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Incidence of Congenital Syphilis in Brazilian Geographic Regions, 2007-2016

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Abstract

Congenital syphilis is an infectious and contagious disease, which is compulsory to report, and is associated with fetal and perinatal deaths, low birth weight and other sequelae. The objective of the study was to analyze the incidence of congenital syphilis in Brazil according to geographic region and year, in the period from 2007 to 2016. This was an epidemiological, an ecological and a time trend study with an exploratory purpose. The annual cases of congenital syphilis reported to SINAN (National System of Notifiable Diseases, Ministry of Health) and the number of live births were obtained according to the Live Birth Information System (SINASC, Ministry of Health) between 2007 and 2016 according to geographic region: North, Northeast, Midwest, Southeast and South. As this is a study that uses secondary data sources, underreporting births and diagnoses is its main methodological limitation. Incidence rates were calculated and presented in tables and graphs. The incidence of congenital syphilis in Brazil in the period from 2007 to 2016 was 3.97 per 1,000 live births, increasing significantly in the last five years ($p < 0.05$), a tendency also verified by geographic region. The increase in congenital syphilis is worrisome, and may be due to poor quality prenatal care, the inadequate model of treatment for pregnant women and their partners, and the reduction of underreporting the problem. As appropriate measures to mitigate the impact of this public health problem, it is recommended that the coverage and quality of prenatal care increase, with early diagnosis and treatment of syphilis in pregnant women and their sexual partners, in addition to the monitoring of newborns.

Keywords: Congenital syphilis; Maternal and Child Health; Descriptive Epidemiology

INTRODUCTION

Congenital syphilis (CS) results from the spread of Treponema pallidum from the infected pregnant woman to the fetus, where the transplacental route is the most common route, occurring in any gestational phase[1].

This is a contagious disease and is associated with fetal and perinatal deaths and low birth weight and is also responsible for neurological injuries and other deformities and sequelae[2]. The Brazilian policy towards CS formulated a plan (Operational Plan for Reducing Vertical Transmission HIV and Syphilis) to improve the control of this disease[2]. It is important to analyze the access and quality of maternal and child health services, treatment of pregnant women with syphilis and their partners, since health systems must exercise surveillance, monitor cases and evaluate programs[1,2].

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According to the WHO, vertical transmission varies between 45% and 75%, with an estimated minimum of 700,000 new cases annually, of which 90% occur in underdeveloped countries, suggesting that transmission of CS is associated with poor socioeconomic conditions[3].

Worldwide, about 2 million pregnant women are infected with syphilis each year. Most pregnant women do not test for the disease, and those who do are not treated properly or even receive treatment. Approximately 50% of untreated or inadequately treated pregnant women can transmit the disease to the fetus, leading to adverse outcomes such as fetal death, neonatal death, prematurity, low birth weight or congenital infection[4].

The use of penicillin initially led to a reduction in the incidence of CS, which was expected to be eradicated at the end of the 20th century, but this trend has not been observed over the years, and an increase in cases has been reported in developed countries[5,6,7].

In Brazil, in 2008, 5,541 cases of CS were notified, resulting in an incidence of 2.1/1,000 live births (LB),2 based on the numbers of the National System of Notifiable Diseases (SINAN) from the Ministry of Health. Authors comment that, despite being a compulsory notification disease, this rate may be underestimated because, despite the increase in prenatal coverage, there was no greater effectiveness of the actions that would lead to the prevention of CS.2 Between 2004 and 2013, according to a survey carried out by the Ministry of Health, the incidence of CS increased in Brazil, with an initial rate of 1.7/1,000LB reaching 4.7/1,000LB at the end of the period, with higher values in the North and Northeast regions[1].

Low education, poor socioeconomic conditions, late start for prenatal care (with consequent reduced number of consultations), a lack of treatment for pregnant women and partners, or inadequate treatment of cases were considered as risk factors[8].

Reporting this infectious and contagious disease has been mandatory since 1986 (Ordinance No. 542, 12/22/86 - Ministry of Health), and 104,853 cases have been reported in children under 1 year old from 1998 to 2014, which is a high number, but which can also mask a underreported CS[9].

The diagnosis of gestational syphilis is simple and its screening is mandatory during prenatal care; however, data on the incidence of CS show that many Brazilian newborns suffer from this disease, which should be eradicated, as it is simple to diagnose and to treat[7]. Treatment is usually carried out with penicillin and should extend to sexual partners. Failure to treat, or improperly treat CS may result in miscarriage, prematurity, acute complications and other fetal sequelae[10].

The epidemiological situation of syphilis in the world can be summarized as follows: WHO estimates the worldwide occurrence of more than one million cases of sexually transmitted infections per day. Annually, there will be 357 million new infections, including chlamydia, gonorrhea, syphilis and trichomoniasis. Syphilis affects one million pregnant women annually, leading to more than 300,000 fetal and neonatal deaths, putting more than 200,000 children at risk of premature death. In Latin America and the Caribbean, it is estimated that between 166,000 and 344,000 children are born with CS annually[10].

In Brazil, databases for infectious diseases in children are available, allowing calculations of incidence, their analysis and evolution, allowing the improvement of public health programs.10,11 From this source, there was an increase in the incidence of CS until 2013, reaching 4.7 per 1,000LB[1].

Two-thirds of live births may be asymptomatic, and CS may appear later, when symptoms appear at puberty[12]. From a financial point of view, the procedures performed on newborns with CS represent costs three times greater than the care provided to a baby without this infection[12].

The successive increases in the detection of syphilis in pregnant women, accompanied by increases in the incidence of CS, make this disease a major challenge for Public Health[13,14,15,16].

Based on this situation, the present study aims to analyze the temporal trend in the incidence of CS in Brazil and in its geographic regions, in order to assess the magnitude of the disease for the period from 2007 to 2016.

MATERIALS AND METHODS

This is an epidemiological study with an exploratory purpose, of an ecological type and of a time series, where all annual cases of CS reported to SINAN (National System of Notifiable Diseases, from the Ministry of Health) between 2007 and 2016 according to Brazilian geographic regions: North, Northeast, Midwest, Southeast and South.

Data on the number of cases of CS are included in the epidemiological bulletin of the Ministry of Health,10 while data on live births are available on the Ministry of Health's website according to the Live Birth Information System (SINASC)[11].

The statistical analysis was performed by calculating incidence rates (I) of CS in Brazil, according to the period, using the formula:

$$I = \frac{numero\ de\ casos\ novos\ de\ SC}{nascidos - vivos}\ x\ 1.000$$

The incidence data (Ix ‰ LB) were presented in tables and in trend graphs showing the comportment of CS over the period under analysis (2007 to 2016) in the country and in the different Brazilian geographic regions. The ratio of five-year incidence rates was calculated between the period (R) and the 95% confidence interval (95% CI). The criterion adopted to decide if there was a significant difference between the two rates related to the five-year periods was to verify if the confidence interval included the value of 1. If the value of 1 was included, the difference was not statistically significant, and if value 1 was not included, it could be said that the difference was significant[17].

RESULTS

CS in Brazil: 2007 to 2016

In the period from 2007 to 2016, 115,639 cases of CS were reported in Brazil, resulting in an incidence rate of 3.97‰ LB.

The temporal trend of the cases in the study period can be seen in Figure 1:

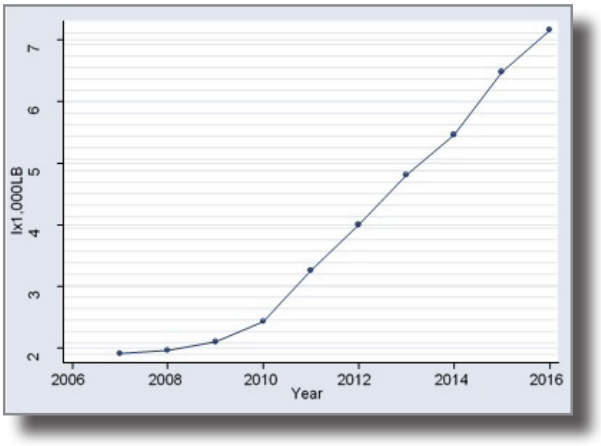

Figure 1. Incidence (I x ‰ LB) of CS in Brazil. 2007 to 2016.

It is observed that the incidence has increased in the last 10 years, with rates (‰ LB) being 1.91 in 2007 and reaching 7.16 in 2016 (1.91, 1.96, 2.10, 2.43, 3.26, 4.00, 4.81, 5.46, 6.48 and 7.16). The correlation coefficient was significant (r=0.98), where the incidence increased as the years passed. The coefficient of determination was 95%, that is, the variability of rates can be explained by the occurrences,

in the different years, of risk factors associated with vertical transmission of syphilis.

Considering the two five-year periods - 2007 to 2011 and 2012 to 2016 - the rates shown in Table 1 were observed.

5-year period	Number of CS cases	LB	I x1,000LB
2007 to 2011	33,737	14,482,745	2.33
2012 to 2016	81,902	14,664,543	5.59
Total	115,639	29,147,288	3.97

Table 1. Number of congenital syphilis cases, number of live births (LB) and congenital syphilis incidence rates per 1,000 live births (Ix1,000 LB). Brazil, 2007–2016.

The ratio between the two five-year rates was 2.40 (95% CI: 2.37–2.43). Thus, there was a statistically significant difference between the incidences in the two periods, in which the latter was 2.40 times greater.

CS in Brazilian geographic regions: 2007 to 2016

The geographic regions North, Northeast, Midwest, Southeast and South presented the following incidence rates of CS, respectively: 3.17, 4.33, 2.68, 4.36 and 3.54. Considering the five-year period study, the trends shown in Figure 2 are observed.

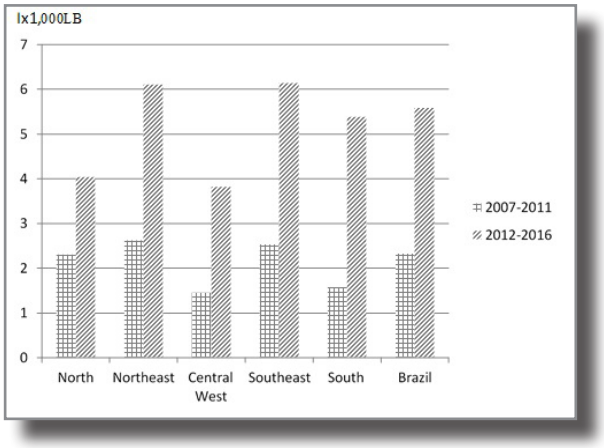

Figure 2. Congenital syphilis incidence rates (IX1,000 LB) by macroregion and nationwide for the periods 2007–2011 and 2012–2016.

As observed throughout the country, all Brazilian geographic regions showed an increase in the incidence rate of CS. The values in Table 2 show the analyzed ratios between the five-year rates by region

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Table 2. Five-year incidence rates of CS per 1,000 LB (Ix ‰ LB) and ratios between five-year periods (R; 95% CI). Brazilian geographic regions, 2007 to 2016.

Table 2. Congenital syphilis incidence rates per 1,000 live births (Ix1,000LB) for a 5-year period and ratios between the 5-year periods assessed by point (R) and by 95% confidence interval (CI95%). Macroregions of Brazil, 2007–2016

5-year period	(Ix1,000LB)				
	North	Northeast	Central West	Southeast	South
2007 to 2011	2.31	2.62	1.45	2.53	1.58
2012 to 2016	4.04	6.11	3.82	6.14	5.38
R	1.75	2.33	2.63	2.43	3.40

It can be seen that all regions showed significant increases in the incidence during 2012-2016 in relation to the 2007-2011 period.

Thus, in relation to the first five-year period, the Northern region demonstrated a 1.75 times greater (95% CI: 1.68; 1.82) increase, the Northeast was 2.33 times greater (95% CI: 2.28; 2.38) , the Southeast was 2.43 times greater (95% CI: 2.38; 2.48), the Midwest was 2.63 times greater (95% CI: 2.48; 2.78) and the South was 3.40 times greater (95% CI: 3.26; 3.54).

DISCUSSION

Within the 10-year duration of this study, which runs from 2007 to 2016, there was a large increase in the incidence of CS, from 1.71 to 7.16 cases ‰LB in the last year of the series. The average incidence rate of CS found for Brazil was 3.97 ‰ LB, in the period from 2007 to 2016, which was close to that of another study previously carried out. The Born in Brazil Study, carried out with data for the 2011-2012 biennium, showed a national CS rate of 3.51‰ LB[18,19].

In regional or local studies, values different from the national average incidence of CS were found, which depended on the specific social, economic and cultural characteristics. For example, in Palmas (TO), in the period 2007-2014, the incidence of CS reached 5.6 ‰ LB[20].

After the statistical analysis, comparing the incidences of the first and the second five-year periods, a statistically significant difference was found for the change observed. This is a significant increase and one that brings great concern to the public health sector, in view of the implications that CS has for children's health.

From the first to the second five-year period, there was an increase in the average incidence in all geographic regions of the country; however, when the data were separated by region, the second five-year period had the average values were greater in the Southeast and Northeast, followed by the South, North and Midwest. In the five geographical regions, the increase was statistically significant from the first to the second five-year period ($P<0.05$).

It cannot be ruled out that the increase in CS from the first to the second five-year periods studied is due to the reduction of underreporting cases and due to the improvement of SINAN mechanisms. The existence of varying rates of underreporting concerning the different diseases that SINAN requires reporting for is notorious, and CS is no exception. A study conducted in São Paulo, Rio de Janeiro and Niterói in 2011 showed the existence of underreporting of the disease[21].

Therefore, the reduction in underreported CS as the main or an associated cause of death of newborns would explain, at least in part, the increase in CS cases in the second period of the present study. The analysis of data from across the country showed that, from the first to the second decade of the 21st century, the quality of filling out the declaration of deaths from perinatal deaths with regard to CS improved; which is a very important fact, given the need for good quality and accurate information to eradicate disease[22].

In the last three decades, a period that coincides with the creation and implantation of the Unified Health System (SUS) which began in 1988, there have been great advances in public policies aimed at health care for the population. The maternal and child health area was one that showed great improvements in the quantity and quality of care offered, with an increase in prenatal coverage and a consequent reduction in infant mortality and maternal mortality rates. In 2016, the Ministry of Health found that 81.0% of mothers of children with CS had received prenatal care; however, information on the

average number of medical visits per pregnant woman was not available[10].

In general, the country obtained, with the implementation of SUS, an increase in access to hospital birth and an increase in the rate of complete prenatal care. The universalization of access to health care in general had a positive impact on maternal and child health, including the diagnosis and treatment of CS. Therefore, it was expected that the higher rates of complete or almost complete prenatal coverage would correspond to lower rates of occurrence of CS, which, on the contrary, did not occur in the present study.

Therefore, an new hypothesis is proposed, to be tested in further studies yet to be carried out, which suggests that differences in the incidence of CS by Brazilian geographic regions are more associated with aspects related to the notification of the event than the actual incidence of gestational syphilis and its treatment during post-natal follow-up. Reinforcing this hypothesis, the numbers referring to the performance of prenatal care by regions show a national average of 61.8% of pregnant women who have had 7 or more medical consultations. Concerning prenatal care in geographical regions and according to DATASUS figures for 2011, 75.1% of women in the South had 7 or more medical appointments, 73.4% in the Southeast, 65.0% in the Midwest, 47.5% in the Northeast and 40.0% in the North.23 The situation is more intriguing when comparing these prenatal coverage rates with the CS rates by geographic region: for the period from 2012 to 2016, for example, the Northeast and Southeast have very similar values of CS rates (6.11 ‰ LB and 6.14 ‰ LB, respectively), meanwhile prenatal coverage with 7 or more medical appointments is very different (47.5% and 73.4%, respectively).

These inconsistencies were also highlighted in a more recent document from the Ministry of Health, with data for 2018, published in October 2019, which suggests the following explanation: the change in SINAN's case definition criteria[24].

In addition to the issue of the quality of CS case notifications, another problem associated with the occurrence of CS, which is outside the scope of the present study, lies in the quality of the treatment offered to women diagnosed with syphilis during pregnancy. Even though pregnant women are diagnosed with syphilis, many are not treated and the failure to receive treatment is explained by the difficulty in using penicillin by the basic units of the SUS, under the justification of a lack of technical conditions to control cases of anaphylaxis.2,10 The earlier the diagnosis of syphilis during prenatal care, the earlier the treatment of syphilis in the pregnant woman may be performed, reducing the chance of disease transmission to the fetus.

Confirming this situation, in a study carried out in Fortaleza, CE, with data from 2008 to 2010, it was found that 85% of the cases of women who had the disease diagnosed during prenatal care received an inadequate drug treatment, where 2/3 of them had not had their sexual partners treated. Another worrying fact in this study was that the notification of cases of gestational syphilis never exceeded 25% of the total diagnoses, where 3 out of 4 cases were underreported[25].

It is a consensus among experts that the late start of prenatal care is delaying the diagnosis of gestational syphilis, which may even be occur long after delivery[25]. Thus, women with syphilis, despite having performed prenatal care, even if only partially, could be going into childbirth without knowing their diagnosis and without having been treated, increase the chance of transmission of the disease to their child.

CONCLUSION

Our study concluded that the incidence of CS in Brazil was 3.97 ‰ LB for the period from 2007 to 2016. Additionally, the incidence has increased in the last 10 years in all Brazilian regions, which showed a significant increase in the incidence of CS for the five-year period 2012-2016 in relation to 2007-2011 ($p<0.05$). This increase is especially worrying because there may be a relationship with the problems in the quality of prenatal care, as well as in the inadequate model of treatment for pregnant women and their partners with syphilis. To alleviate the problem, it is recommended that the coverage and quality of prenatal care increase, as well as the early diagnosis and treatment of the disease in pregnant women with their sexual partners, and earlier monitoring of newborns.

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