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Efficacy of prenatal care in preventing congenital syphilis: a retrospective longitudinal analysis in Araçatuba, São Paulo

Eficácia do acompanhamento pré-natal na prevenção da sífilis congênita: uma análise longitudinal retrospectiva em Araçatuba, São Paulo

Eficacia del seguimiento prenatal en la prevención de la sífilis congénita: un análisis longitudinal retrospectivo en Araçatuba, São Paulo

Damaris Rodrigues da Conceição¹ , Ligia Arabe Lima¹ , Laura Mendes Guedes¹ , Leticia Cazarré Nascimento¹ , Julia Carvalho de Souza¹ , Nathália de Oliveira Cardoso¹ 

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¹ Salesian Auxilium Catholic University Center, Department of Medicine. Araçatuba, São Paulo, Brazil

ABSTRACT

Introduction: Congenital syphilis stands as one of the primary causes of abortion worldwide, presenting a public health challenge in Brazil, where its incidence has been on the rise for the past 10 years, despite its preventable nature. **Aim:** To assess the effectiveness of prenatal care in averting congenital syphilis and mitigating adverse complications for newborns. **Design:** An observational, longitudinal, retrospective study was conducted, involving 65 newborns with congenital syphilis and their respective mothers. Data were gathered from the Notifiable Diseases Information System of Araçatuba-SP, spanning from 2018 to 2021. **Results:** A significant correlation was observed between attendance of prenatal care and neonatal outcomes. It was discovered that delayed diagnosis of infection in pregnant women was linked to more severe clinical manifestations in newborns. While only 13.7% of infants born to mothers diagnosed during prenatal care exhibited early symptoms, this figure rose to 57.1% in cases where diagnosis occurred during delivery. **Implications:** Despite endeavors to eradicate congenital syphilis, the persistent uptick in its incidence indicates deficiencies in prenatal care, underscoring the urgent necessity for interventions in primary healthcare.

DESCRIPTORS

Syphilis, Congenital; Disease Prevention; Infectious Disease Transmission, Vertical; Prenatal Care.

Corresponding Author:

Damaris Rodrigues da Conceição
Address: Avenida Antônio Cavasana 520,
Araçatuba, São Paulo, Brazil
Zip Code: 16013-385 - Araçatuba, SP, Brazil.
Phone: 55 (17) 991086932
Email:
damarisrodrigues_medt2@unisalesiano.com.br

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INTRODUCTION

Syphilis is caused by a Gram-negative bacterium called *Treponema pallidum*. It is mainly transmitted through sexual and vertical means, thus classified as a Sexually Transmitted Infection (STI).¹ Regarding its congenital form, it is associated with risk factors such as late onset or inadequacy of prenatal care, an insufficient number of consultations resulting in screening failures, and inadequate diagnosis and treatment.²

The infection occurs through the transmission of the bacterium in the bloodstream of the infected pregnant woman to the fetus, which can happen at any intrauterine period, the most frequent way, or during delivery if the mother has an active lesion.³ The manifestations of Congenital Syphilis (CS) can be early or late, occurring in the fetus, newborn, or only in childhood if the child does not receive proper diagnosis and treatment. The abnormalities found can range from laboratory and imaging findings to involvement of multiple systems, resulting in situations such as abortion, stillbirth, premature birth, and neonatal death.⁴

CS is preventable, treatable, and curable, with a potential success rate of 100%, as it is a disease of known etiology and with wide access to testing, monitoring, and effective diagnosis. However, it remains a public health problem; thus, there is a need to expand screening strategies for this disease to facilitate and improve its detection.⁵ To cover the entire period of possible transmission, syphilis testing is recommended at the 1st prenatal visit (ideally in the 1st trimester), at the beginning of the 3rd trimester, and at the time of delivery or in case of abortion. Treatment should be initiated in all cases.¹

These actions are essential because, in current times, this infection significantly contributes to maternal and infant morbidity and mortality, being the second most common cause of abortion worldwide that is preventable. The World Health Organization (WHO) estimates that syphilis

complicates one million pregnancies per year worldwide, leading to over 300,000 fetal and neonatal deaths and putting over 200,000 children at risk of premature death.⁶ In Brazil, over the last decade, there has been a progressive increase in CS incidence rates, and from 1998 to June 2021, 260,596 cases of congenital syphilis in children under one year of age were reported in the SINAN system, of which 115,806 (44.4%) were residents of the Southeast region, 77,686 (29.8%) in the Northeast, 30,442 (11.7%) in the South, 22,155 (8.5%) in the North, and 14,507 (5.6%) in the Midwest.⁷

According to the World Health Organization (WHO), in an attempt to improve these indicators, the United Nations (UN) has identified the elimination of CS as a public health problem by 2030 as one of its main objectives, requiring a rate lower than 0.5 cases per 1,000 live births in 80% of countries.⁸

Based on the above premise, the impact of prenatal care and the number of consultations on the diagnosis of CS, as well as their influence on treatment and the early outcome of vertical transmission, were evaluated.

METHOD

Study design, period, and location

This study adopts an observational approach with a retrospective longitudinal design. It took place in Araçatuba, a city in the state of São Paulo, Brazil, spanning from 2018 to 2021.

Sample; Inclusion and exclusion criteria

The study population comprised pregnant women aged between 15 and 49 years, with a positive treponemal test for infection, and their infants born with syphilis. Also included were newborns exposed to syphilis during pregnancy. Cases lacking essential information regarding newborn signs and symptoms, as well as neonatal and maternal treatment, were excluded. Additionally, infants exposed to syphilis during pregnancy without a diagnosis at birth or with

a negative Venereal Disease Research Laboratory (VDRL) result were excluded.

Results analysis and statistics

Data were sourced from the Notifiable Diseases Information System (SINAN-NET) platform, accessed through the Municipal Epidemiological Surveillance and Health Department of Araçatuba-SP. Information pertaining to the year of diagnosis, neonatal signs and symptoms, and treatment was analyzed and presented using simple percentages, facilitating the interpretation of trends and patterns over time. This methodology allowed for the identification of significant variations across different years.

To assess the relationship between prenatal care, the number of consultations, timing of diagnosis, and early negative outcomes in neonates, the chi-square statistical test was employed. This test is commonly used to analyze associations between categorical variables and is appropriate for this study's analysis.

A significance level of $p < 0.05$ was set, indicating that associations with p-values below this

threshold are statistically significant, suggesting real relationships between the variables studied.

Jamovi version 2.3.9 was utilized as the statistical software for data analysis. This program offers a comprehensive array of statistical tools and is well-regarded for its effectiveness and precision in data analysis. Through the use of Jamovi, researchers conducted robust statistical analyses, yielding reliable results that contribute to understanding the factors associated with congenital syphilis and the efficacy of prenatal interventions in its prevention.

Ethical considerations

The study received approval from the Human Research Ethics Committee of Centro Universitário Católico Salesiano Auxilium - UNISALESIANO/SP (CAAE- 53754921.8.0000.5379).

RESULTS

Of the pregnant women analyzed, 90.76% underwent prenatal care. Data on the prenatal care characteristics are presented in Table 1.

Table 1. Characterization of prenatal profile of congenital syphilis cases in Araçatuba/SP, between the years 2018 to 2021

Variables	N°	%
Prenatal care attendance		
Yes	59	90.76
No	6	9.24
Number of consultations		
Less than 6 consultations	21	32.31
6 or more consultations	44	67.69
Timing of diagnosis		
Prenatal	51	78.46
During delivery	7	10.77
Postpartum	7	10.77

Source: authors (2022).

Pregnant women who did not undergo prenatal care discovered the disease only at delivery, 66.7%, or after delivery, 33.3%, while those who underwent prenatal care, 86.4% of them received the diagnosis during pregnancy, thus indicating a significant relationship between prenatal care

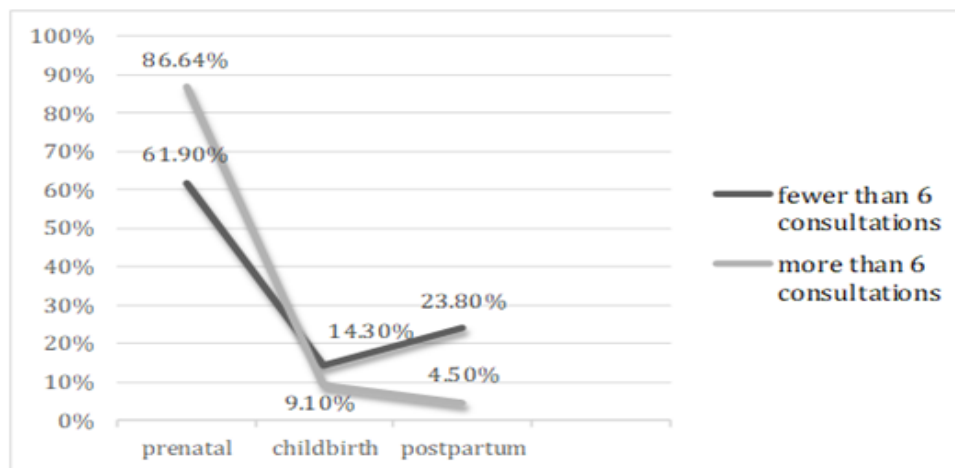
attendance and the timing of positive VDRL test occurrence ($p=0.001$) (data not shown).

The number of consultations was significant when related to the timing of diagnosis ($p=0.042$). Those who had an inadequate number of prenatal consultations (less than six) were more likely to

diagnose syphilis during delivery and postpartum compared to those who had six or more consultations.

The correlation between the number of consultations and the timing of diagnosis is elucidated in Graph 1.

Graph 1. Percentage correlation between the number of consultations and the timing of diagnosis of pregnant women in the city of Araçatuba/SP between the period of 2018 to 2021



Source: authors (2022).

The comparison between the timing of diagnosis and negative outcomes proved to be relevant ($p=0.007$). It was observed that there was an

increased chance of developing signs and symptoms at birth when the diagnosis occurred during delivery. The data are presented in Table 2.

Table 2. Correlation between neonates with clinical presentations at birth and maternal diagnostic timing in the city of Araçatuba/SP, between the period of 2018 to 2021

Timing of diagnosis	Neonates with clinical presentations at birth	
	N°	%
During delivery	7	13.70
After delivery	8	57.10

Source: authors (2022).

Of the analyzed neonates, 84.37% did not present clinical manifestations at birth, while 15.63%

showed signs and symptoms. The outcomes are presented in Table 3.

Table 3. Percentage in descending order of signs and symptoms observed in newborns with congenital syphilis in the city of Araçatuba/SP, between the period of 2018 to 2021

Observed Outcomes	%
Jaundice	45.40
Hematological changes (anemia and leukopenia)	45.40
Bone lesions	18.10
Cerebrospinal fluid abnormalities	18.10
Púrpura	9.10
Hepatomegaly	9.10
Splenomegaly	9.10
Parrot's pseudoparalysis	9.10
Generalized edema	9.10
Respiratory distress	9.10
Mucosanguineous rhinitis	9.10

Source: authors (2022).

In Table 4, the total number of treated children with CS is presented, and in Graph 2, the total number of CS cases is depicted. Both demonstrate that in the year 2018, out of 15 cases, 80% received treatment; in 2019, out of 15 neonates,

93.3% were treated; in 2020, out of 14 neonates, 78.6% underwent treatment; and in 2021, out of 21 neonates, surprisingly, only 71.4% received treatment, indicating a progressive decline in the number of treated cases.

Table 4. Percentage of newborns with congenital syphilis receiving appropriate treatment in the city of Araçatuba/SP between the years 2018 to 2021

Year	Number of cases	Treated (%)
2018	15	80%
2019	15	93.3%
2020	14	78.6%
2021	21	71.1%

Source: authors (2022).

DISCUSSION

The incomplete or inadequate attendance of prenatal care is a significant factor in explaining the progressive increase in cases of congenital syphilis (CS) as it hampers the diagnosis and early intervention of this pathology.⁹ According to the Ministry of Health's guidelines, a minimum of six consultations is recommended to cover the entire gestational period during which the infection can be diagnosed. Ideally, this diagnosis should occur before the birth of the neonate to prevent serious complications of this disease in the child in both the short and long term.¹⁰ Therefore, the findings of this research underscore the preventive nature of prenatal care, given its role in health education, health promotion, and the control of conditions that may affect the health of women and infants.

In this study, a notable failure in prenatal care assistance is evident, as pregnant women who had fewer than six consultations (incomplete prenatal care) during pregnancy had a higher percentage of diagnosis during the peripartum period compared to those who had more than six consultations (complete prenatal care). These findings were similar to another study, where it was found that 58.7% of mothers whose newborns had CS had completed prenatal care, 19.6% had incomplete prenatal care, and 21.7% did

not undergo prenatal care.⁹ Therefore, it was noted that pregnant women who had fewer consultations were more likely to have a delayed diagnosis of syphilis.

Furthermore, it was found that newborns who had a higher number of negative signs and symptoms at birth were associated with a delayed diagnosis of syphilis, usually diagnosed upon admission to the maternity ward. However, most of these mothers had incomplete prenatal care (less than six consultations). Thus, there is a gap in the data of these patients, as the reason for not completing the six consultations is not addressed, reducing it to just a number.

Conversely, a national study showed lower prenatal care attendance, which was the reason for early outcome rates. In the same article, it was observed that only 26% of adverse outcomes associated with syphilis during pregnancy were prevented by prenatal care.¹¹ However, it was found that these women had a later onset of care and recorded lower adherence to the number of consultations, which corroborated with the analysis of the data obtained in this study and pointed out shortcomings in the conduct and protocols established for adequate prenatal care, hindering

early interventions and contributing to the increase in CS and its various consequences.

The need for better access to prenatal care and improvements in its delivery, such as early identification of pregnant women, systematic screening, monitoring, and encouragement of bonding throughout the gestational period, was observed.

Most cases of CS in newborns are asymptomatic at birth, which can lead to complications if the diagnosis is delayed. In the present study, it was noted that of mothers who were diagnosed only at birth, more than 57% of newborns had negative outcomes. When this result was compared with a global study that analyzed data on prevention and outcomes, it was observed that 66% of negative outcomes occurred in those mothers tested incorrectly or without successful treatment.¹² This information was validated with the results found in a study carried out in Porto Alegre - RS, which linked late diagnosis with newborn symptoms, and it was found that, the later mothers are diagnosed, there is a greater delay in starting treatment, thus increasing negative outcomes in newborns.¹³ In this way, it is noted that this cascade effect is preventable with maternal diagnosis at the ideal time, which will result in early and effective treatment, reducing the chances of the newborn presenting clinically with CS.

The recommended tests for the children of pregnant women with syphilis include a complete blood count, cerebrospinal fluid analysis, long bone radiography, and VDRL (Venereal Disease Research Laboratory test).¹⁴ In the literature, the majority of newborns did not present symptoms at birth, and when present, the main findings included prematurity, low birth weight, small size for gestational age, anemia, thrombocytopenia, and hepatosplenomegaly. This information highlights the necessity of screening tests to diagnose the disease early.¹⁵ Bone fractures and lytic bone lesions in newborns should always consider the possibility of intrauterine infections, especially syphilis.¹⁶ Additionally, at the national level, negative results in

X-rays were found in the states of Paraná and Rio de Janeiro, with rates of 1.6% and 9.6%, respectively.¹⁷⁻¹⁸

Among the disorders found in a systematic review, hematological disorders were the most common, with anemia being the most prevalent, followed by thrombocytopenia and leukocytosis. Additionally, increases in protein levels and/or leukocytosis and positive VDRL in cerebrospinal fluid tests were found. Similarly, significant numbers of early clinical manifestations of infection were observed, such as hepatomegaly and/or splenomegaly and scaling skin lesions. Furthermore, jaundice, thick purulent and serosanguinous nasal secretions, perioral or perianal fissures, petechiae, purpura, and/or rashes were also evident.¹⁸

In this context, the signs and symptoms found in newborns in this study, through the recommended tests, were similar to the aforementioned evidence. Thus, the importance of conducting screening tests to identify early outcomes and prevent complications was demonstrated.

The drug of choice for treating children with CS is benzylpenicillin.¹⁹ As a measure to ensure access, benzathine benzylpenicillin became a strategic component in the National List of Essential Medicines, with centralized acquisition by the Ministry of Health.²⁰ Although this treatment is widely available in primary healthcare facilities, this research demonstrated an increase in newborns not adequately treated over the years analyzed between 2018 and 2021. However, despite extensive efforts and improved access to treatment for the disease, another study supports the finding that there have been advancements and an increase in the capacity for screening and diagnosing the disease, but treatment of newborns with the disease did not keep pace with this progress.²¹

With the advent of the COVID-19 pandemic, the healthcare sector was significantly affected in various aspects. A multicenter study showed a decrease in the diagnosis and treatment of syphilis during the pandemic compared to previous years.²²

The same was demonstrated in the present study, which showed an increase in CS cases during the pandemic period, especially during the year 2021. This can be explained due to social distancing and the overload of the Unified Health System (SUS), which led to the neglect of various diseases, as well as their early diagnosis and treatment.

Study Limitations

This study highlights several limitations that should be considered when interpreting the results and drawing general conclusions. Among these limitations, it is worth noting that the data were obtained from medical and public health records, which may result in gaps or inaccuracies in certain information. Additionally, it is important to consider that the quality of these records may vary among different sources, potentially affecting the reliability of the obtained results. Furthermore, the selection of participants was based on specific criteria, such as the age of the pregnant women. This process may

introduce selection bias, limiting the representativeness of the sample and impacting the generalization of the results to other populations.

CONCLUSION

Our study results demonstrate a significant relationship between the inadequacy or absence of prenatal care and the delayed diagnosis of syphilis in pregnant women, resulting in an increase in clinical manifestations in newborns. Additionally, an increase in cases of vertical transmission was observed due to the lack of diagnosis during pregnancy, especially during the COVID-19 pandemic. These findings underscore the importance of interventions that facilitate access to basic care for pregnant women, aiming to carry out adequate screening and treatment. These measures are crucial to achieving the goals established by the UN to eradicate congenital syphilis by the year 2030.

RESUMO

Introdução: A sífilis congênita é a segunda causa de aborto no mundo e um problema de saúde pública no Brasil tendo nos últimos 10 anos aumento de sua incidência, mesmo sendo uma doença passível de prevenção. **Objetivo:** Avaliar o impacto do pré-natal na prevenção da sífilis congênita e na minimização de desfechos desfavoráveis para o recém-nascido. **Delineamento:** Tratou-se de um estudo observacional, longitudinal, retrospectivo e documental. Participaram da pesquisa 65 recém-nascidos com sífilis congênita e suas respectivas progenitoras. Os dados foram retirados da plataforma Sistema de Informação de Agravos de Notificação da cidade de Araçatuba-SP, entre os anos de 2018 a 2021. **Resultados:** Verificou-se uma relação significativa entre a realização do pré-natal e o desfecho nos neonatos. Sendo que, manifestações clínicas no recém-nascido tiveram maior impacto quanto mais tardio o momento da identificação da infecção na gestante. Das mães diagnosticadas no pré-natal 13,7% de seus filhos tiveram apresentações clínicas precoces e das que obtiveram o diagnóstico no parto essas apresentações foram identificadas em 57,1% dos neonatos. **Implicações:** Apesar da tentativa de erradicar a sífilis congênita, ainda há aumento em sua incidência devido a falhas na assistência ao pré-natal, indicando a necessidade de intervenções na atenção básica.

DESCRITORES

Sífilis congênita; Prevenção de Doenças; Transmissão Vertical de Doenças Infecciosas; Cuidado Pré-Natal.

RESUMEN

Introducción: La sífilis congénita representa una de las principales causas de aborto a nivel mundial, siendo un desafío de salud pública en Brasil, donde su incidencia ha aumentado en los últimos 10 años, a pesar de ser una enfermedad evitable. **Objetivo:** Evaluar la eficacia del seguimiento prenatal en la prevención de la sífilis congénita y en la reducción de complicaciones adversas para los recién nacidos. **Delineación:** Se realizó una investigación observacional, longitudinal y retrospectiva, que incluyó a 65 recién nacidos con sífilis congénita y sus respectivas madres. Los datos se recopilaron del Sistema de Información de Agravos de Notificación de la ciudad de Araçatuba-SP, durante el período de 2018 a 2021. **Resultados:** Se identificó una correlación significativa entre la realización del seguimiento prenatal y los resultados neonatales. Se encontró que el diagnóstico tardío de la infección en la gestante estuvo asociado con manifestaciones clínicas más graves en los recién nacidos. Mientras que solo el 13,7% de los hijos de madres diagnosticadas durante el seguimiento prenatal presentaron síntomas tempranos, este número aumentó al 57,1% en los casos en que el diagnóstico se realizó durante el parto. **Implicaciones:** Aunque existen esfuerzos para erradicar la sífilis congénita, el aumento persistente en su incidencia sugiere fallos en la asistencia prenatal, destacando la necesidad urgente de intervenciones en la atención primaria de salud.

DESCRIPTORES

Sífilis Congénita; Prevención de Enfermedades; Transmisión Vertical de Enfermedad Infecciosa; Atención Prenatal.

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COLLABORATIONS

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There are no conflicts of interest to declare.