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Congenital syphilis in Paraná and its twin cities: focus on Foz do Iguaçu

Sífilis congênita no Paraná e em suas cidades gêmeas: enfoque em Foz do Iguaçu

Sífilis congénita en Paraná y sus ciudades gemelas: foco en Foz de Iguazú

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ABSTRACT

Objective: to analyze the occurrence of congenital syphilis in Paraná and its twin cities, with a focus on Foz do Iguaçu. **Method:** cross-sectional, retrospective study with a quantitative approach, based on secondary data collected in the Notifiable Diseases Information System between 2011 and 2020. The incidence rates of congenital syphilis per 1,000 live births were calculated. **Results:** in Paraná, 6,088 cases of congenital syphilis were reported. Of these, 338 were in its twin cities. The city with the highest number of cases was Foz do Iguaçu with 320 cases. In Paraná and Foz do Iguaçu, the average annual incidence rates were 3.9 and 7.3 cases/1,000 live births ($p<0.05$), respectively. The most relevant maternal characteristics were diagnosis of syphilis during prenatal care (65.9%) and inadequate treatment (41.3%) ($p<0.05$). **Conclusion:** maternal characteristics related to congenital syphilis require improvement in prenatal care and the feasibility of cross-border public policies.
Descriptors: Public Health; Prenatal Care; Syphilis, Congenital; Border Areas.

RESUMO

Objetivo: analisar a ocorrência de sífilis congênita no Paraná e suas cidades gêmeas, com enfoque em Foz do Iguaçu. **Método:** estudo transversal, retrospectivo, de abordagem quantitativa, com base em dados secundários coletados no Sistema de Informação de Agravos de Notificação entre 2011 e 2020. Foram calculadas as taxas de incidência de sífilis congênita por 1.000 nascidos vivos. **Resultados:** no Paraná, foram notificados 6.088 casos de sífilis congênita. Desses, 338 foram em suas cidades gêmeas. A cidade com maior número de casos foi Foz do Iguaçu com 320 casos. No Paraná e em Foz do Iguaçu, as taxas médias de incidência anual foram de 3,9 e 7,3 casos/1.000 nascidos vivos ($p<0,05$), respectivamente. As características maternas de maior relevância foram diagnóstico de sífilis durante o pré-natal (65,9%) e com tratamento inadequado (41,3%) ($p<0,05$). **Conclusão:** as características maternas relacionadas a sífilis congênita requerem melhoria do acompanhamento pré-natal e viabilização de políticas públicas transfronteiriças.
Descritores: Saúde Pública; Cuidado Pré-Natal; Sífilis Congênita; Áreas de Fronteira.

RESUMEN

Objetivo: analizar la ocurrencia de sífilis congénita en Paraná y sus ciudades gemelas, con foco en Foz de Iguazú. **Método:** estudio transversal, retrospectivo, con enfoque cuantitativo, basado en datos secundarios recopilados en el Sistema de Información de Agravios, notificación entre 2011 y 2020. Se calcularon las tasas de incidencia de sífilis congénita por 1.000 nacidos vivos. **Resultados:** en Paraná se notificaron 6.088 casos de sífilis congénita. De ellos, 338 estaban en sus ciudades gemelas. La ciudad con mayor número de casos fue Foz de Iguazú con 320 casos. En Paraná y Foz de Iguazú, en promedio, las tasas de incidencia anual fueron de 3,9 y 7,3 casos/1.000 nacidos vivos ($p<0,05$), respectivamente. Las características maternas más relevantes fueron el diagnóstico de sífilis durante el control prenatal (65,9%) y el tratamiento inadecuado (41,3%) ($p<0,05$).
Conclusión: las características maternas relacionadas con la sífilis congénita requieren la mejora de la atención prenatal y la implementación de políticas públicas transfronterizas.
Descriptores: Salud Pública; Atención Prenatal; Sífilis Congénita; Zonas Fronterizas.

INTRODUCTION

Syphilis is an infectious disease caused by the *Treponema pallidum* bacterium and mainly transmitted through the sexual and/or vertical pathways, responsible for the acquired or congenital form of the disease[1]. Vertical transmission exerts an impact on Public Health due to the consequences presented by the fetus or newborn, including fetal and neonatal death, miscarriage and premature birth. The more recent the maternal infection, the higher the risk of fetal impairment[2].

During the primary and secondary phases of the infection, transmission is 70% to 100% of the cases in untreated pregnant women, whereas it reaches 30% in the late latent and tertiary phases. The disease also presents a high mortality rate, with up to 40% of infected fetuses and newborns, varying from miscarriage to perinatal death[2].

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Assistance to pregnant women during the prenatal period is important to curb the incidence of Congenital Syphilis (CS)[3]. Prenatal care makes it possible to perform rapid tests and routine examinations, in addition to the availability of medications and supplements necessary for the treatments[4]. This assistance is provided in Primary Care, but the high rates of CS indicate weaknesses in prenatal care[5,6].

In states with international borders, the situation seems to be even more worrying, given the presence of a fluctuating population and unstable sexual relationship records. In the context of these regions, the creation of the Integrated Border Health system (*SIS Fronteiras*) in 2005 by the Ministry of Health (*Ministério da Saúde*, MS) sought to improve actions in these areas, and had the following among its objectives: to develop the infrastructure of health services; to identify migratory flows; and to analyze the impact of actions and programs on a local scale[7,8].

The border is the place where contact between systems takes place and, therefore, a particular social movement. The geographical area of the territorial division represents a place of spontaneous interaction based on the daily actions experienced by the people and institutions that inhabit it; however, many of these relationships take place at the informal level [9]. The dividing lines are the best demonstrations that the international, the local, the regional and the national coexist in the same everyday life; even if the boundary zones of the various political levels operate separately, the border boundary cannot be seen beyond the map[8].

In view of the above, it is assumed that the occurrence of CS in border regions is intensified by social, behavioral conditions and related to deficient health services (due to the presence of a floating population), to control this problem. Considering the heterogeneity of the populations living in the border regions and the need to develop effective strategies aimed at CS prevention and control, the objective of this study was to analyze the occurrence of congenital syphilis in Paraná and its twin cities, focusing on Foz do Iguaçu.

LITERATURE REVIEW

Syphilis remains a global challenge, with approximately 7.1 million new cases in 2020[10]. According to estimates, there were 661,000 CS cases in 2016 and more than 200,000 stillbirths and neonatal deaths[11]. In Brazil, 61,127 syphilis cases in pregnant women were reported in the Notifiable Diseases Information System (*Sistema de Informação de Agravos de Notificação*, SINAN) in 2019, with a detection rate of 20.8 cases/1,000 live births. CS recorded 24,130 cases in the same year, with an incidence rate of 8.2 cases/1,000 live births[2].

In the Brazilian border arches, called spatial cutouts, contemplated by the North, Central and South regions), there were 3,960 Gestational Syphilis (GS) cases in 2020, with a detection rate of 21.6/1,000 live births and 836 CS cases (incidence of 4.6/1,000 live births). From 2010 to 2020, the mean annual rise in the GS detection rate was 53.4% in Brazil and 48.0% in the border region. The annual oscillation of the CS incidence for the period was 31.0% in Brazil and 38.4% at the border, in relative terms[8].

Although the relevance of the border region in Brazil and of CS as a challenge for Public Health, few studies investigate the epidemiology of this disease in the region[5]. Proportional to the extent of the Brazilian border areas is the extent of the challenges with regard to the decrease in gestational and congenital syphilis cases. Due to its own characteristics, the territorial division requires a different treatment, as the challenges on the Brazilian border are diverse, encompassing educational, health, environmental and cultural issues with neighboring countries[12].

Thus, it is fundamental to analyze the epidemiological profile of pregnant women and children diagnosed with syphilis in the affected region to support the elaboration and implementation of effective courses of action aimed at CS control measures that meet the peculiarities of this environment[8].

METHOD

A cross-sectional, descriptive/quantitative and retrospective study was carried out, based on public data from the Informatics Department of the Unified Health System (DATASUS) collected from May 2nd to May 10th, 2022.

The methodological path consisted of the following steps: access to the DATASUS portal and selection of the items: access to the information; health information (TABNET); epidemiological and morbidities; Notifiable Diseases and Health Problems - from 2007 onwards (SINAN); and congenital syphilis (http://www.datasus.gov.br).

The study population consisted of the data referring to the number of CS cases, diagnosed in children up to one year of age in the state of Paraná and its twin cities, focusing on the city with the highest number of reported cases from 2011 to 2020.

Choice of this state was due to diverse empirical evidence of the CS situation in the municipality of Foz do Iguaçu. However, in order to make a comparison, an investigation was initially carried out in all the twin cities of Paraná, to know if the evidence would be confirmed.

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In order to avoid errors related to delay in notification, it was decided to analyze the data available until 2020, as this was the last year that the full data were included in the collection period.

The state of Paraná is located in the Brazilian Southern region, with an estimated population of 11,597,484 inhabitants[13]. It borders a contour made by the Atlantic Ocean and two South American countries: Paraguay and Argentina. In that state there are 139 municipalities within the border strip, with four twin cities among them: Foz do Iguaçu, Guaíra, Santo Antônio do Sudoeste and Barracão[14].

Conceptually, twin cities are municipalities with a population greater than two thousand inhabitants, separated by a border line, dry or fluid, articulated or not by infrastructure work that has economic and cultural integration with the neighboring country[15].

The occurrence of CS cases was analyzed according to the maternal sociodemographic variables related to the child. Thus, the variables analyzed in this research were the following: race/skin color, maternal age and schooling, prenatal care, time since the maternal syphilis diagnosis, appropriate maternal treatment or not, age of the child at the time of diagnosis and death due to CS in children up to one year old.

Descriptive statistics were performed to obtain absolute values (n), number of live births (LBs), detection rate (DT) and percentages (%). The analysis of the CS incidence rates in the time series was performed with the chi-square test (χ^2) for trends. The analysis of the association between the number of CS reported cases and the age variable was performed with the χ^2 test for independence. The other variables were analyzed with the G test[16]. p-values ≤ 0.05 were considered for statistical significance. The Minitab 18 software was used.

In addition, the CS incidence rates were calculated between 2011 and 2020, referring to the state of Paraná and its twin city with the highest number of cases. For this purpose, the number of reported cases per year was used, divided by the number of live births in the same year and place and multiplied by 1,000.

The research complies with the determinations described in Resolution 466/2012 and complementary resolutions of the National Health Council and, for dealing with public domain data with aggregated information without the possibility of identifying the individuals, proceedings before a Research Ethics Committee are waived.

RESULTS

During the period from 2011 to 2020, 6,088 CS cases were reported in SINAN in the state of Paraná and, among the twin cities from the state, Foz do Iguaçu presented the highest number with 320 cases, followed by Guaíra with nine cases, Santo Antônio do Sudoeste with five and Barracão with four. The data are presented in Table 1.

TABLE 1: Number of cases (n), number of live births and detection rate (DT) per 1,000 live births for congenital syphilis in children up to one year of age, in the state of Paraná and in the twin city of Foz do Iguaçu, between 2011 and 2020. Foz do Iguaçu, PR, Brazil, 2020.

	Notification locations					
Notification of the Diagnosis	Paraná			Foz do Iguaçu		
	n*	n/Live births	DT*	n*	n/Live births	DT*
2011	215	152,902	1.4	1	4,312	0.2
2012	304	153,945	2.0	4	4,392	0.9
2013	384	155,758	2.5	7	4,385	1.6
2014	468	159,915	2.9	9	4,501	2.0
2015	645	160,947	4.0	15	4,327	3.5
2016	727	155,066	4.7	21	4,198	5.0
2017	865	157,701	5.5	41	4,401	9.3
2018	862	156,201	5.5	53	4,422	12.0
2019	867	153,469	5.6	90	4,423	20.3
2020	751	146,291	5.1	79	4,159	19.0
Total	**6,088**	**1,552,195**	**39.3**	**320**	**43,520**	**73.9**

Source: Prepared by the authors with data from the Information System for Notifiable Diseases. Ministry of Health (2022). *Chi-square test for trends (p<0.05).

According to the SINAN notifications, in the state of Paraná and in the twin city of Foz do Iguaçu there was an annual growth in the number of cases between 2011 and 2019 (p<0.05), with a reduction in 2020. In the analysis of the incidence values, it was observed that, both in the state of Paraná and in the city of Foz do Iguaçu, the CS rates increased significantly during the period considered, with more significant growth from 2017 to 2019 (p<0.05). The

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mean annual rates observed were 3.9 and 7.3 cases/1,000 live births. The maternal sociodemographic characteristics are presented in Table 2.

Table 2: Maternal sociodemographic characteristics in terms of congenital syphilis in children up to one year of age between 2011 and 2020. Foz do Iguaçu, PR, Brazil, 2020.

	Notification period					
	2011-2012	2013-2014	2015-2016	2017-2018	2019-2020	Total
Characteristics	n/%	n/%	n/%	n/%	n/%	n/%
Age group						
10-14	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.3)	2 (0.6)	3 (0.9)
15-19	3 (0.9)	4 (1.3)	8 (1.3)	22 (6.9)	47 (14.7)	84 (26.3)
20-29	2 (0.6)	9 (2.8)	14 (4.4)	57 (17.8)	96 (30.0)	178 (55.6)
30-39	0 (0.0)	3 (0.9)	14 (4.4)	13 (4.1)	20 (6.3)	50 (15.6)
40+	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.3)	4 (1.3)	5 (1.6)
Unknown/Blank	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Total	5 (1.6)	16 (5.0)	36 (11.3)	94 (29.4)	169 (52.8)	320 (100.0)
***p*-value**						**0.0367**
Schooling						
Illiterate	0 (0.0)	0 (0.0)	2 (0.6)	4 (1.3)	3 (0.9)	9 (2.8)
Incomplete 1st-4th grade	0 (0.0)	1 (0.3)	2 (0.6)	6 (1.9)	6 (1.9)	15 (4.7)
Complete 4th grade	0 (0.0)	0 (0.0)	1 (0.3)	3 (0.9)	8 (2.5)	12 (3.8)
Incomplete 5th-8th grade	2 (0.6)	7 (2.2)	6 (1.9)	17 (5.3)	27 (8.4)	59 (18.4)
Complete Elementary School	0 (0.0)	1 (0.3)	5 (1.6)	6 (1.9)	15 (4.7)	27 (8.4)
Incomplete High School	0 (0.0)	1 (0.3)	5 (1.6)	16 (5.0)	15 (4.7)	37 (11.6)
Complete High School	1 (0.3)	1 (0.3)	2 (0.6)	13 (4.1)	32 (10.0)	49 (15.3)
Incomplete Higher Education	0 (0.0)	0 (0.0)	1 (0.3)	1 (0.3)	7 (2.2)	9 (2.8)
Complete Higher Education	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.3)	1 (0.3)	2 (0.6)
Not applicable	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.9)	3 (0.9)
Unknown/Blank	2 (0.6)	5 (1.6)	12 (3.8)	27 (8.4)	52 (16.3)	98 (30.6)
Total	5 (1.6)	16 (5.0)	36 (11.3)	94 (29.4)	169 (52.8)	320 (100.0)
***p*-value**						0.7322
Maternal race or skin color						
White	4 (1.3)	10 (3.1)	25 (7.8)	77 (24.1)	119 (37.2)	235 (73.4)
Black	0 (0.0)	0 (0.0)	1 (0.3)	2 (0.6)	3 (0.9)	6 (1.9)
Asian	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.6)	2 (0.6)
Brown	0 (0.0)	5 (1.6)	8 (2.5)	14 (4.4)	39 (12.2)	66 (20.6)
Indigenous	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Unknown/Blank	1 (0.3)	1 (0.3)	2 (0.6)	1 (0.3)	6 (1.9)	11 (3.4)
Total	5 (1.6)	16 (5.0)	36 (11.3)	94 (29.4)	169 (52.8)	320 (100.0)
***p*-value**						0.5487

Source: Prepared by the authors with data from the Information System for Notifiable Diseases. Ministry of Health (2022). *Chi-square test. **G test.

When analyzing the maternal sociodemographic characteristics in terms of CS in Foz do Iguaçu, predominance of the age group from 20 to 29 years old (55.6%) was noticed, followed by the age group from 15 to 19 years old (26.3%), and low percentages in the groups below 14 and above 40 years of age ($p<0.05$). There was predominance of incomplete 5th to 8th grade with 59 cases (18.4%) and of white race or skin color among the mothers, with 235 (73.4%) ($p>0.05$).

Table 3 presents the maternal health conditions and the children's social conditions, according to the data sources collected.

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Table 3: Maternal health conditions and children's social characteristics, related to the occurrence of congenital syphilis in children up to one year of age, in Foz do Iguaçu between 2011 and 2020.

	Notification period					
Characteristics	**2011-2012 n/%**	**2013-2014 n/%**	**2015-2016 n/%**	**2017-2018 n/%**	**2019-2020 n/%**	**Total n/%**
Maternal characteristics						
Attended prenatal care						
Yes	5 (1.6)	9 (2.8)	33 (10.3)	82 (25.6)	147 (45.9)	276 (86.3)
No	0 (0.0)	5 (1.6)	3 (0.9)	10 (3.1)	18 (5.6)	36 (11.3)
Unknown/Blank	0 (0.0)	2 (0.6)	0 (0.0)	2 (0.6)	4 (1.3)	8 (2.5)
Total	5 (1.6)	16 (5.0)	36 (11.3)	94 (29.4)	169 (52.8)	320 (100.0)
****p*-value**						0.1177
Maternal syphilis diagnosis						
During prenatal care	2 (0.6)	8 (2.5)	31 (9.7)	66 (20.6)	104 (32.5)	211 (65.9)
At delivery/curettage	2 (0.6)	4 (1.3)	3 (0.9)	19 (5.9)	58 (18.1)	86 (26.9)
After delivery	1 (0.3)	1 (0.3)	2 (0.6)	5 (1.6)	5 (1.6)	14 (4.4)
Not performed	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.3)	1 (0.3)	2 (0.6)
Unknown/Blank	0 (0.0)	3 (0.9)	0 (0.0)	3 (0.9)	1 (0.3)	7 (2.2)
Total	5 (1.6)	16 (5.0)	36 (11.3)	94 (29.4)	169 (52.8)	320 (100.0)
****p*-value**						**0.0105**
Maternal treatment scheme						
Adequate	0 (0.0)	1 (0.3)	4 (1.3)	9 (2.8)	23 (7.2)	37 (11.6)
Inadequate	4 (1.3)	8 (2.5)	20 (6.4)	35 (10.9)	65 (20.3)	132 (41.3)
Not performed	0 (0.0)	4 (1.3)	7 (2.2)	32 (10.0)	73 (22.8)	116 (36.3)
Unknown/Blank	1 (0.3)	3 (0.9)	4 (1.6)	18 (5.6)	8 (2.5)	35 (10.9)
Total	5 (1.6)	16 (5.0)	36 (11.3)	94 (29.4)	169 (52.8)	320 (100.0)
****p*-value**						**0.0129**
Children's characteristics						
Children's age						
Less than 7 days old	5 (1.6)	16 (5.0)	33 (10.3)	89 (27.8)	165 (51.6)	308 (96.3)
From 7 to 27 days old	0 (0.0)	0 (0.0)	3 (0.9)	2 (0.6)	3 (0.9)	8 (2.5)
From 28 to 364 days old	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.6)	1 (0.3)	3 (0.9)
1 year old	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.3)	0 (0.0)	1 (0.3)
Unknown/Blank	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Total	5 (1.6)	16 (5.0)	36 (11.3)	94 (29.4)	169 (52.8)	320 (100.0)
****p*-value**						0.8914
Deaths due to congenital syphilis up to one year old						
Total number of deaths due to congenital syphilis	1 (0.3)	0 (0.0)	0 (0.0)	2 (0.6)	0 (0.0)	3 (0.9)

Source: Prepared by the authors with data from the Information System for Notifiable Diseases. Ministry of Health (2022). **G test.

Regarding the maternal health conditions in terms of CS in Foz do Iguaçu, it was observed that 276 pregnant women (86.3%) attended prenatal care (p>0.05); that the maternal syphilis diagnosis was confirmed during prenatal care in 211 pregnant women (65.9%) (p<0.05); that the maternal treatment scheme was inadequate in 132 (41.3%) (p<0.05); and that 116 pregnant women (36.3%) did not undergo treatment (p<0.05).

As for the children's social characteristics related to CS occurrence in the city of Foz do Iguaçu between 2011 and 2020, there was greater predominance in those aged less than 7 days old, with 308 cases (96.3%) (p>0.05); and the number of deaths due to CS corresponded to 3 cases (0.9%).

DISCUSSION

In open border regions, Public Health is influenced by population mobility, increasing the risk for the emergence and re-emergence of diseases. Associated with this, the living conditions of more vulnerable groups make health care in the region complex. Consequently, the high flow of users can alter the results regarding effectiveness of the health actions[17].

As for border limits, they can generate fragile situations for the population's health, as the international limit hinders disease surveillance and control and epidemiological information is rarely shared between countries, while

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diseases circulate freely in these regions[12]. The situations herein presented support the incidence of CS cases reported in the state of Paraná and in its twin city, Foz do Iguaçu, between 2011 and 2020.

The results of this study point out the complexity of the problem based on the high number of cases and the incidence rate of CS ($p<0.05$); the values are in excess of those proposed by the WHO for eradication of the disease (reduction in the incidence rate to 0.5% or less per 1,000 live births)[12]. Studies that investigate the CS incidence over the years are extremely relevant, as identifying the clinical and epidemiological characteristics makes it possible to uncover the critical aspects of the interventions in maternal and child health[5,6,8,11,18,19].

During the period from 2011 to 2020, the state of Paraná and the city of Foz do Iguaçu reached the highest number of cases and the highest incidence rate for CS in 2019: 867 cases, incidence of 5.6/1,000 live births; and 90 cases, incidence of 23.3/1,000 live births ($p<0.05$), respectively. Other Brazilian municipalities with significant migration of people also presented an increase in the incidence rate with a high Relative Risk (RR) for CS, between 2015 and 2018, with the most affected being those that border other countries and tourist cities, such as: Porto Alegre (RR=6.4), Recife (RR=5.8), Manaus (RR=5.1), Rio de Janeiro (RR=3.7) and Campo Grande (RR=2.7) ($p<0.001$)[5]. In addition to that, the annual variation in the CS incidence during 2010 and 2020 was 31.0% in Brazil and 38.4% on the border, with the North and South arcs presenting 18.3% and 65.7%, respectively[8].

The significant increase in the number of cases and the incidence rate of CS can be related to several factors such as reduced condom use during sexual intercourse, mandatory treponemal tests at the time of delivery, pregnant women and sexual partners with inadequate treatment, increased coverage and offer of rapid tests and improvement in notifications[19,20].

In the case of the twin city of Foz do Iguaçu, another possible associated factors is that commuting residents who live in neighboring countries (Paraguay and Argentina) seek medical and hospital care in the city[21], supported by the Unified Health System (*Sistema Único de Saúde*, SUS) principles of gratuitousness and universality. Large circulation of people in this border municipality attributes a higher demand to the local health system, considering that the municipality inevitably ends up serving people from other places[22]. In order to access the network of social rights offered in Foz do Iguaçu, foreigners or Brazilians living in other countries forge strategies such as false addresses and relatives and temporary stays, so as to obtain SUS-related cards or other social benefits[23].

Also regarding the number of CS cases, in relation to 2020, although there was a decline in the number of CS cases reported in Paraná and Foz do Iguaçu, in relation to 2019, according to the syphilis epidemiological bulletin, the trend is that the number of cases and the incidence rate will continue to rise. It is important to emphasize that this reduction can be associated with the vulnerability of the data filled out in the research forms or resulting from data underreporting in the system at the time of typing as well as underreporting of cases in SINAN, due to the demand for health professionals required to work in the COVID-19 pandemic[24].

Regarding the maternal sociodemographic factors analyzed in this study, the result of the statistical analysis showed that maternal age was directly related to vertical CS transmission ($p<0.05$). Although not significant, other factors involved were schooling and skin color, signaling the susceptibility and risk for the vertical transmission of syphilis. With the exception of skin color, the data of the current study confirm findings in the literature with similar results[6,8,25].

The most prevalent age group can be associated with women's reproductive range: therefore, young women are more predisposed to acquiring syphilis because they are sexually active. In addition, inappropriate sexual behavior, as well as non-condom use and multiplicity of partners can be considered risk factors for contracting a Sexually Transmitted Infection (STI)[26].

In this regard, the distance between Foz do Iguaçu and neighboring countries (Paraguay and Argentina) may contribute to the incidence of CS cases in the twin city being higher than in the state of Paraná. The distance from the center of Foz do Iguaçu to Ciudad del Este (Paraguay) is 8.4 kilometers, requiring a mean commute time of 11 minutes. In turn, the distance to Puerto Iguazú is 12.1 kilometers, with an approximate commute time of 12 minutes. Proximity between the countries increases the opportunity for relationships and coexistence, given that the border is not only a line that delimits countries, but also people's access possibility from one place to another[12].

In addition, the low schooling levels evidence lack of knowledge about issues inherent to health, such as prevention of STIs, which has repercussions on lack of access to and guarantee of continuity of the population in educational systems and the low effectiveness of the PSE and, subsequently, differences in disease prevention and health promotion[25,27].

In addition to that, the “maternal syphilis diagnosis during prenatal care” and “inadequate maternal treatment” variables, were significantly related to CS transmission, affecting weaknesses related to prenatal care. Although Foz do

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Iguaçu has 97.8% of population coverage by Primary Health Care[28], 86.3% of the notified pregnant women attended prenatal care, but the maternal syphilis diagnosis during prenatal care was only detected in 65.9% of the cases; in addition, only 11.6% of the cases had adequate maternal treatments ($p<0.05$).

These indicators imply the low quality of prenatal care in the municipality of Foz do Iguaçu, which can be due to the professionals' lack of knowledge and familiarity in relation to the syphilis control protocols, as well as to the difficulty managing STIs. Diverse evidence report that health professionals have presented difficulties interpreting the results of the examination for CS and inadequate management of newborns (NBs) exposed to the infection, indicating the need to further train the professionals involved in performing prenatal care in the Triple Border[29]. Care for children with CS involves monitoring; therefore, it is extremely important to set up the line of care in the assistance network [30].

The GS treatment is considered adequate when it is initiated at least 30 days before delivery, with Benzathine Benzylpenicillin at the dosage indicated for the clinical stage of the disease8. Although treating the sexual partners is extremely important due to the reinfection possibility, it is not part of the epidemiological criteria for defining CS cases[31].

Diverse evidence indicate that, in Brazil, the treatment for the partners of pregnant women diagnosed with syphilis is insufficient and that the partners are communicated about the diagnosis by the pregnant women themselves or by a health professional; however, there are not enough studies to evaluate the effectiveness of the information provided to the partners about the importance of treatment in asymptomatic cases of the infection and about the consequences of incorrect treatments. The partners' treatment requires frequent consultations with health services, resulting in travel costs and absences from work[32].

Regarding the sociodemographic characteristics related to the children in the occurrence of CS, it was observed that the disease was identified in the age group of less than seven days old (96.3%). It is important to note that inadequate management of NBs exposed to syphilis or with the infection can lead to readmissions and/or to prolonged hospitalization, causing countless harms to the newborns, such as low birth weight, anemia, hepatosplenomegaly and dental changes, with consequent additional costs for the health systems[30].

In this study it is observed that CS is a condition inherent to Primary Care that requires the need for all professionals to consciously perform their roles to reduce any avoidable risk by making a timely diagnosis and providing adequate treatment[33,34]. Accordingly, as CS is a consequence of acquired syphilis, there is a need for health education in order to guide the border population living in Foz do Iguaçu regarding the transmission mechanisms of syphilis and other STIs[34].

Thus, papers of an academic nature involving health education are important, in order to offer safe information on transmission and prevention mechanisms about STIs[35], especially in the border region, where the flow of people allows contact between individuals from different locations, favoring transmission of diseases[36]. In addition to aiming at the prevention of diseases, the objective of health education is to promote quality of life and self-care in a given population. Therefore, its actions should be continuous, through diversified teaching and learning strategies, regardless of location or region[35].

Study limitations

As for the limitations of this study, the use of secondary data may represent only part of the existing cases due to failures, both in filling out the forms and in typing data into the system.

However, studies that resort to secondary data to analyze the CS epidemiological profile can contribute to structuring, surveilling and monitoring health services, identifying failures and allowing professional interventions [5,6,8,11].

CONCLUSION

There is a significantly growing trend of CS incidence in the decade analyzed, both in the state of Paraná and in the twin city (Foz do Iguaçu), pointing to certain distancing from the goal of eradicating vertical transmission proposed by the PAHO. The sociodemographic factors and maternal health conditions significantly related to the risk of contracting CS were maternal age, syphilis diagnosis during prenatal care, and inadequate maternal treatment.

The maternal factors associated with CS found in this study indicate failures in prenatal care, pointing to the need for continued training strategies for health professionals to reduce vertical transmission, as well as issues directly related to syphilis transmission, such as non-treatment of sexual partners and the deficiency of actions in sexual and reproductive health.

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Furthermore, this study may support the elaboration and implementation of courses of action aimed at the effectiveness of health actions in Primary Care, with subsequent improvements of prenatal care and adequate management of newborns exposed to syphilis or to the infection in the border municipality: Foz do Iguaçu. Finally, studies targeted at health education, which offer guidelines to the population on the transmission and prevention mechanisms for STIs, are required, specifically in the border region.

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Authors' contributions

Conceptualization, K.M.S, H.U.C, Z.A, S.S.R.A, S.R.M.M and M.N.M.; methodology, K.M.S, H.U.C, Z.A, S.S.R.A, S.R.M.M and M.N.M.; formal analysis, K.M.S and M.N.M.; investigation, K.M.S.; data curation, K.M.S and M.N.M.; manuscript writing, K.M.S and M.N.M.; manuscript review and editing, K.M.S, H.U.C, Z.A, S.S.R.A, S.R.M.M and M.N.M.; visualization, K.M.S, H.U.C, Z.A, S.S.R.A, S.R.M.M and M.N.M.; supervision, M.N.M.; project administration, M.N.M. All authors have read and agreed to the published version of the manuscript.