figure 1B), most of which were identified in 2018, with 1,892 notifications (19.5%; $H = 497.7$; $p < 0.0001$) (Figure 1C).

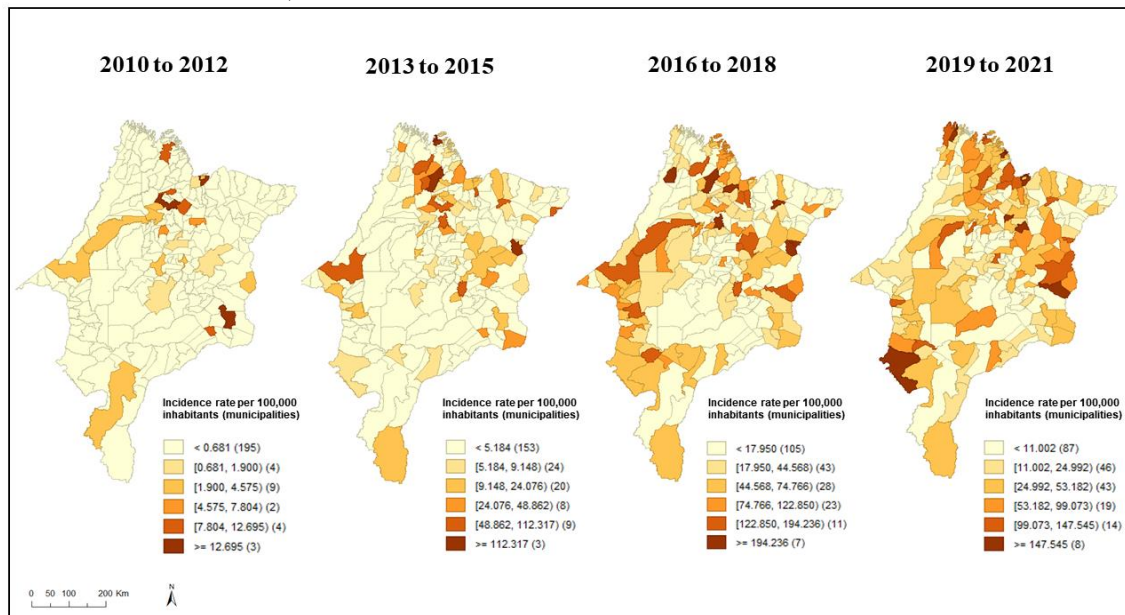
Figure 1. Number of confirmed cases of syphilis in the state of Maranhão, among 2010 and 2021. (A) Spatial distribution of confirmed cases of acquired syphilis (2010 to 2021). (B) Spatial distribution of confirmed cases of gestational syphilis (2010 to 2020). (C) Temporal distribution of confirmed cases of acquired syphilis and gestational syphilis.



Source: Prepared by the authors (2023).

The highest incidence rates of acquired syphilis were found in the municipalities of Viana, in the North Mesoregion of the state (14.0 per 100,000 inhabitants), in the triennium of 2010 to 2012; Pinheiro, in the North Mesoregion (144.6 per 100,000 inhabitants), in the triennium of 2013 to 2015; Duque Bacelar, in the East Mesoregion (285.5 per 100,000 inhabitants), in the triennium of 2016 to 2018; and, Luís Domingues in the West Mesoregion (229.1 per 100,000 inhabitants), in the triennium of 2019 to 2021 (Figure 2).

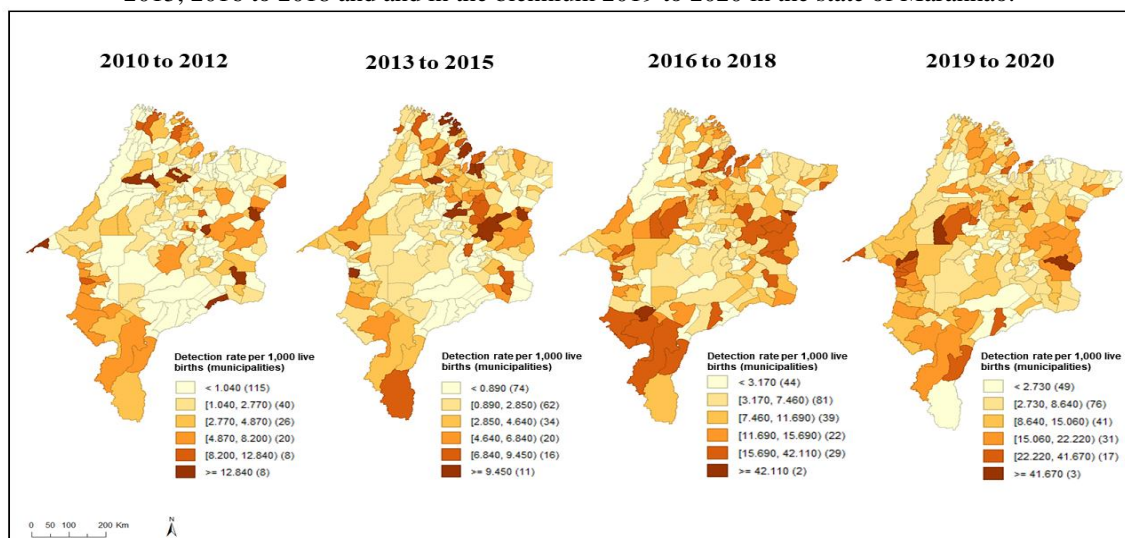
Figure 2. Incidence rates of acquired syphilis per 100,000 inhabitants in triennia 2010 to 2012, 2013 to 2015, 2016 to 2018 and 2019 to 2021 in the state of Maranhão.



Source: Prepared by the authors (2023).

The highest detection rates for gestational syphilis were found in the municipalities of Lago Verde, in the Central Mesoregion of the state (19.9 per 1,000 live births), in the triennium of 2010 to 2012; Coelho Neto, in the East Mesoregion (12.3 per 1,000 live births), in the triennium of 2013 to 2015; Feira Nova do Maranhão, in the South Mesoregion (12.3 per 1,000 live births), in the triennium of 2016 to 2018; and, Buriticupu in the West Mesoregion (42.4 per 1,000 live births), in the biennium of 2019 to 2020 (Figure 3).

Figure 3. Detection rates of gestational syphilis per 1,000 live births in triennia 2010 to 2012, 2013 to 2015, 2016 to 2018 and and in the biennium 2019 to 2020 in the state of Maranhão.

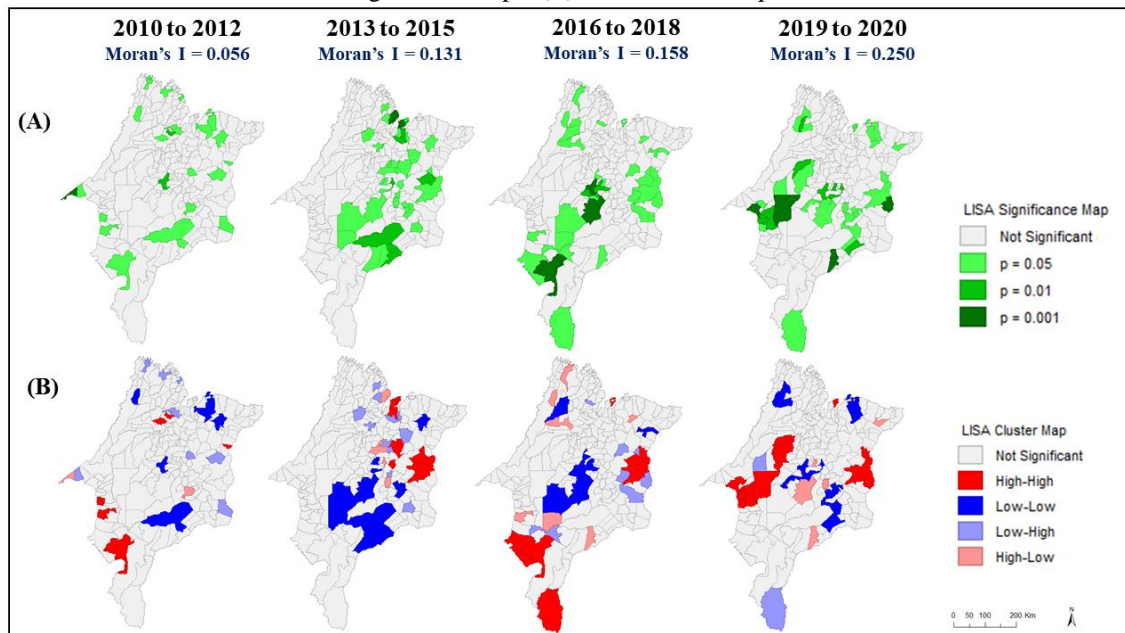


Sources: Prepared by the authors (2023).

.The Moran Global Index (I) with the highest value for gestational syphilis was verified in the biennium of 2019 to 2020 (Moran's $I = 0.250$) (Figure 4A and 4B). Figure 4A shows the Local Significance Maps (LISA), with the representation of the municipalities that obtained statistically significant spatial autocorrelation, in addition to the areas without significance, for the study years.

In the triennium of 2010 to 2012, 25 municipalities had spatial statistical significance (Figure 4A), and six municipalities presented a High-High pattern: Matinha and Penalva in the North Mesoregion of the state; Duque Bacelar in the East Mesoregion; Ribamar Fiquene in the West Mesoregion; and, Porto Franco and Riachão in the South Mesoregion (Figure 4B). In the triennium of 2013 to 2015, 41 municipalities had spatial statistical significance (Figure 4A), and eleven municipalities presented a High-High pattern: Bacabeira, Paço do Lumiar, Raposa, Rosário, São José de Ribamar and São Luís in the North Mesoregion of the state; and, Aldeias Altas, Afonso Cunha, Capinzal do Norte, Caxias and Coroatá in the East Mesoregion (Figure 4B). In the triennium of 2016 to 2018, 38 municipalities had spatial statistical significance (Figure 4A), and nine municipalities showed a High-High pattern: Raposa and São José de Ribamar in the North Mesoregion of the state; Aldeias Altas, Caxias and Coelho Neto in the East Mesoregion; and, Alto Parnaíba, Carolina, Nova Colinas and Riachão in the South Mesoregion (Figure 4B). In the biennium of 2019 to 2020, 44 municipalities had spatial statistical significance (Figure 4A), and 18 municipalities showed a High-High pattern: Paço do Lumiar, Raposa and São José de Ribamar in the North Mesoregion of the state; Alto Alegre do Pindaré, Buritirana, Davinópolis, Governador Edison Lobão, Imperatriz, Montes Altos, São Francisco do Brejão, Santa Luzia do Maranhão, Senador La Rocque, Tufilândia and Ribamar Fiquene in the West Mesoregion; and, Caxias, Coelho Neto and Timon in the East Mesoregion (Figure 4B). These municipalities represented important regions of clusters with a high number of syphilis records in pregnant women in the state of Maranhão.

Figure 4. Local Indicators of Spatial Association (LISA) maps for gestational syphilis in triennia 2010 to 2012, 2013 to 2015, 2016 to 2018, and in the biennium 2019 to 2020 in the state of Maranhão. (A) LISA significant maps. (B) LISA cluster maps.



Source: Prepared by the authors (2023).

3.2 Sociodemographic and Clinical Aspects of Gestational Syphilis

During the study period, most pregnant women with syphilis in the state of Maranhão had the following characteristics with statistically significant medians: 20 to 39 years (6,345; 71.3%), and 15 to 19 years (2,235; 25.1%) ($H = 450.4$; $p < 0.0001$); Complete High School (2,232; 30.4%), 5th to 8th grade incomplete of Elementary School (1,818; 24.5%), and Incomplete High School (1,310; 17.6%) ($H = 437.2$; $p < 0.0001$); *parda* race (6,770; 77.8%; $H = 518.3$; $p < 0.0001$); and Primary clinical classification (4,238; 59.2%; $H = 152.9$; $p < 0.0001$) (Table 1).

Table 1. Absolute and relative frequencies, and statistical analysis, of confirmed cases of gestational syphilis in the State of Maranhão, between 2010 and 2020, by age group, schooling, race, and clinical classification.

Variables	N	%	H	P
Age range (years) (Total = 8,904)¹				
10 to 14	160	1.7		
15 to 19***	2,235	25.1	450.4	< 0.0001
20 to 39***	6,345	71.3		
40 to 59	164	1.9		
Schooling (Total = 7,413)²				
No schooling	151	2.0		
Incomplete 1 st to 4 th grade of Elementary School	550	7.4		
4 th grade complete of Elementary School	364	4.9		
5 th to 8 th grade incomplete of Elementary School***	1,818	24.5		
Complete Elementary School	832	11.2	437.2	< 0.0001
Incomplete High School***	1,310	17.6		
Complete High School***	2,232	30.4		

Incomplete Higher Education	78	1.0		
Complete Higher Education	78	1.0		
Race (Total = 8,722)³				
White	783	8.9		
Black	1,047	12.0		
Yellow	71	0.8	518.3	< 0.0001
<i>Parda</i> ***	6,770	77.8		
Indigenous	51	0.5		
Clinical Classification (Total = 7,171)⁴				
Primary***	4,238	59.2		
Secondary	969	13.5	152.9	< 0.0001
Tertiary	789	11.0		
Latent	1,175	16.3		

¹Ignored or blank cases = 87; ²Ignored or blank cases = 1,578; ³Ignored or blank cases = 269; ⁴Ignored or blank cases = 1,820; Ignored or blank cases were not included in the statistical analyzes; N = number of cases; % = percentage; H = Kruskal-Wallis value; p = p-value; ***Significant at the level of p < 0.0001 in relation to the medians of other categories of the variable analyzed by Dunn's test. Source: Data collected on the *Departamento de Informática do Sistema Único de Saúde (DATASUS)* platform on June 9 and 10, 2022. Source: Prepared by the authors (2023).

4. DISCUSSION

The present study measures how acquired and gestational syphilis are a serious public health problem in Maranhão, thus reinforcing the need for more investments in Primary Health Care, aiming to break the transmission chain, and consequently, reduce the number of individuals infected and prevent vertical transmission.

It is worth mentioning that to the best of our knowledge, this is the first study carried out on the spatial and epidemiological profile of acquired and gestational syphilis in the state of Maranhão. There are other studies in the literature (CONCEIÇÃO; CÂMARA; PEREIRA, 2019; GATINHO *et al.*, 2021), but those who do not cover both acquired and gestational syphilis in the same study, and neither use spatial analysis for both.

During the analyzed period, there was a gradual increase in the number of cases of acquired and gestational syphilis, with a significant decrease only in the last two years (in 2020 and 2021 to acquired syphilis, and in 2019 and 2020 to gestational syphilis). It is important to emphasize that in the last two years the world has been suffering with the COVID-19 pandemic, and the public health emergency caused by this chaotic moment has impacted the notification of several pathologies, increasing underreporting (WALKER *et al.*, 2020). Therefore, is not possible to exclude the role of sub notification in the recent decrease trend of syphilis cases.

This research showed many acquired syphilis cases in Maranhão, mainly in cities in the interior of the state. Also, the highest notifications of acquired syphilis in Maranhão occurred in 2018, in agreement to national results for the same year (MENEZES *et al.*,

2021). A high incidence rate of acquired syphilis was observed in the cities of Viana and Pinheiro, both located in the Baixada Maranhense. A study carried out on the profile of CS in the Baixada of Maranhão showed that Pinheiro was the region of the Baixada with the highest incidence of infection GATINHO *et al.*, 2021). This finding corroborates the data described in this study, as the high incidence of acquired syphilis combined with the non-use of condoms contributes to the high number of cases of this pathology in pregnant women, and consequently to the high incidence of CS.

Also, a high incidence rate of acquired syphilis was identified in the cities of Duque Bacelar and Luís Domingues. Both are sparsely populated cities compared to other municipalities in the interior of Maranhão. This data is important, since there are no studies in the literature that describe the epidemiological situations regarding the infection in these cities.

As for gestational syphilis, there was a high number of cases during the study period, which also occurred mostly in 2018 and were concentrated in the interior of the state. The municipalities of Lago Verde, Coelho Neto, Feira Nova do Maranhão and Buriticupu were the cities in Maranhão that had the highest detection rates of gestational syphilis during the study period. These rates ranged from 12.3 per 1,000 live births to 42.4 per 1,000 live births. Both rates being higher than the detection rate for the state of Maranhão only in 2020 (IBGE, 2022).

Several municipalities in Maranhão presented a High-High spatial autocorrelation pattern for gestational syphilis, especially those located in the North, West and East Mesoregions of the state. The large number of notifications in the aforementioned regions may be related to the large population of these locations, since they are the regions with the highest population rates in the state, together adding approximately 5,000,000 inhabitants (IBGE, 2022), which possibly favors the speed of transmission of this IST (VERDE *et al.*, 2020).

Despite the already preoccupying rates, the results found on this study could be underestimated, since the underreporting in Brazil is still very expressive. Regardless of gestational syphilis being a condition of compulsory notification, the country registers only 32% of cases (CAMPOS *et al.*, 2010). Thus, the great importance of investments in epidemiological surveillance is emphasized, since without proper registration, the investigation, control, reduction, and prevention are inefficient, thus increasing the events related to the infection (CAVALCANTE; PEREIRA; CASTRO, 2017).

In the present study, an epidemiological cut was made on the profile of gestational syphilis, in which a higher prevalence of the pathology was identified in young pregnant women (20 to 29 years), corroborating to previously observed data in the Brazil, for the years 2011 to 2020 (RAMOS *et al.*, 2022). This finding may be related to the fact that this age group is sexually active and have a tendency of not regularly using condoms, which can significantly contribute to the increased vulnerability to STI (CAVALCANTE *et al.*, 2019).

It was observed that most of the pregnant women notified with the infection had incomplete basic education. The same profile was found in a similar study carried out in the state of Tocantins, a state that borders Maranhão, where it was found that the infection mainly affected pregnant women with low levels of education. Low education is related to health risks, since the hampered access to information can contribute to a greater propensity for the development of infectious diseases, jeopardizing the interruption of the transmission chain (CABRAL *et al.*, 2017).

As for race, there was a predominance of pregnant women who declared themselves as *parda* (77.8%). These results are similar to those of a study carried out in the Northeast of Brazil, in which more than 65% of syphilis notifications occurred in self-declared *parda* pregnant women (DE SOUSA *et al.*, 2022). However, it is worth mentioning that this finding may be related to the number of people who self-declare as *parda* in Brazil, since according to the IBGE (2019) 46.8% of Brazilians declare themselves as mixed race.

Regarding the clinical classification, a significant number of cases were of primary gestational syphilis (59.2%). The predominance of the primary form of infection was also found in a similar study carried out in Caxias, state of Maranhão, referring to cases of gestational syphilis living in the city between 2013 and 2017, of which 71.1% were in the primary phase of infection²¹. This stage of the pathology is the one with the highest chance of vertical transmission, which increases the possibility of fetal infection (GUIMARÃES *et al.*, 2018).

It is important to emphasize that, to the best of our knowledge, this is the first study that shows that some regions in the interior of the state have a high rate of gestational syphilis. Therefore, the use of spatial techniques applied concomitantly to epidemiological studies made it possible to understand how the syphilis distribution process is occurring in the state of Maranhão, showing the locations with the highest

transmission rates, in addition to identifying the profile of pregnant women affected by the infection.

5. CONCLUSIONS

The data obtained in this study showed a high number of cases of acquired and gestational syphilis in Maranhão, especially in the interior of the state, with a gradual increase in both forms of infection in recent years. The study also pointed out that gestational syphilis mainly affects young pregnant women, with low education and a predominance of *parda* race.

Given this, it is clear that in order to reduce the prevalence of acquired syphilis and, consequently, gestational syphilis, it is essential that health professionals, and the community become aware of the importance of condom use, early diagnosis, and effective treatment of this disease. It is up to the multidisciplinary teams to conduct educational campaigns to make the population aware of the risks of unsafe sexual practice and the importance of self-care, especially among the most vulnerable.

Therefore, the information found in this study is relevant to public health, as it can contribute to the creation and implementation of strategies and actions aimed at prioritizing the regions and groups at higher risk of infection.

The limitation of this study was the use of secondary data, as there is a possibility of underreporting, being the number of cases possibly higher than stated. Furthermore, the absence of fundamental information to describe the gestational syphilis cases profile in the SINAN database limited the knowledge of socioeconomic and treatment related aspects. In addition, the data comparison obtained in this study is hampered due to the lack of research that performs spatial and epidemiological analysis of syphilis in the region or in neighboring states. Therefore, further studies are needed to corroborate these data.

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