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ORIGINAL ARTICLE

SPATIO-TEMPORAL EVOLUTION OF GESTATIONAL AND CONGENITAL SYPHILIS IN THE STATE OF PARANÁ

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ABSTRACT

Objective: to compare sociodemographic characteristics, distribution and spatial association of gestational and congenital syphilis in Paraná in 2008 and 2018. **Methods:** ecological study with cases of gestational syphilis (GS) and congenital syphilis (CS) reported in the years 2008 and 2018 in the Information System of Notifiable Diseases of the State of Paraná. Data were analyzed through descriptive analysis, distribution and spatio-temporal association, using techniques called Getis-Ord General G and Getis-Ord Gi*. **Results:** GS increased from 194 cases in 2008 to 2,828 in 2018, and CS from 85 cases to 880 in 2018, mainly among pregnant women of white race/color and aged between 20 and 39 years. In 2008, there were more diagnoses among women with less than eight years of study and primary clinical classification. In 2018, with more than eight years of study and latent clinical classification. For CS, in both years, predominated children of white race/ color, age group up to six days of life and recent CS. The spatio-temporal analysis showed a higher prevalence in the East and West macro-regions of the state of Paraná. **Conclusions:** The lower the educational level, the greater the probability for the development of the disease among pregnant women and, consequently, for their children. The profile of pregnant women and the spaces of greater occurrence favor the planning and execution of localized actions for diagnosis and health education.

Keywords: Spatial Analysis. Sexually Transmitted Infections. Nursing. Syphilis. Maternal and Child Health.

INTRODUCTION

Despite decades of epidemiological and clinical experience with gestational syphilis (GS) and congenital syphilis (CS), both diseases continue to be important global public health problems[1,2]. Syphilis, a systemic infectious disease caused by *Treponema pallidum*, has as its main route of transmission the sexual and vertical, the latter occurs from the mother to the fetus during the gestation period[2]. CS is one of the main causes of abortion, fetal death, stillbirth, low birth weight, prematurity and congenital malformations[3].

The World Health Organization (WHO) estimates that there are, annually, around 12 million new cases of syphilis in the world, of these, 1.5 to 1.85 million cases occur in pregnant women, and half of them have children with some health problem, adverse outcome due to the consequences of the disease[4].

In Brazil, as of 2010, there was a significant increase in GS and CS in several regions. A study conducted in the state of Maranhão shows that the incidence rate of GS increased from 9.55 cases/1,000 live births in 2013 to 16.53 cases/1,000 live births in 2017, especially among non-white women with low education and reproductive age[5]. In 2006, CS had a rate of 2.0 cases/1,000 live births, and, in 2015, it increased to 6.5 cases/1,000 live births[2].

The high rates of GS and CS and the exponential increase in the number of cases show the need to know the profile and spatial distribution of this event in the macro-regions of the state of Paraná. Such information enables the

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most accurate location of the most prevalent areas and the sociodemographic characteristics of the most affected population[6,7], managers and health professionals to optimize prevention and treatment actions according to the specific characteristics of the population.

Few studies point to epidemiological data of the GS and CS in the state of Paraná. However, a study conducted in the 15th Regional Health of the state, in 2018, shows that the detection rate of OS went from 2.02 cases/1,000 live births in 2011 to 12.79 cases/1,000 live births in 2015, and the SC went from 0.1 cases/1,000 live births to 6,55 cases/1,000 live births in the same years[8].

Considering that GS and CS are preventable and treatable, this study is necessary to know the prevalence and spatial distribution of these diseases in the macro-regional health of the state of Paraná, providing subsidies for health managers to implement measures to reduce maternal and child morbidity and mortality from these causes at a regionalized level in the state. With this understanding, this study aimed to compare the sociodemographic characteristics, spatial distribution and spatial association of gestational and congenital syphilis in the state of Paraná in 2008 and 2018.

METHODS

Ecological study, with cases of GS and CS in the state of Paraná in 2008 and 2018. The units of analysis comprised the 399 residents of the state. With an area of 199,298.979 km², Paraná is considered the most populous state in the region, with 11,516,840 inhabitants[9]. It is subdivided into four health macro-regions: East (MRS E), North (MRS N), West (MRS W) and Northwest (MRS NW).

The inclusion criteria adopted were all reported cases of GS and CS in the state in 2008 and 2018 (last year available at the time of collection). These data were obtained from secondary data from the UHS Department of Informatics (DATASUS), specifically from the Information System for Notifiable Diseases (SINAN). To calculate the rates, the number of live births per municipality in 2008 (151,092 in all municipalities) and 2018 (156,201 in all municipalities) was collected in the Information System on Live Births (SINASC). The exclusion criterion was the non-fulfillment (white or ignored) of the characterization fields, which totaled 89 SG fields in 2008 and 1,017 fields in 2018, and 26 SC fields in 2008 and 57 fields in 2018.

For the sociodemographic characterization of GS, the variables race/color (white and non-white (black, yellow, brown and indigenous)); age (10 to 19, 20 to 39, over 40 years); schooling (< 8 years of study and ≥ 8 years of study) were analyzed; clinical classification (primary, secondary, tertiary and latent). For CS, race/color (white and non-white (black, yellow, brown and indigenous)), child age (up to 6 days, 7-27 days, 28 days to < 1 year of age) and clinical classification (recent CS, late CS, stillbirth/abortion and discarded) were selected.

Data analysis was developed in three stages. In the first stage, exploratory, was applied descriptive statistics with absolute and relative frequency, performed in the software SPSS version 20.0. The percentage variation of the first and last year of study was calculated for the following variables in the GS: race/color, age group, schooling and clinical classification. For CS: race/color, age of the child and clinical classification. The calculation of the percentage change used [(total value of the year 2018 ÷ value of the year 2018)], and for the calculation of annual growth, [(value of the ratio ÷ for 11 years)].

In the second stage, thematic maps were elaborated in ArcGis software version 10.5. For this purpose, the rates of GS and SC (per 1,000 live births - LB) described in Chart 1 were calculated.

Chart 1. Formula used to calculate the rates of gestational and congenital syphilis.

Gestational syphilis	Number of cases divided by live births multiplied by 1,000
Congenital syphilis	Number of cases divided by live births multiplied by 1,000

In the third stage, to identify the spatial association of the rates of SG and SC, the techniques called Getis-Ord General G and Getis-Ord Gi* were applied. In the Getis-Ord

General G technique, based on the Moran Global Index, the results are based on the null hypothesis that there is no spatial grouping. If the *p*-value is significant, the null hypothesis can be rejected and the z-score value becomes important as values of ±3 represent a 99% confidence level. If the value of the z-score is positive, the observed G-index is higher than expected, indicating high indexes of the event grouped in the area[10].

Getis-Ord Gi* allows verifying the association of GS and CS locally, that is, considering the number of cases in each unit of analysis from a matrix of neighbors, that is, considering the average number of events in neighboring municipalities[10].

This analysis generates a z score with its respective p-value for each of the municipalities. The higher the z-score, the more intense the grouping of high values (Hotspot – risk areas), and the lower the z-score, the more intense the grouping of low values, or the lower the occurrence of the event (Coldspot – protection areas)[11].

In line with Resolution N. 510, of April 7, 2016 of the National Council for Ethics in Research, this study was not submitted to the approval of the Ethics Committee in Research with Human Beings, data available in public databases that preserve the identity of the participants.

RESULTS

In 2008, 151,092 live births were reported in the state of Paraná and 194 cases of GS (0.12%). In 2018, 156,201 live births and 2,828 cases (1.81%) of GS, showing an increase of 1,357.73%. Regarding the percentage variation, it is noted that, for non-white race/color, presented a ratio of 15.96 and annual growth of 1.45, age group 10 to 19 years ratio 19.79 and annual growth 1.80, schooling above eight years ratio 22.69 and annual growth of 2,06 and latent clinical classification ratio of 27.28 and annual growth of 2.48.

Table 1. Sociodemographic and clinical characteristics of cases of gestational syphilis in the state of Paraná, 2008 and 2018.

Variables	Gestational Syphilis					
	2008		2018		Ratio	Annual growth
	Total cases: 194 Rate: 1.28		Total cases: 2828 Rate: 1,81			
Race/color						
White	130	67,01%	1901	67,22%	14,62	1,33
Non white	55	28,35%	878	31,04%	15,96	1,45
Ignored/Blank	9	4,64%	49	1,74%	5,44	0,49
Age range						
10 to 19	39	20,10%	772	27,29%	19,79	1,80
20 to 39	144	74,23%	2004	70,86%	13,92	1,27
Over 40	11	5,67%	52	1,85%	4,73	0,43
Ignored/Blank	0	0%	0	0%		
Education						
< 8 years of study	89	45,87%	845	29,87%	9,49	0,86
≥ 8 years of study	67	34,53%	1520	53,74%	22,69	2,06
Ignored/Blank	38	19,60%	463	16,39%	12,18	1,11
Clinical classification						
Primary	89	45,87%	925	32,70%	10,39	0,94
Secondary	12	6,18%	121	4,27%	10,08	0,92
Tertiary	11	5,67%	186	6,57%	16,91	1,54
Latent	40	20,61%	1091	38,57%	27,28	2,48
Ignored/Blank	42	21,67%	505	17,89%	12,02	1,09

For CS, in 2008, 151,092 live births and 85 cases (0.05%) occurred and in 2018, 156,201 live births and 880 cases (0.56%), an increase of 935.29%. The sociodemographic characteristics presented in Table 2 show that the highest proportion of infected individuals were of white race/color and aged up to six days of life in both years. There is also a higher proportion of recent CS in 2008 and 2018. As for the percentage variation of congenital syphilis, it was noted that

the race/white color ratio 12.04 and annual growth of 1.09, age of the child up to six days ratio 10.68 and annual growth of 0.97, stillbirth/abortion ratio 17.00 and annual growth 1.55.

Table 2. Sociodemographic and clinical characteristics of congenital syphilis in the state of Paraná, 2008 and 2018.

Variables	Congenital Syphilis					
	2008		2018		Ratio	Annual growth
	Total cases: 85 Rate: 0,56		Total cases:: 880 Rate: 5,63			
Race/Color						
White	54	63,52%	650	73,86%	12,04	1,09
Other	16	18,82%	174	19,77%	10,88	0,99
Ignored/Blank	15	17,66%	56	6,37%	3,73	0,34
Child's age						
Up to 6 days	79	92,94%	844	95,90%	10,68	0,97
7-27 days	2	2,35%	15	1,70%	7,50	0,68
28 days to <1 year	4	4,71%	20	2,27%	5,00	0,45
Ignored/Blank	0	0%	1	0,13%		
Clinical classification						
Recent CS	63	74,11%	827	93,97%	13,13	1,19
Late CS	1	1,17%	1	0,11%	1,00	0,09
Stillbirth/abortion	2	2,35%	34	3,86%	17,00	1,55
Discarded	8	9,41%	18	2,06%	2,25	0,20
Ignored/Blank	11	12,96%	0	0%	0,00	0,00

Figure 1 shows the spatial distribution of GS and CS in the 399 municipalities of Paraná, with a significant increase for both diseases analyzed in 2018, compared to 2008, and higher rates in the East and West macro-regions, located in the south of the state.

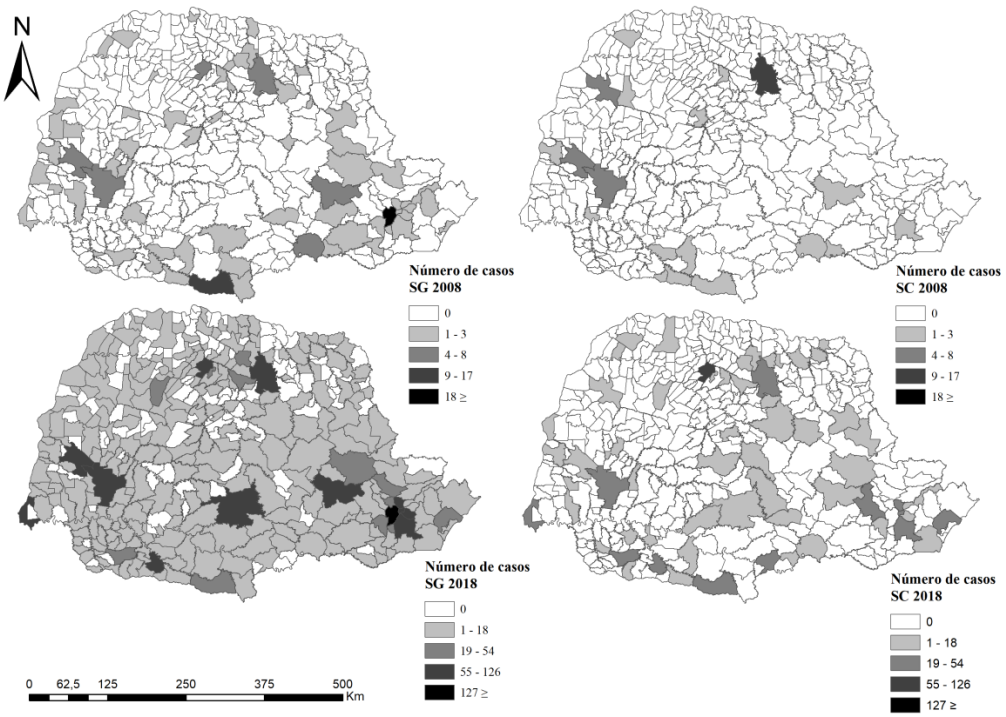

Figure 1. Spatial distribution of gestational syphilis and congenital syphilis in the state of Paraná in the years 2008 and 2018. Paraná-2021.

The local spatial association (IG*) of the GS in 2008 (Figure 2) identifies hotspots (hot spots) in the East, Northwest and West macro-regions, with a z=0.91 score and p=0.36 value. The municipalities with the highest evident risk were Paranapoema with 48.78 cases/1,000 LB (MRS NW), Pinhal de São Bento 26.31 cases/1,000 LB (MRS W) and Indianópolis 24.39 cases/1,000 LB (MRS NW). In 2018, hotspots are concentrated in the East and West macro-regions and coldspots in the North and Northwest macro-regions, with a score z=4.574515; value p=0.000005. The municipalities of Mariópolis 78.65 cases/1,000 LB (MRS O), Diamante D'Oeste 78.12 cases/1,000 LB (MRS W), Itapejara D'Oeste 76.92 cases/1,000 LB (MRS W) and Coronel Domingos Soares 60.83 cases/1,000 LB (MRS) areas presented the highest risk of NV (NV).

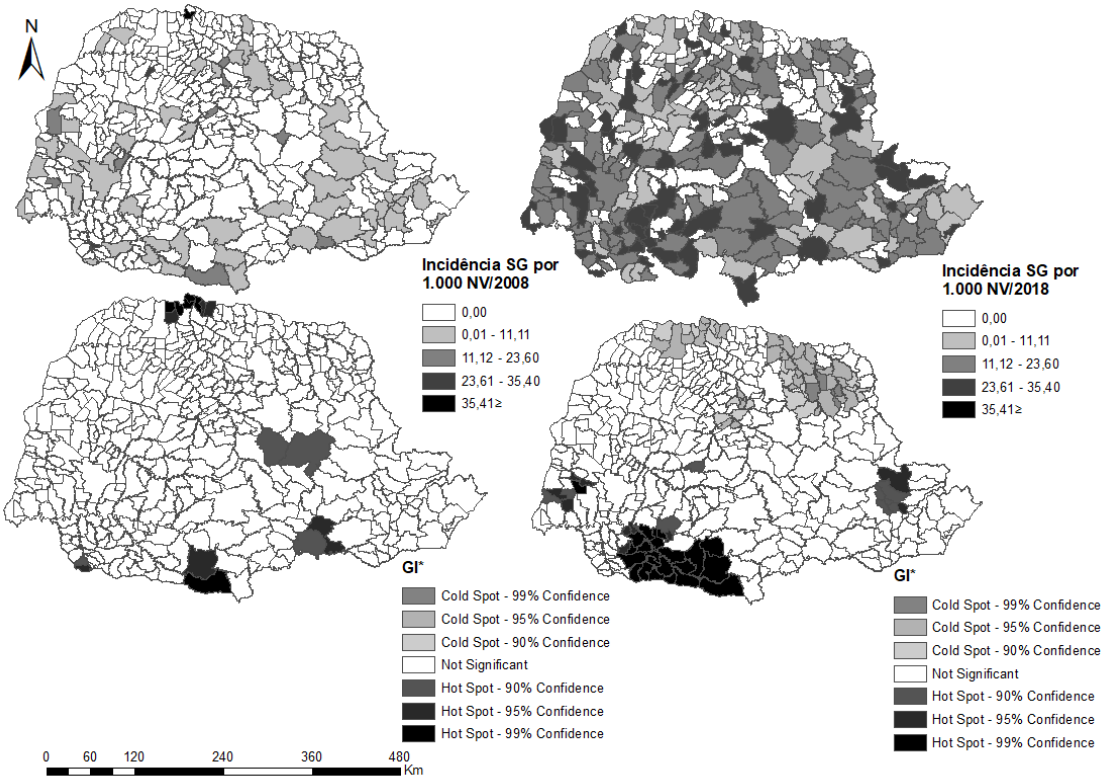

Figure 2. Spatial distribution of gestational syphilis and congenital syphilis in the state of Paraná in the years 2008 and 2018. Paraná-2021.
*Getis-Ord G statistical significance level for cases of Gestational Syphilis in 2008. Observed General G: 0.001731; z-score: -0.910910; p-value: 0.362343.
*Getis-Ord G statistical significance level for cases of Gestational Syphilis in 2018. Observed General G: 0.002834; z-score: 4.574515; p-value: 0.000005.

Regarding CS, in 2008, hotspots were identified in the East and West macro-regions. The municipalities of Capitão Leônida Marquês (14.35 cases/1,000 LB - MRS W), Antônio Olinto (12.82 cases/1,000 LB - MRS E) and Mariópolis (11.11 cases/1,000 LB - MRS W) had the highest rates.

In 2018, hotspots were observed in the East and West macro-regions, with the municipality of Pato Branco presenting the highest prevalence, with 40.98 cases per 1,000 LB (MRS W) (Figure 3).

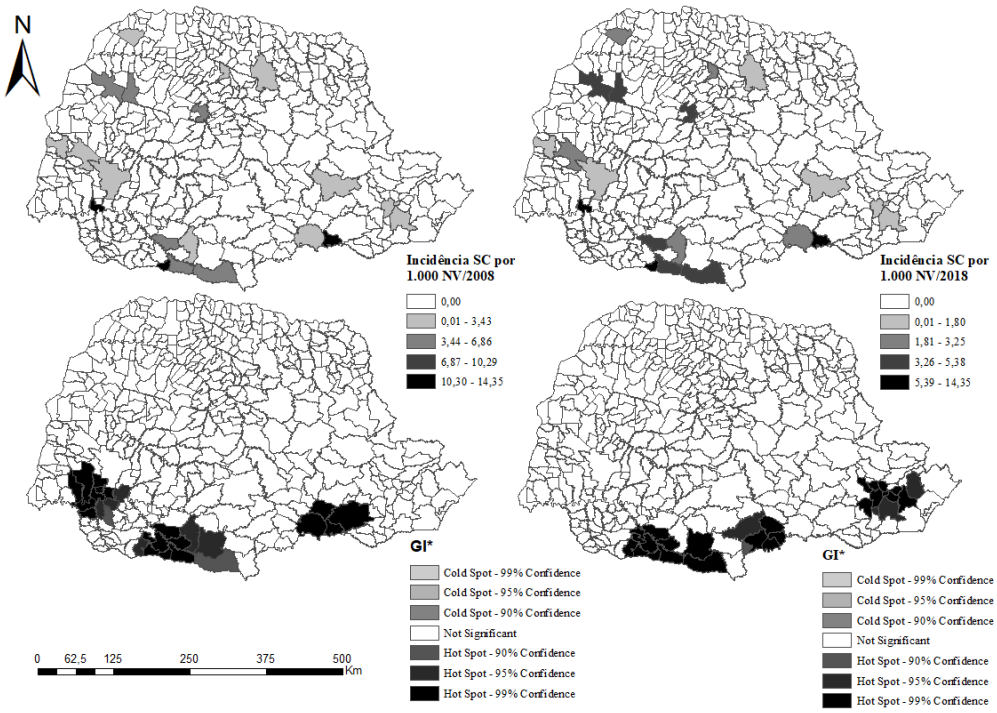

Figure 3. Spatial association of congenital syphilis in the state of Paraná in 2008 and 2018. Paraná-2021.

*Getis-Ord G statistical significance level for cases of Congenital Syphilis in 2008. Observed General G: 0.009226; z-score: 3.067377; p-value: 0.002159.

*Getis-Ord G statistical significance level for cases of Congenital Syphilis in 2018. Observed General G: 0.003343; z-score: 1.244500; p-value: 0.213316.

DISCUSSION

The study aimed to compare the sociodemographic characteristics, spatial distribution and spatial association of GS and CS in the state of Paraná in 2008 and 2018, it was possible to observe an increase in the number of cases of GS and CS in the state of Paraná from 2008 to 2018, corroborating findings from other states of the country, such as Goiás (Central-West region of Brazil), where the detection rate of GS increased from 2.8 in 2007 to 14.8/1,000 live births in 2017, and that of CS increased from 0.3 in 2007 to 2.9/1,000 live births in 2017[11]. In Maranhão, the GS increased from 9.55 in 2013 to 16.53/1 thousand live births in 2017, but the SC decreased from 2.29 in 2013 to 1.54 in 2017[5]. However, this increase should not be interpreted as a unique condition of Brazil. Foreign studies conducted in the Americas and the Eastern Mediterranean from 2012 to 2016 showed an increase in the prevalence of GS from 0.64% to 0.86% and from 0.69% to 0.77%, respectively[13].

The increase in cases of GS and CS may be directly associated with the precariousness of health services, specifically prenatal services when treating CS[12], as well as the absence of prenatal care or the low number of consultations, in addition to ineffective or late treatment[8]. Among the major problems in prenatal care, there are: inadequate history, nontreponemic serology (VRDL and RPR) for syphilis not performed in the recommended periods (first and third trimesters), ineffective interpretation of serology, failure to recognize signs of syphilis in pregnant women, lack of adherence of the partner to treatment, which increases the reinfection of the pregnant woman, and lack of consensus among professionals who perform prenatal care.[14,15].

It is well known that adequate prenatal care can bring several benefits to pregnant women and conceptus, especially the detection of fetal problems, reduction of premature births, identification of pre-existing diseases such as syphilis[2].

Sociodemographic characteristics, both in

cases of GS and in cases of CS in both years, showed more cases of infection in women and children of white race/color, different from that observed in other Brazilian regions. Such divergence may be associated with the fact that Paraná has a predominantly white population[9], affecting the largest number of white race/color infected. It is worth mentioning that, in relation to the variance of annual growth for CS, the highest were for white race/color, with annual growth of 1.09. This finding directs a deeper look, which deserves investigation about this specificity.

The highest proportion of pregnant women with GS (over 70% in both years) was aged 20 to 39 years, that is, age group considered reproductive and consequently at higher risk, corroborating research developed in other countries. In the United States of America, from 2010 to 2016, there was a predominance in the age group of 20 to 29 years, with 50% of cases[16], and in Romania, in 2017, 29.12% of pregnant women (most of the study) had a similar age group, being 25 to 29 years[17].

It is known that age below 25 years is an important predictor for lower condom use. Unprotected sexual activity is an important risk factor for exposure to sexually transmitted infection[18], highlighting the need to intensify guidelines on protected sexual intercourse for Paraná women, family planning and use of health services, including early prenatal care[19].

In 2008, GS was higher among women with less than eight years of schooling, as also observed in Rio Grande do Sul in the years 2001 to 2012 (55.9%)[21]. In 2018, the highest proportion of GS occurred among women with more than eight years of schooling, as well as in the city of Florianópolis-SC in 2016 and 2017 (38%)[22], drawing attention to the increase in maternal education in Paraná and other Brazilian states. The annual growth variance for schooling was more than eight years, with a total of 2.06.

There was a predominance of clinical classification of GS as primary syphilis in 2008 (45.87%), classification also observed in other studies[5,8]. In 2018, the highest proportion observed was latent syphilis (38.57%), corroborating what was observed in Maranhão, from 2015 to 2019 (30.76%)[23]. It is worth noting that an annual growth variance was observed for the latent clinical classification of 2.48. Some studies show that the classification of primary syphilis may be inadequate, since in some cases, the impossibility of defining the clinical evolution of the disease may occur. Thus, the appropriate clinical classification would be "latent syphilis of unknown duration", considering that treatment for primary syphilis would be ineffective if the classification was not correct[2,5].

CS was predominantly diagnosed among newborns with up to six days of life, with high percentages in both years (over 90%). A higher proportion of diagnoses with up to six days of life is also reported in a study conducted in Maranhão (77.8%)[5]. There is importance of diagnosis of CS with up to six days of life, since the early diagnosis, such as VDRL or RPR in the neonatal period, provides the immediate start of treatment, avoiding late complications, a protocol that is probably being complied with by health teams. However, through adequate prenatal care, rapid and VDRL tests in pregnant women in the first and third trimesters of pregnancy, and testing at admission to the maternity hospital, it is possible to diagnose GS early, preventing CS[2,20].

The predominance of clinical classification of CS as recent syphilis in 2008 and 2018 was also observed in another study. In Paraíba-PB, from 2014 to 2019, 89.6% of newborns were diagnosed with recent CS[24]. The possible cause for the main classification not having undergone changes between years may be associated with early capture (up to six days of life) of CS cases. However, regarding the annual growth variance for the clinical classification, the highest was stillbirth/abortion with variance of 1.55 year.

Regarding the spatial distribution, analyzing both years, the macro-regions with the highest prevalence for both syphilis were the East and West macro-regions, followed by the North and Northwest, respectively. The identification of the most prevalent macro-regions is an essential tool for the elaboration of public policies aimed at these areas[21].

It is important to highlight that macro-regions with higher prevalence have sociodemographic characteristics and socioeconomic development distinct from each other. Although both have 93 municipalities, the East has a population of

5,106,405 inhabitants and the West, 1,903,132 inhabitants. In addition, the Eastern macro-regional region has greater participation in the Gross Domestic Product (GDP) of the state (58.3%), while the Western macro-regional region has lower participation (15.8%)[7]. It is also noteworthy that the municipalities of the Eastern macro-region have Municipal Human Development Indexes (MHDI) lower than that observed in the municipalities of the Western macro-region[25].

Despite the socioeconomic and sociodemographic differences of the East and West macro-regions, there are similarities in relation to the prevalence of both syphilis. This fact may be related to the supply and access to health services in both macro-regions, but also to the quality of services. We draw attention to the need for more specific studies in these macro-regions, to determine the causes, and the need for investments at the local level to control syphilis.

The local spatial association (IG*) of the GS in 2008, shows that the macro-regions that presented hotspots, were East, North and West, but the municipalities with higher evident rates are located in the macro-regional North and West. These results can be justified by the low MHDI of the municipalities of these macro-regions[25] which is consequently associated with social and economic disadvantages of the population, making it more vulnerable to undesirable health events, such as sexually transmitted infections.

A study conducted in Fortaleza also shows that OS has been associated with low socioeconomic status and, although it is not a diagnosis restricted to the less favored population, these results indicate that low schooling and low income may be important characteristics of low access to health services[26], favoring non-treatment during prenatal care and, consequently, increased CS.

For the GS in 2018, and for CS in both years, the areas of greatest association were the East and West macro-regions, which also had a higher prevalence of cases and larger population clusters, such as the metropolitan region of Curitiba and the region of Pato Branco. These regions are highly populated considering the characteristics of the state of Paraná[9], which may hinder access to health services and health education, also favoring disadvantages in diagnosis and early treatment.

The use of the Geographic Information System (SIGs - *Sistema de Informações Geográficas*) in health allows the spatial location of elements of interest to be visualized, which makes it possible to analyze the health situation in the territory and to provide subsidies for decision-making[27]. In this study, the thematic map was used to represent the distribution and spatial association of GS and CS in the state of Paraná.

The limitations of this study are those inherent to ecological studies, and it is not possible to make inferences regarding geographic levels more restricted than the planning areas. There is also a possibility of bias regarding the updating of data in the system over time, after individual analysis of cases by the Epidemiological Surveillance teams. The ecological bias due to the ecological fallacy, since the variables are used at the aggregate level, the results may not represent associations at the individual level. It is also worth mentioning the use of secondary data sources, which may include incomplete data or typo. However, the results presented are of great importance for the formulation of public health policies aimed at the population studied.

CONCLUSION

This study unveiled the relationship of the GS and CS with the sociodemographic profile between the territories, since the GS occurred predominantly among white mothers, in reproductive age and with lower education and, consequently, the CS predominated among white children. The lower the educational level, the greater the probability for the development of the disease among pregnant women and, consequently, for their children.

The age range of diagnosis for children occurred within six days, with clinical classification of recent congenital syphilis, indicating better attention to newborns already in the first moments of life.

There is not only a large increase in GS and CS in the state of Paraná from 2008 to 2018, but also some changes in the sociodemographic and

clinical profile of women infected with GS, which in 2008 were predominantly those with less than eight years of study, and in 2018, those with more than eight years of study, and the clinical classification of syphilis as primary in 2008 and latent in 2018.

The maintenance of the other variables analyzed, the highest rates and the spatio-temporal association of both syphilis, concentrated predominantly in the East and West macro-regions (located in the South of the state) in both years of study (one decade), evidence the need for greater investments in professional qualification and public policies aimed at prevention, detection and early treatment of OS in the different macro-regions and municipalities of Paraná, especially in the macro-regions East and West, health of this population and reduce maternal and child morbidity and mortality.

EVOLUÇÃO ESPAÇO-TEMPORAL DA SÍFILIS GESTACIONAL E CONGÊNITA NO ESTADO DO PARANÁ

RESUMO

Objetivo: comparar características sociodemográficas, distribuição e associação espacial da sífilis gestacional e congênita no Paraná em 2008 e 2018. **Métodos:** estudo ecológico com casos de sífilis gestacional (SG) e sífilis congênita (SC) notificados nos anos de 2008 e 2018 no Sistema de Informação de Agravos de Notificação do Estado do Paraná. Os dados foram analisados por meio de análise descritiva, distribuição e associação espaço-temporal, por meio das técnicas denominadas de Getis-Ord General G e Getis-Ord Gi*. **Resultados:** a SG aumentou de 194 casos em 2008 para 2.828 em 2018, e a SC, de 85 casos para 880 em 2018, principalmente entre gestantes de raça/cor branca e idade entre 20 e 39 anos. Em 2008, houve mais diagnósticos entre mulheres com menos de oito anos de estudo e classificação clínica primária. Em 2018, com mais de oito anos de estudo e classificação clínica latente. Para a SC, em ambos os anos, predominaram crianças de raça/cor branca, faixa etária de até seis dias de vida e SC recente. A análise espaço-temporal mostrou maior prevalência nas macrorregionais Leste e Oeste do estado do Paraná. **Conclusões:** Quanto menor o nível educacional, maior a probabilidade para o desenvolvimento do agravo entre as gestantes e, consequentemente, para seus filhos. O perfil das gestantes e os espaços de maior ocorrência favorecem o planejamento e a execução de ações localizadas para o diagnóstico e educação em saúde.

Palavras-chave: Análise Espacial. Infecções Sexualmente Transmissíveis. Enfermagem. Sífilis. Saúde Materno-Infantil.

EVOLUCIÓN ESPACIO-TEMPORAL DE LA SÍFILIS GESTACIONAL Y CONGÉNITA EN EL ESTADO DE PARANÁ

RESUMEN

Objetivo: comparar características sociodemográficas, distribución y asociación espacial de la sífilis gestacional y congénita en Paraná en 2008 y 2018. **Métodos**: estudio ecológico con casos de sífilis gestacional (SG) y sífilis congénita (SC) notificados en los años 2008 y 2018 en el Sistema Nacional de Información de Agravios de Notificación del Estado de Paraná-Brasil. Los datos fueron analizados por medio de análisis descriptivo, distribución y asociación espacio-temporal, por medio de las técnicas denominadas de *Getis-Ord General G* y *Getis-Ord Gi**. **Resultados**: la SG aumentó de 194 casos en 2008 para 2.828 en 2018, y la SC, de 85 casos para 880 en 2018, principalmente entre gestantes de raza/color blanco y edad entre 20 y 39 años. En 2008, hubo más diagnósticos entre mujeres con menos de ocho años de estudio y clasificación clínica primaria. En 2018, con más de ocho años de estudio y clasificación clínica latente. Para la SC, en ambos años, predominaron niños de raza/color blanco, franja etaria de hasta seis días de vida y SC reciente. El análisis espacio-temporal mostró mayor prevalencia en las macrorregionales Este y Oeste del estado de Paraná-Brasil. **Conclusiones**: cuanto menor sea el nivel educativo, mayor será la probabilidad para el desarrollo del agravio entre las gestantes y, consecuentemente, para sus hijos. El perfil de las gestantes y los espacios de mayor incidencia favorecen la planificación y la ejecución de acciones específicas para el diagnóstico y la educación en salud.

Palabras clave: Análisis Espacial. Infecciones de transmisión sexual. Enfermería. Sífilis. Salud Materno-Infantil**.**

REFERENCES

1. Kojima N, Klausner JD. An Update on the Global Epidemiology of Syphilis. Curr Epidemiol Rep. 2018. 5:24–38. DOI: 10.1007/s40471-018-0138-z

2. Brasil. Ministério da Saúde (BR), Secretaria de Vigilância em Saúde. Boletim Epidemiológico: Sífilis [Internet]. Brasília: Ministério da Saúde; 2020. Disponível em: https://www.gov.br/aids/pt-br/centrais-de-conteudo/boletins-epidemiologicos/2020/sifilis/boletim_sifilis_2020.pdf/view. Acesso em: 15 jan, 2021.

3. Taylor MM, Nurse-Findlay S, Zhang X, Hedman L, Kamb ML,

Broutet N, Kiarie J. Estimating Benzathine Penicillin Need for the Treatment of Pregnant Women Diagnosed with Syphilis during Antenatal Care in High-Morbidity Countries. PLoS One. 2016;11(7):e0159483. DOI: 10.1371/journal.pone.0159483

4. World Health Organization. Guidelines for the treatment of Treponema pallidum (syphilis). Geneva: WHO; 2016. Disponível em: https://www.who.int/publications/i/item/9789241549714. Acesso em: 17 nov, 2022.

5. Conceição HN, Câmara JT, Pereira BM. Análise epidemiológica e espacial dos casos de sífilis gestacional e congênita. Saúde e Debate. 2019;43(123):1145-1158. DOI: 10.1590/0103-1104201912313.

6. Wong NS, Chen L, Tucker JD, Zhao P, Goh BT, Poon CM, et al. Distribution of reported syphilis cases in South China: spatiotemporal analysis. Sci Rep. 2018; 14;8(1). DOI: 10.1038/s41598-018-27173-y.

7. Salway T, Gesink D, Lukac C, Roth D, Ryan V, Mak S, et al. Spatial-Temporal Epidemiology of the Syphilis Epidemic in Relation to Neighborhood-Level Structural Factors in British Columbia, 2005-2016. Sex Transm Dis. 2019 Sep;46(9):571-578. DOI: 10.1097/OLQ.0000000000001034.

8. Padovani C, Oliveira RR, Pelloso SM. Syphilis in during pregnancy: association of maternal and perinatal characteristics in a region of southern Brazil. Rev. Latino-Am. Enfermagem. 2018;26:e3019. DOI: 10.1590/1518-8345.2305.3019.

9. IBGE. Instituto Brasileiro de Geografia e Estatística. Cidades e estados - Paraná. 2020. Disponível em: https://cidades.ibge.gov.br/brasil/pr/panorama. Acesso em: 10 nov. 2021.

10. Getis A, Ord JK. The analysis of spatial association by use of distance statistics. Geographical analysis. 1992;24(3):189-206. DOI: 10.1111/j.1538-4632.1992.tb00261.x.

11. Instituto de Pesquisa de Sistemas Ambientais (Esri). HOW Hot Spot Analysis (Getis-Ord Gi*) works. Disponível em: https://pro.arcgis.com/en/pro-app/latest/tool-reference/spatial-statistics/h-how-hot-spot-analysis-getis-ord-gi-spatial-stati.htm. Acesso em: 17 out. 2021.

12. Nunes PS, Guimarães RA, Rosado LEP, Marinho TA, Aquino EC, Turchi MD. Temporal trend and spatial distribution of syphilis in pregnancy and congenital syphilis in Goiás, Brazil, 2007-2017: na ecological study. Epidemiol. Serv. Saúde [Internet]. 2021; 30(1): e2019371. DOI: 10.1590/S1679-49742021000100002.

13. Korenromp EL, Rowley J, Alonso M, Mello MB, Wijesooriya NS, Mahiané SG, et al. Global burden of maternal and congenital syphilis and associated adverse birth outcomes-Estimates for 2016 and progress since 2012. PLoS One. 2019;14(2):e0211720. DOI: 10.1371/journal.pone.0211720.

14. Menegazzo LS, Toldo MKS, Souto AS. A recrudescência da sífilis congênita. Arquivos Catarinenses de Medicina, 2018; 47 (1): 2-10. DOI: 10.1590/2317-6431-2015-1629.

15. Barimacker SV, Zocche DAA, Zanatta EA, Junior JDR, Korb A. Construction of a nursing flochartr and protocol for syphilis management in primary health care. Cienc Cuid Saude, 2022; 21 (1). DOI: 10.4025/ciencuidsaude.v21i0.59856.

16. Slutsker JS, Hennessy RR, Schillinger JA. Factors Contributing to Congenital Syphilis Cases - New York City, 2010-2016. MMWR Morb Mortal Wkly Rep. 2018;67(39):1088-1093. DOI: 10.15585/mmwr.mm6739a3.

17. Manolescu LSC, Boeru C, Caruntu C, Dragomirescu CC, Goldis M, Jugulete G, Marin M, Popa GL, Preda M, Radu MC, Popa MI. A Romanian experience of syphilis in pregnancy and childbirth. Midwifery. 2019;78;58-63. DOI: 10.1016/j.midw.2019.07.018.

18. Almeida RAAS, Corrêa RGCF, Rolim ILTP, Hora JM, Linard AG, Coutinho NPS, Oliveira PS. Knowledge of adolescents regarding sexually transmitted infections and pregnancy. Rev. Bras. Enferm. 2017;70(5):1033-1039. DOI: 10.1590/0034-7167-2016-0531.

19. Campos CO, Campos CO. Abordagem diagnóstica e terapêutica da sífilis gestacional e congênita: revisão narrativa. Rev Eletrônica Acervo Saúde. 2020;53. DOI: 10.25248/reas.e3786.2020.

20. Galvis AE, Arrieta A. Congenital Syphilis: A U.S. Perspective. Children. 2020;7(203). DOI: 10.3390/children7110203.

21. Teixeira LO, Belarmino V, Gonçalves CV, Mendoza-Sassi RA. Tendência temporal e distribuição espacial da sífilis congênita no estado do Rio Grande do Sul entre 2001 e 2012. Ciên. Saúde Colet. 2018;23(8):2587-2597. DOI: 10.1590/1413-81232018238.25422016.

22. Paiva KM, Silveira DS, Besen E, Moreira E, Corrêa VP, Hillesheim D, Hass P. Perfil epidemiológico da sífilis materna e congênita em Florianópolis, 2016-2017. Braz. J. of Develop. 2020;6(8):54750-54760. DOI: 10.34117/bjdv6n8-042.

23. Costa AWS, Freitas AS, Lopes KFAL. Epidemiologia da sífilis gestacional no Estado do Maranhão de 2015 a 2019. Rev Cereus. 2021;13(1). DOI: 10.18605/2175-7275/cereus.v13n1p52-61.

24. Vieira ISA, Caldas MLLS, Medeiros HRL, Lima TNFA, Berezin EM. Características epidemiológicas dos casos de sífilis congênita no Estado da Paraíba. Res., Soc. Dev. 2021;10(4). DOI: 10.33448/rsd-v10i4.13511.

25. Paraná. Secretaria de Estado da Saúde do Paraná. Plano Estadual de Saúde Paraná 2016-2019 – Curitiba: SESA, 2016. 200 p. Disponível em: https://www.conass.org.br/pdf/planos-estaduais-de-saude/PR_PlanoEstadualSaude2016MioloAlt.pdf. Acesso em: 15 out, 2022.

26. Araújo MAL, Andrade RFV, Barros VL, Bertoncini PMRP. Factors associated with unfavorable outcomes caused by Syphilis infection in pregnancy. Rev Bras Saúde Mater Infant. 2019;19(2)421-429. DOI: 10.1590/1806-93042019000200009.

27. Arjona, FBS. Sistemas de informações geográficas: usos e aplicações na área da saúde. Técnico de vigilância em saúde: fundamentos. 2017;2:113-136. Disponível em: https://www.arca.fiocruz.br/bitstream/handle/icict/39908/T%E9cnico%20de%20Vigil%E2ncia%20em%20Sa%FAde%20v.2%20-%20Sistemas%20de%20informa%E7%F5es%20geogr%E1ficas.pdf;jsessionid=B103469C5B3AFF2BA036499B64E37B50?sequence=2. Acesso em: 28 mar, 2023.

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