REVISTA DA ESCOLA DE ENFERMAGEM DA USP
JOURNAL OF SCHOOL OF NURSING · UNIVERSITY OF SÃO PAULO

ORIGINAL ARTICLE

DOI: https://doi.org/10.1590/1980-220X-REEUSP-2020-0271

Epidemiology of gestational syphilis in a Brazilian state: analysis in the light of the social-ecological theory

Epidemiologia da sífilis gestacional em um estado brasileiro: análise à luz da teoria social ecológica

Epidemiología de la sífilis gestacional en un Estado brasileño: análisis a la luz de la teoría social ecológica

How to cite this article:
Moura JRA, Bezerra RA, Oriá MOB, Vieira NFC, Fialho AVM, Pinheiro AKB. Epidemiology of gestational syphilis in a Brazilian state: analysis in the light of the social-ecological theory. Rev Esc Enferm USP. 2021;55:e20200271. DOI: https://doi.org/10.1590/1980-220X-REEUSP-2020-0271

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ABSTRACT

Objective: To analyze, in the light of the social-ecological theory, the temporal progression of gestational syphilis and its relationship with the implementation of the *rede cegonha* in Ceará. **Method:** This is a retrospective documental study, based on the information system of notifiable diseases about gestational syphilis in the perspective of the social-ecological theory. The sample consisted of all notifications from the state of Ceará in the period from 2007 to 2017. Data collection was carried out in October 2019. **Results:** A total of 229,558 cases of gestational syphilis was reported in Brazil; of these, 7,040 were from the state of Ceará (3.1%), with a growing increase in cases over the years. Regarding the distribution of syphilis cases between the period before and after the implementation of the *rede cegonha*, there was an association with education ($p < 0.0001$), clinical classification ($p < 0.0001$), and gestational age ($p = 0.0005$). **Conclusion:** Despite the implementation of public policies and improvement of the epidemiological surveillance system, there is still a long way to go to control syphilis during pregnancy.

DESCRIPTORS

Syphilis; Pregnancy; Health Promotion; Sexually Transmitted Diseases; Maternal and Child Health; Health Surveys.

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Received: 07/01/2020
Approved: 06/07/2021

INTRODUCTION

Syphilis is a Sexually Transmitted Infection (STI) that has persisted for thousands of years even with wide application of preventive measures and efficient treatments. It is assumed that it affects approximately 12 million people worldwide[1–2]. In addition to being associated with serious complications in untreated people, Gestational Syphilis (GS) is related to perinatal complications such as Congenital Syphilis (CS), fetal deaths/stillbirths, neonatal deaths, premature babies/low birth weight, and infected children[3].

During pregnancy, syphilis causes more than 300,000 fetal and neonatal deaths per year worldwide, in addition to increasing the risk of premature death in another 215,000 children[4]. In Brazil, an increase of 300% in the number of cases of GS between 2010 and 2016 was estimated, as a result of the improvement of the health surveillance system and the expansion of the distribution and use of rapid tests, leading to a greater number of diagnoses and notifications[1].

In 2017, the number of cases of SG notified in Brazil was 49,013 (28.4% higher than in 2016). Of these cases, 9,084 (18.5%) lived in the Northeast Region, with 1,297 cases in the state of Ceará alone (2.65%). Also in 2017, the Brazilian Public Health System (*SUS*) spent approximately 2.8 million dollars on medium- and high-cost procedures, such as hospitalizations, of which a significant amount was directly related to syphilis and CS[5].

The effective control of syphilis relies, among other measures, on the optimization of public policies and the commitment of managers to implement actions aimed at the quality of care provided to pregnant women, along with their sexual partners, during the prenatal period (PN). Moreover, it is essential to raise awareness in the community in general and of health professionals about the importance of early diagnosis, as well as of effective treatment of the pregnant woman and her partner[3].

In 2007, the World Health Organization (WHO) launched an initiative to eliminate the transmission of syphilis that aimed, among other objectives, to increase the access of pregnant women to testing and treatment[6]. Since then, Brazil has implemented several national policies to achieve this goal. Among them, in 2011, the Ministry of Health, through Ordinance No. 1459, which established the *Rede Cegonha* (RC, a Brazilian strategy to provide women with health, quality of life, and well-being during pregnancy, delivery, postpartum, and child development in the first two years of life) within *SUS*, established serological screening for syphilis in the PN routine, providing decentralization and availability of rapid tests for the pregnant woman and her partner[7–8]. Despite these efforts, there has been an increase in this infection during pregnancy[7] in recent years. Furthermore, there is still a predominance of late diagnosis of GS, with treatments considered inadequate[9].

Based on the assumption that the health and disease process is the result of the interaction of various social, political, and economic elements, and aiming to analyze the epidemiology of gestational syphilis, the Social-Ecological Theory (SET) was chosen as a theoretical framework[10–11] for the conduct of this study. Therefore, the aim was to analyze, in the light of the social-ecological theory, the temporal progression of gestational syphilis and its relationship with the implementation of the *rede cegonha* in Ceará.

METHOD

Design of Study

This is a retrospective documental study, carried out in accordance with the recommendations of STROBE (Strengthening the Reporting of Observational Studies in Epidemiology), from the database of the Brazilian Public Health System, the Information System for Notifiable Diseases (*SINAN*), about the notifications of gestational syphilis in the State of Ceará.

Population and Sample

The sample consisted of all notifications from the state of Ceará made between 2007 and 2017 (n = 7,040), a period in which the system presents complete data.

Data Collection

The database was accessed in October 2019. The variables investigated were: (1) GS and CS detection rate; (2) age group, up to 19 years old and ≥ 20 years old; (3) level of education – illiterate, some/completed Elementary School (ES), some/completed High School (HS), some/completed Undergraduate Degree (UD); (4) gestational age – 1st trimester, 2nd trimester, 3rd trimester; (5) clinical classification of GS – primary, secondary, tertiary, latent; and, (6) treatment regimen – penicillin, another regimen, not performed, ignored. Gestational and congenital syphilis detection rates were calculated by the number of reported cases of syphilis in pregnant women and congenital syphilis respectively, per year, divided by the number of live births in the same year/place and multiplied by 1,000.

Data Analysis and Treatment

Data were organized and analyzed using the software SPSS (Statistical Package for the Social Sciences), version 23.0, considering absolute and relative frequency. Pearson Chi-Square of proportions was used to assess the relationship between the temporal distribution, considering the periods before (2007–2011) and after (2012–2017) the implementation of *Rede Cegonha*, and social and gestational variables. The significance level of 5% was adopted, with a 95% confidence interval. The analysis was carried out based on the identification of individual, social, and environmental factors associated with GS, taking the SET as a theoretical framework in health promotion.

SET views the environment in levels, metaphorically compared to a set of Russian dolls, so that one level is contained by the next level. The microsystem, the innermost level of the SET, contains the individual's immediate environment, which includes his/her closest relationships, for example, with the family, work, the immediate neighborhood, the school. At the second level (mesosystem) there is the

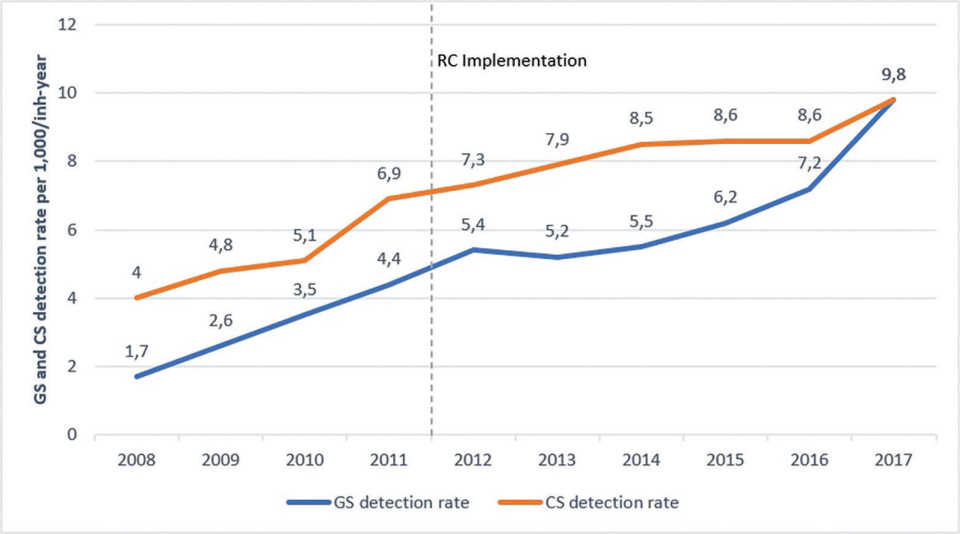

Figure 1 – Detection rate of gestational syphilis and congenital syphilis between 2008 and 2017. Ceará, Brazil, 2019.
Source: http://indicadoressifilis.aids.gov.br/; GS = Gestational Syphilis; CS = Congenital Syphilis; RC = *Rede Cegonha*.

relationship among microsystems. The Exosystem (third level) is configured by environments that, despite the individual not being present, directly affect their development. The macrosystem (last level) encompasses elements related to temporality, such as value and belief systems[12].

Ethical Aspects

To carry out the study, approval by the Research Ethics Committee was not necessary, since secondary data in the public domain, available via the internet, were used, with no identification of the patients.

RESULTS

From 2007 to 2017, 229,558 cases of GS were reported in Brazil; of these, 7,040 were from the state of Ceará, representing 3.1% of the total. A growing increase in GS cases over the years can be observed, with the detection rate in Ceará rising from 1.7 in 2008 to 9.8 in 2017.

When comparing the detection rates of GS and CS in the period from 2008 to 2017, it was found that both grew together. However, it was expected that with the detection of syphilis in pregnant women there would be timely and adequate treatment that would lead to lower rates of detection of CS in the newborn. Only in 2017 did the detection rates of GS and CS be equal (Figure 1).

Regarding treatment, data are only available for the period 2014 to 2016, with 7.4% of cases not being treated with penicillin, and the year 2015 being highlighted for showing the lowest number of pregnant women treated with penicillin (86.5%) (Table 1).

The data presented in Table 2 indicate that there was no association between the age group of pregnant women with syphilis and the periods assessed (period 1: 2008 to 2011 and period 2: 2012 to 2017). However, there was a relationship among level of education, clinical classification, and gestational age and the periods investigated. In the period from 2012 to 2017, among women diagnosed with syphilis, there was an increase in women with higher level of education (high school and undergraduate degree); a higher proportion of tertiary syphilis diagnosis; and greater number of diagnoses made in the 1st trimester of pregnancy.

Table 1 – Distribution of the number of cases of gestational syphilis by treatment regimen and period between 2014 and 2016 in Ceará – Fortaleza, CE, Brazil, 2019.

Treatment regimen	Period					
	2014 (n = 712)		2015 (n = 828)		2016 (n = 956)	
	n	%	n	%	n	%
Penicillin	660	92.7	716	86.5	871	91.1
Another regimen	7	1	34	4.1	29	3
Not performed	25	3.5	40	4.8	33	3.5
Ignored	20	2.8	38	4.6	23	2.4

Source: http://indicadoressifilis.aids.gov.br/.

Based on SET analysis, the study variables were graphically organized in levels, from the innermost (age, education, gestational age) to the outermost (detection rate), as shown in Figure 2.

DISCUSSION

According to the results presented, syphilis is still a problem among pregnant women, with its detection rate increasing over the years. This infection causes harm to the mother-child binomial, as the rate of congenital syphilis, similarly, has also increased over the years.

Regarding the treatment performed, most used penicillin. However, treatment with other regimens is still observed, especially in 2015. Regarding the distribution of syphilis cases, there was a relationship between the periods before and after the implementation of *rede cegonha* and level of education, clinical classification, and gestational age.

Table 2 – Analysis of the distribution of cases of gestational syphilis according to age group, level of education, clinical classification, gestational age, and the implementation of *rede cegonha* in Brazil – Fortaleza, CE, Brazil, 2019.

Variables	Period				p-value*
	2007–2011		2012–2017		
	n	%	n	%	
Age group**					p = 0.162
Up to 19 years	403	22.4	1396	77.6	
≥ 20 years	1179	24	3726	74	
Level of education					p < 0.0001
Illiterate	47	34.1	91	65.9	
Some/completed ES	998	32.6	2065	67.4	
Some/completed HS	432	25.3	1276	74.7	
Some/completed UD	13	17.1	63	82.9	
Clinical classification					p < 0.0001
Primary	754	29.6	1794	70.4	
Secondary	137	36.4	239	63.6	
Tertiary	300	19	1281	81	
Latent	261	30.1	605	69.9	
Gestational age					p = 0.005
1st trimester	451	24.6	1381	75.4	
2nd trimester	669	28.1	1711	71.9	
3rd trimester	703	29	17.23	71	

Source: http://indicadoressifilis.aids.gov.br/; ES = Elementary School; HS = High School; UD = Undergraduate Degree; *Pearson Chi-Square. **Data available from 2008 onwards.

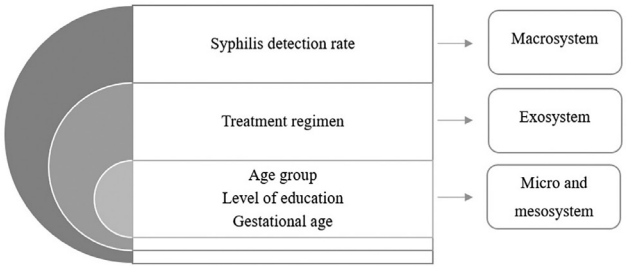

Figure 2 – Graphical organization of variables according to social-ecological theory. Ceará, Brazil, 2019.
Source: research data.

Several factors can contribute to the increased incidence of this infection in pregnant women in Ceará, from more distant factors to those closer to these women. Thus, understanding how these cases are distributed and how they relate to the environment (natural and social) can help to control this infection. According to SET, the environment determines human development through the influence of interactions established and re-established among people, between them and their external environment and among systems[13–14].

From a macroscopic perspective, the increase in the number of GS cases is largely due to the improvement of the epidemiological surveillance system and the decentralization of prevention and control actions, such as the expansion of the distribution of rapid tests in family health units, a strategy proposed by *rede cegonha*[1,15].

Although RC aims at qualifying obstetric-neonatal health, has brought benefits to the mother-child binomial, and has been published for almost a decade, its actions are still insufficient. In an analysis conducted in Pernambuco, Brazil, based on an evaluation using the Delphi method, the quality of obstetric-neonatal care developed through the precepts of RC was unsatisfactory, pointing to the need to make the policy more effective, especially among people in situation of vulnerability, and in an adverse political-economic scenario[16].

In addition, even with a greater offer of diagnostic tests for pregnant women and their partners in PN care services, the vertical transmission of syphilis has not been reduced as expected, which highlights the need for organized and sensitive care, as the access to diagnosis alone is not enough to ensure the breaking of the chain of infection in pregnant women with syphilis[15].

Regarding the relationship between the pregnant woman and the health service, an integral part of the exosystem (3rd SET system), it is essential for conducting and managing syphilis cases in this population, especially during PN consultations. The development of quality PN is a great challenge for health managers, as it shall ensure the development of pregnancy, favoring a healthy birth, minimizing risks, and providing a positive impact on maternal and fetal health[14,17].

However, this reality is not always observed. In a study carried out in the city of Fortaleza-CE, which aimed to assess the quality of care regarding the process in the PN of pregnant women with usual risk, it was evident that it is not totally adequate, in what regards the beginning of follow-up, the number of consultations during pregnancy, the clinical and obstetric procedures, and laboratory tests[18].

Corroborating findings in the literature, most pregnant women with syphilis, after the implementation of the strategy *rede cegonha*, obtained the diagnosis of GS in the 1st trimester, indicating that they also started prenatal care in the ideal period[3,17]. However, it is worth noting that even when RC is fully operational, the number of cases of GS detected with tertiary classification is alarming.

The CS detection rate has also increased over the years, equaling the GS detection rate in 2017. With high detection rates, CS is configured as a moderator of the prenatal care quality, and reflects the need to enhance this quality through intersectoral actions, to avoid underreporting, late treatment, reinfection, and difficulties in interpreting CS definition criteria[17].

A finding that draws attention in the results regards the treatment received by the pregnant woman, which is still observed to be inadequate. Studies show that, to a large extent, this reality is associated with the difficulty in properly guiding and treating the partner and the difficulty health professionals have in using the standard therapeutic regimen[19–21], leading to an increase in cases of congenital syphilis[22].

Linked to this, there was a national shortage of penicillin, which took place from years 2014 to 2017, due to the scarcity of raw material for its production around the world. In 2015, the Ministry of Health published the Joint Informative Note No. 109/2015/GAB/SVS/MS, which provided guidance regarding the prioritization of penicillin G benzathine for syphilis in pregnant women and other therapeutic alternatives that could minimize the damage caused by shortages[21].

With this restriction, the greatest difficulty faced in the treatment of cases of acquired syphilis and of the pregnant women's partners was the dosage and duration of the most extensive therapeutic regimen, between 8 to 5 days, of second-line antibiotics available in *SUS* (Ceftriaxone and Doxycycline), which negatively impacted adherence to this treatment, favoring failures and reinfections[21,23].

Regarding the systems closest to the pregnant woman (micro and mesosystem), individual characteristics, such as age, level of education, income, family relationships with the partner, as well as their interactions with their environment, also interfere directly with the development and maintenance of bonds[13].

Bonds created between health care services and the mother during prenatal care are crucial for the avoidance of negative outcomes, such as maternal and neonatal mortality and complications during childbirth, through the promotion of qualified care, with early diagnosis and treatment of infections, appreciation of women's complaints, when necessary, referral to high-risk prenatal care, active search in cases of interruption of follow-up, and health professionals commitment to the mother throughout pregnancy until the puerperium[24].

The incidence of syphilis in pregnant women is closely linked to the unfavorable socioeconomic structure of countries, especially observed in underdeveloped countries, such as poverty, unemployment, low level of education, incipient coverage of prenatal care[25]. A study carried out to determine the sociodemographic, behavioral, and health care factors related to the occurrence of syphilis in women cared for in public maternity hospitals in the city of Recife-PE identified as determining factors for gestational syphilis: some elementary school or illiteracy, no access to a telephone, history of four or more pregnancies, three or more sexual partners in the past year, use of illicit drugs before age 18, and use of illicit drugs by the current partner. In addition to these, the occurrence of only one to three prenatal visits and a previous history of sexually transmitted infection were observed[26]. These more proximal factors, contained in the micro and mesosystem, are preponderant in the planning of quality prenatal care, in order to direct strategies to reduce vertical transmission of syphilis.

Education is an important social indicator and, when it is low, it is a risk factor for GS[26]. It was possible to observe an increase in notifications at all levels of education, but the occurrence of GS is even greater in women with elementary education. Furthermore, studies indicate that the adequacy of prenatal care is lower in the case of black/brown women, with low social conditions, with lower income and level of education and, in particular, for those living in the North and Northeast regions, who have the worse performances in PN care at primary, secondary, and tertiary care[20,27].

It is noteworthy that despite the largest number of notifications being concentrated in women with elementary education, when comparing the two time cuts, there was a greater increase in GS in women with education level between secondary and higher education. This is due, in part, to the general increase in the level of education in the population and greater access to *SUS* health services[28].

These findings demonstrate that the analysis of isolated factors cannot explain the incidence of this disease, besides drawing attention to the insufficiency of control measures and the need to enhance them, especially starting from a quality PN care[29].

Given the above, the use of SET as a framework for analysis was due to the investigation coverage of aspects that influence the incidence of syphilis in pregnant women, and because it considered interactive factors within individuals and their social relationships and behaviors in the family and social environment. The theory helps to identify the factors affecting the behavior of individuals and population groups at different levels, which enhances the effects on targeting the problem that one wants to achieve, and allows the establishment of action and goals planning in health promotion[30]. The analysis based on this theory allows to broaden the understanding of health problems. In this study, it demonstrates how the variables act at different levels in the occurrence of syphilis, which reinforces the need to make efforts to ensure coverage of health care in the prenatal period, especially for women with lower level of education, and more surveillance in early pregnancy and clinical situation.

This study has as a limitation the use of secondary data, as they are conditioned to the quality of the records, and do not allow estimating how much the frequency of underreporting can distort the results found. However, the database used, even with its limitations, is considered to produce reliable information.

For future research, it is suggested that they involve historical, geospatial, and demographic analysis so that this phenomenon can be understood in depth and that strategies can be determined with a view to controlling and reducing syphilis during pregnancy.

CONCLUSION

Despite the implementation of public policies and improvement of the epidemiological surveillance system in the country, there is still a long way to go to reduce the number of cases of syphilis during pregnancy. It was shown that after *rede cegonha* was implemented, there was an increase in notifications of cases of gestational syphilis, earlier diagnosis of syphilis, and an increase in the diagnosis of tertiary syphilis. However, the rate of congenital syphilis remained high, leading to reflection on the quality of health care received by the pregnant women during prenatal care.

For this reality to change, it is imperative that health professionals and the community in general are sensitized to the issue, especially about the importance of early diagnosis and effective treatment of women and their partners, as well as the development of activities that aim at community empowerment, increase in the quality of prenatal care, reduction of sexually risky practices, improvement of self-care, especially among the most vulnerable.

RESUMO

Objetivo: Analisar, à luz da teoria social ecológica, a evolução temporal da sífilis gestacional e sua relação com a implantação da rede cegonha no Ceará. **Método:** Estudo retrospectivo, documental, a partir do sistema de informação de agravos de notificação acerca da sífilis gestacional na perspectiva da teoria social ecológica. A amostra foi composta por todas as notificações do estado do Ceará no período de 2007 a 2017. A coleta de dados foi realizada em outubro de 2019. **Resultados:** Foram notificados 229.558 casos de sífilis gestacional no Brasil; destes, 7.040 foram oriundos do estado do Ceará (3,1%), com aumento crescente dos casos no decorrer dos anos. Com relação à distribuição dos casos de sífilis entre o período antes e após a implantação da rede cegonha, houve associação com escolaridade (p < 0,0001), classificação clínica (p < 0,0001) e idade gestacional (p = 0,0005). **Conclusão:** Apesar da efetivação de políticas públicas e aprimoramento do sistema de vigilância epidemiológica, ainda há um longo caminho para controle da sífilis na gestação.

DESCRITORES

Sífilis; Gravidez; Promoção da Saúde; Doenças Sexualmente Transmissíveis; Saúde Materno-Infantil; Inquéritos Epidemiológicos.

RESUMEN

Objetivo: Analizar, a la luz de la teoría social ecológica, la evolución temporal de la sífilis gestacional y su relación con la implantación de la *rede cegonha* en Ceará. **Método:** Estudio retrospectivo, documental, a partir del sistema de información de agravios de notificación acerca de la sífilis gestacional en la perspectiva de la teoría social ecológica. La muestra fue compuesta por todas las notificaciones del estado de Ceará en el período de 2007 a 2017. La colecta de datos fue realizada en octubre de 2019. **Resultados:** Fueron notificados 229.558 casos de sífilis gestacional en Brasil; de estos, 7.040 fueron provenientes del estado de Ceará (3,1%), con aumento creciente de los casos a lo largo de los años. Con relación a la distribución de los casos de sífilis entre el periodo y después de la implantación de la *rede cegonha*, hubo asociación con escolaridad (p < 0.0001), clasificación clínica (p < 0,0001) y edad gestacional (p = 0,0005). **Consideraciones Finales:** A pesar de la efectuación de políticas públicas y mejora del sistema de vigilancia epidemiológica, todavía hay un largo camino para el control de la sífilis en la gestación.

DESCRIPTORES

Sífilis; Embarazo; Promoción de la Salud; Enfermedades de Transmisión Sexual; Salud Materno-Infantil; Encuestas Epidemiológicas.

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