

Congenital Syphilis in five health regions in the state of Santa Catarina in the period 2010 to 2019

Sífilis congênita em cinco regiões de saúde do estado de Santa Catarina no período 2010 a 2019

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ABSTRACT | OBJECTIVE: To know the morbidity and mortality profile of congenital syphilis in five Health Regions of Santa Catarina from 2010 to 2019. **METHODS AND MATERIALS:** A descriptive, retrospective ecological study with a quantitative approach carried out in Santa Catarina, in five Health Regions from a total of 16 regions, selected according to the geographic distribution of the Regionalization Master Plan/2012. Secondary data from the Information System on Notifiable and Population Diseases of the Informatics Department of the Unified Health System were used. The collected data were organized, tabulated, and described in absolute and relative frequencies to identify the clinical characteristics of the newborn and the epidemiological profile based on the construction of morbidity and mortality indicators. **RESULTS:** The highest incidence occurred in the Northeast and Serra Catarinense Health Regions, although these are below 10 cases/1000 Live Births. Mortality rates in the Health Regions are low. The highest rates are in the Western Health Region (53.34 cases/100,000 LB) and Serra Catarinense (25.11 cases/100,000 LB). **CONCLUSION:** With this study, it was possible to describe the morbidity and mortality profile of congenital syphilis in five Health Regions of Santa Catarina in the period from 2010 to 2019, and this disease remains an important public health problem in Santa Catarina.

KEYWORDS: Congenital syphilis. Morbidity. Mortality. Epidemiology.

RESUMO | OBJETIVO: Conhecer o perfil de morbidade e mortalidade da sífilis congênita em cinco Regiões de Saúde de Santa Catarina no período de 2010 a 2019. **MÉTODOS E MATERIAIS:** Estudo ecológico descritivo, retrospectivo, com abordagem quantitativa, realizado em Santa Catarina, em cinco Regiões de Saúde de um total de 16 regiões selecionadas segundo a distribuição geográfica do Plano Diretor de Regionalização/2012. Utilizou-se dados secundários do Sistema de Informação de Agravos de Notificação e populacionais do Departamento de Informática do Sistema Único de Saúde. Os dados coletados foram organizados, tabulados e descritos em frequências absolutas e relativas para identificação das características clínicas do recém-nascido e o perfil epidemiológico a partir da construção de indicadores de morbidade e mortalidade. **RESULTADOS:** As maiores incidências ocorreram nas Regiões de Saúde Nordeste e Serra Catarinense, ainda que essas estejam abaixo de 10 casos/1000 Nascidos Vivos. As taxas de mortalidade nas Regiões de Saúde são baixas. As mais elevadas estão na Região de Saúde Oeste (53,34 casos/100.000 NV) e Serra Catarinense (25,11 casos/100.000 NV). **CONCLUSÃO:** Com este estudo foi possível descrever o perfil da morbidade e mortalidade da sífilis congênita em cinco Regiões de Saúde de Santa Catarina, no período de 2010 a 2019, indicando um problema importante de saúde pública em Santa Catarina.

DESCRITORES: Sífilis congênita. Morbidade. Mortalidade. Epidemiologia.

Introduction

Congenital syphilis is a millennial disease that continues to be a public health problem due to its high vertical transmission rates. This disease is a systemic bacterial infection caused by *Treponema pallidum*, and it is also sexually transmitted¹; however, this disease is easily diagnosed, and its treatment is free.²

Vertical transmission could have immediate or late consequences for the baby, such as abortion, stillbirth, preterm birth, neonatal death, and congenital anomalies.² Monitoring women with syphilis and providing adequate treatment and follow-up during prenatal care could help to prevent this disease.³ Other factors are also associated with an increased risk for syphilis infection during pregnancy, such as ethnic differences, lower socioeconomic status, poor education, unsafe sex practices, limited access to diagnosis, and failure in triage or medical assistance in health services.^{4,5}

Syphilis is a compulsory notification disease, and all public and private health professionals must report cases of this infection so that each case can be investigated and confirmed through the Notifiable Diseases Information System – SINAN.²

According to the World Health Organization, in 2016, an estimated 600 thousand cases of syphilis were reported around the world.⁶ Congenital syphilis has a rate of 472 cases per 100,000 live births, and it causes more than 200,000 stillbirths and perinatal deaths.⁷

In 2017, the United States reported a national rate of congenital syphilis of 23.3 cases per 100,000 live births – the highest rate since 19975. In 2018, there was an increase of 261% in cases compared to 2013 in the country.⁸ In addition, these rates were 6.4 and 3.3 times greater in newborns from black and Hispanic mothers, respectively, compared to white mothers.⁵

According to the Epidemiological Bulletin of the Ministry of Health, a significant increase in congenital syphilis rates was observed in Brazil in the last two decades.² Between 1998 and 2019, 414,891 cases were reported in infants below one year of age, and 8.5% (18,119) were from South Brazil.²

In 2018, 25,889 (98.4%) cases of congenital syphilis in newborns were confirmed in Brazil, 25,456 (96.8%) of these were diagnosed in their first week of life, and

93.6% of these were classified as early congenital syphilis.² The incidence rate of congenital syphilis was 8.2/100,000 live births. Eleven States of Brazil presented an incidence rate greater than 9.0/1,000 live births in that same year.²

In the State of Santa Catarina, 680 new cases of congenital syphilis were reported in 2018, with an incidence rate of 6.8/1,000 live births and 28 deaths (mortality rate of 28.1/100,000 live births).⁸

Some of the reasons that motivated the choice for the theme of this study were the rise in congenital syphilis cases in the State of Santa Catarina during the last decade; the limited number of studies about morbidity and mortality rates of this disease; and the geographic distribution of this disease in the 16 Health Regions that are part of the Director Plan of Regionalization of Santa Catarina.

Studies that describe the morbidity and mortality profile of congenital syphilis could contribute to the decision-making and design of health strategies. This information could also assist in policies and programs and expand health professionals' knowledge on monitoring, preventing, and assisting the population.

Therefore, the research question of the present study was “what is the morbidity/mortality profile of congenital syphilis in the Health Regions of Santa Catarina between the years 2010 and 2019?”. This study aimed to identify the morbidity and mortality profile of congenital syphilis in five Health Regions of the State of Santa Catarina, Brazil, during the years 2010 to 2019.

Methods

This was an ecologic, descriptive, and retrospective study with a quantitative approach aimed to identify the distribution of congenital syphilis cases in children below one year of age between the years 2010 and 2019.

The initial proposal of this research was to analyze the epidemiological profile of congenital syphilis in all the State of Santa Catarina, according to the division stated in the Master Plan of Regionalization (PDR), which divides the State into 16 Health Regions –HR.⁹ However, the design of this research, which is an ecologic and longitudinal study of a time series of 10

years, limited the time available for data collection and analysis that, in turn, made it difficult to perform calculations for each epidemiological indicator proposed for the 16 HR. Thus, it was decided to work with five Health Regions (HR) in the State of Santa Catarina: Foz do Rio Itajaí, Serra Catarinense, Grande Florianópolis, Northeast and West. These are geographically located in distinctive parts of the State's Map.

This study was conducted in the State of Santa Catarina, and its design was based on the Health Regions described in the Director Plan of Regionalization (2012), according to the Organizational Contract for Public Actions, which was published in Resolution Number 7508/201.⁹

The participants in this research were all infants up to one year of age, positively diagnosed with congenital syphilis between 2010 and 2019, and born to mothers living in one of the municipalities inside the five Health Regions chosen for the study.

Data were collected in July of 2020 and retrieved from the Notifiable Diseases Information System (SINAN) and the Mortality Information System (SIM); both systems were accessed via the website of the Epidemiological Surveillance Board in the Secretary of Health of Santa Catarina. The population data were obtained on the website Technology Department of Brazil's Unified Health System – DATASUS. Then, data were organized according to the independent variable defined as the year of notification/confirmation. The dependent variables were defined as sex, the result of the nontreponemal test (positive), symptomatic/asymptomatic newborn, and early diagnosis. All of these variables were available in the SINAN forms.

Data were initially tabulated and organized in worksheets in the software Microsoft Office Excel® 2013. Then, absolute and relative frequencies were calculated using the newborns' clinical characteristics. The clinical characteristics of the population used in this study were a positive nontreponemal test at birth, newborns with a diagnosis of early congenital syphilis, and symptomatic newborns.

First, the specific incidence rates for each year of the time series were calculated for every Health Region

to define the epidemiological profile of this disease in the Health Regions selected for this study. Second, the specific incidence rates according to sex were also calculated.

To better understand the morbidity of congenital syphilis, it was decided to present the specific incidence rate and the incidence rate according to sex in the five Health Regions selected for this study. These incidences were calculated using the mean of the indicators for specific incidence rates and incidence rates of congenital syphilis according to sex (male and female, respectively) of the time series. Thus, these calculations made it possible to compare the mean results of the epidemiological indicators of the five Health Regions and better comprehend the results of such comparisons.

The mortality analysis used a multiplication constant to every 100,000 live births, as the number of congenital syphilis deaths is low in the Health Regions selected for this study. All ethical aspects were followed in every stage of this research according to Resolution Number 466/2012 of the Ministry of Health.¹⁰ The Research Ethics Committee approved the Research Project on May 15, 2020, under motion number 4.030.171.

Results

The results of the indicators obtained in this study were organized and presented according to the clinical characteristics of newborns and the morbidity and mortality profile of congenital syphilis in the State of Santa Catarina.

The clinical characteristics are displayed in Table 1, which shows that the Northeast Health Region presented a greater proportion of newborns with a positive nontreponemal test after birth (92.65%) and the West Region showed the lowest mean proportion (62.32%). The majority of newborns were diagnosed with early congenital syphilis and the proportion varied from 89.20% (Foz do Rio Itajaí) to 99.23% (West). At birth, the incidence of cases in symptomatic newborns was 5.5% in the Northeast Health Region and 20.94% in the Serra Catarinense, as Table 1 shows.

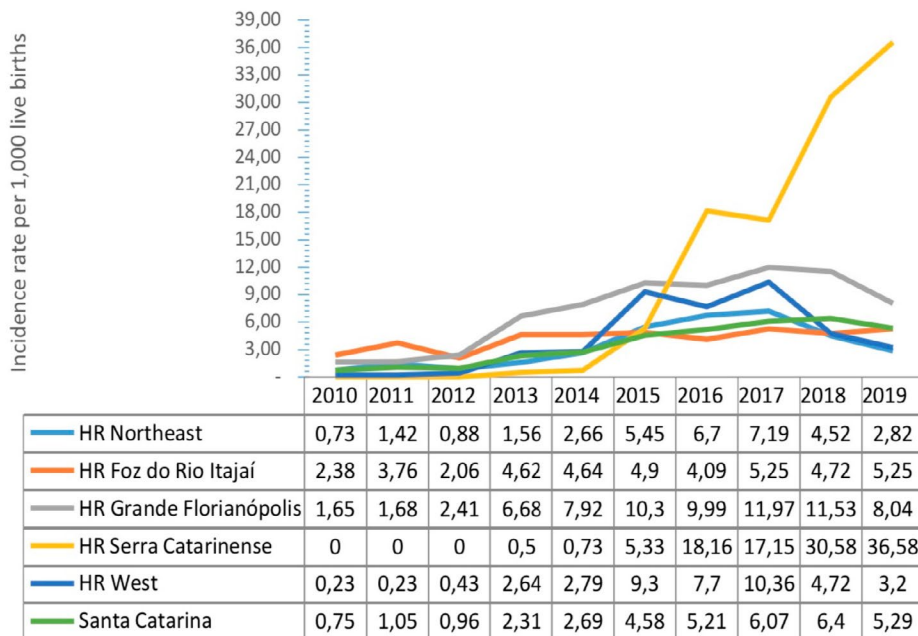
Table 1. Mean Proportion of clinical characteristics of newborns with congenital syphilis in five Health Regions. Santa Catarina, Brazil, 2010-2019

Indicators	Health Regions				
	Northeast	Foz do Rio Itajaí	Grande Fpolis.	Serra Catarinense	West
Proportion of cases with positive nontreponemal tests	92.65%	87.81%	91.59%	90.61%	62.32%
Proportion of cases with an early congenital syphilis diagnosis	90.22%	89.20%	91.00%	92.56%	99.23%
Proportion of cases with symptomatic newborns	5.51%	8.92%	9.81%	20.94%	15.33%

Source: DIVE/SC

Figure 1 shows the Morbidity Profile of congenital syphilis. This figure shows that the incidence rate of congenital syphilis in the State of Santa Catarina between the years 2010 and 2018 presented a modest increase, and the year 2018 had the highest incidence, with 6.40 cases per 1,000 live births. The incidence rates, according to the Health Regions, demonstrated an increase in every year since 2014. Although, the Serra Catarinense Health Region presented an abrupt rise in the curve and reached a rate of 36.58 new cases per 1,000 live births in 2019, which was the highest rate among the other regions in this study.

Figure 1. Time series of congenital syphilis incidence rates per 1,000 live births in five Health Regions. Santa Catarina, Brazil, 2010-2019



Source: Dive/SES-SC

Table 2 shows the mean of specific incidence rates and the mean of incidence rates according to sex, calculated per 1,000 live births. The Serra Catarinense had a mean incidence rate of congenital syphilis of 15.57 cases/1,000 live births; this was the highest rate among the five Health Regions studied. The lowest rate was 3.36 cases/1,000 live births in the Northeast Health Region.

The results of the mean incidence rates according to sex showed the same pattern as the total mean incidence rate. The Serra Catarinense Health Region presented the highest mean rate for the female sex, with 16.18/1,000 live births. On the other hand, the lowest rates for total mean and female mean incidence were registered in the Northeast Health Region, with 3.36/1,000 live births and 3.05/1,000 live births in female newborns. The results for mean incidence rates in the male sex demonstrated that the lowest rate was reported for the Northeast Region (2.97/1,000 live births), while the highest rate was registered, again, in the Serra Catarinense (13.04/1,000 live births) and the same pattern for morbidity was maintained (Table 2).

Table 2. Mean incidence rate and incidence rate according to sex for congenital syphilis per 1,000 live births in five Health Regions Santa Catarina, Brazil, 2010-2019.

Indicators	Northeast	Foz do Rio Itajaí	Grande Fpolis.	Serra Catarinense	West
Total mean specific rate of incidence	3.36	4.17	7.22	15.57	4.16
Mean rate of incidence for male sex	2.97	3.53	6.49	13.04	4.35
Mean rate of incidence for female sex	3.05	4.30	7.05	16.18	3.96

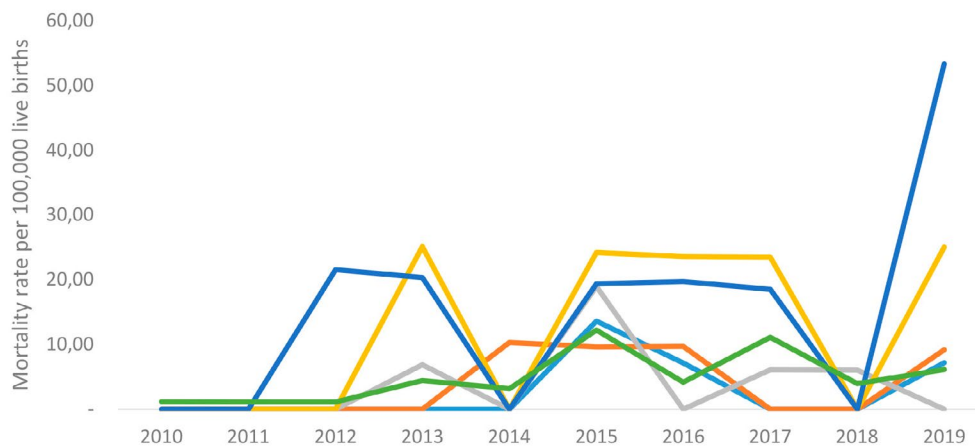
Source: DIVE/SC

Another criterion of analysis used in this study was the mortality profile and its associated indicators that evaluated the severity of this disease. It was observed that the specific mortality rate for congenital syphilis and the rate according to sex in the State of Santa Catarina were low in this study.

The results displayed in Figure 2 presented a stability in the mortality rate of approximately 1.18/100,000 live births in Santa Catarina between the years 2010 and 2012. The highest mortality rate was registered in 2015 (15.22 cases/100,000 live births); however, it was reduced to 6.15 cases per 100,000 live births in 2019.

The results of the five Health Regions demonstrated that the mortality rate of congenital syphilis is low, with some oscillations in the curves for the Health Regions analyzed in this study. The West and Serra Catarinense Regions showed an increase in the mortality rate in the years 2012 (21.54/100,000 live births) and 2013 (25.11/100,000 live births), respectively. The West Region also maintained a mortality rate close to 20 deaths per 100,000 live births between the years 2015 and 2017; however, in 2019 this rate increased to 53.34/100,000 live births. A similar trend was observed in the Serra Catarinense Region during the same period from 2015 to 2017, with mortality rates close to 24 deaths per 100,000 live births. Whereas, the Foz do Rio Itajaí Region presented mortality rates close to 10/100,000 live births between 2014 and 2016 and in the year 2019.

Figure 2. Time series of specific mortality rates for congenital syphilis per 100,000 live births in five Health Regions. Santa Catarina, Brazil, 2010-2019



Source: Dive/SES-SC

Table 3 presents the mean specific mortality rates for congenital syphilis, total and according to sex, in the five Health Regions selected for this study. It was observed that the mean mortality rates were higher in the Serra Catarinense Region (24.29/100,000 live births) and in the West Region (25.47/100,000 live births), as it was expected. When data was analyzed according to sex, the highest rates were found for male sex, with 47.67/100,000 live births in the Health Region of Serra Catarinense. Whereas, for female sex, the West Region showed a rate of 26.73/100,000 live births, the highest mean rate of all the regions analyzed.

Table 3. Mean specific mortality rates and mean mortality rates according to sex for congenital syphilis in five Health Regions. Santa Catarina, Brazil, 2010-2019

Indicators	Regions				
	Northeast	Foz do Rio Itajaí	Grande Fpolis.	Serra Catarinense	West
Total mean specific mortality rate	9.31	9.72	9.49	24.29	25.47
Mean mortality rate for male sex	13.6	4.65	6.03	47.67	24.74
Mean mortality rate for female sex	4.93	14.97	13.13	-	26.73

*100,000 Live Births

Source: DIVE/SC

Finally, the case fatality rate for congenital syphilis for each of the five Health Regions selected for this study was calculated. Table 4 shows that case fatality rate varied from 0.51 deaths per 100 cases of syphilis in the Health Region of Grande Florianópolis, in the year 2017, to 50.00 deaths per 100 cases of syphilis in the Health Regions of West (2012) and Serra Catarinense (2013), respectively. Although, it is important to clarify that these high case fatality rates are a result of the low number of confirmed cases (n=2) in each one of the regions in this study. The other Health Regions presented low rates, which varied from 0.51 in Grande Florianópolis Region to 16.7 deaths in West Region, in the year 2019.

Table 4. Case Fatality Rates of congenital syphilis in five Health Regions. Santa Catarina, Brazil, 2010-2019

Health Regions	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
HR Northeast	-	-	-	-	-	2.50	1.06	-	-	2.86
HR Foz do Rio Itajaí	-	-	-	-	2.22	1.96	2.38	-	-	1.75
HR Grande Florianópolis	-	-	-	1.03	-	1.84	-	0.51	0.52	-
HR Serra Catarinense	-	-	-	50.00	-	4.55	1.30	1.37	-	0.68
HR West	-	-	50.00	7.69	-	2.08	2.56	1.79	-	16.7

Source: DIVE/SEC-SC

Discussion

The control of communicable diseases, such as syphilis, is a primary care responsibility. That includes adopting control measures directed not only to pregnant women but also to their partners. As a result, establishing an efficient treatment can break the chain of transmission of this disease and avoid spreading a preventable infection in newborns, congenital syphilis.

Although national control measures were established to limit the advance of congenital syphilis, the present study observed a different behaviour of this disease in the five Health Regions of Santa Catarina.

The analysis of the newborns' clinical characteristics in this study demonstrated a percentage greater than 90% in the diagnosis of early congenital syphilis in the five Health Regions analyzed. A study conducted in Recife between 2011 and 2015 identified that 47.36% of nontreponemal tests in peripheral blood of newborns were positive, and 5.26% of these infants were symptomatic.¹¹ Another research in the city of São Paulo showed that 61% of cases were positive and 20% negative. Meanwhile, bone anomalies were present in 14% of notifications.¹²

In the South of Brazil, from 2001 to 2009, 86.9% of congenital syphilis cases were classified as early, and a similar trend was found in another Brazilian study.¹³

Prenatal care was reported by 79.29% of pregnant women, following recommendations from the Ministry of Health of Brazil.¹⁴ During prenatal visits, pregnant women with a syphilis diagnosis represented 60.01% of the population; however, 55.05% of the reported treatments were inadequate.¹² Another study revealed that, although 96.6% of pregnant women went through adequate prenatal care, 40% of them had a diagnosis of syphilis only during labor, which compromised the treatment and contributed to an increase in the number of congenital syphilis cases.¹⁵

The inadequate treatment of pregnant women and their partners is a great challenge, and it contributes to the increase in the number of congenital syphilis cases; this problem was described in some studies^{12,13,16}, which evidenced room for improvement. Simultaneously, the Ministry of Health also states the importance of an early diagnosis in children with congenital syphilis.²

In the time series analyzed in this study, the incidence rate of congenital syphilis in the State of Santa Catarina presented the smallest value in 2010, with an incidence rate of 0.75/1,000 live births, which is still higher than the goal established by the World Health Organization/Pan American Health Organization of 0.5 cases/1,000 live births.¹⁷ The behavior of this disease between the years 2010 and 2018 did not show great changes, and the highest incidence rate was reported in 2018, with 6.40 cases/1,000 live births.

A study conducted in the capitals of Brazil described 44,056 cases of congenital syphilis in infants below one year of age between 2009 and 2016.¹⁸ The highest rate of congenital syphilis was reported in 2016 in Porto Alegre (31.07/1,000 live births). The capitals of Northeast Brazil were featured among the cities with the greatest incidence rates, especially the city of Recife (23.67/1,000 live births).¹⁸

In these studies, it was verified that the incidence rates were higher than the mean of 0.5/1,000 live births determined by the Ministry of Health, according to recommendations from the Pan American Health Organization.¹⁷

The mean incidence rates for the Health Regions analyzed in this study were seven cases per 1,000 live births, except for the Serra Catarinense Region. A study about congenital syphilis performed in the city of Sobral, in the State of Ceará, identified nine newborns with this disease, and eight of them were female babies.¹⁹

The follow-up of pregnant women during prenatal care visits and the treatment administered in the maternity hospital are fundamental steps for caring for newborns diagnosed with congenital syphilis at birth.

Two Health Regions were featured because of their high incidence rates, as both of them were distant from urban centers, which could difficult the access to an early diagnosis at birth and prompt treatment administration that requires the newborn's admission into a maternity hospital. Additionally, home deliveries in rural areas are a reality in the two Health Regions with a high prevalence of congenital syphilis in the present study. Another study confirmed that lower social conditions, the vulnerability of pregnant women, poor education, insufficient income, and limited access to health services was associated with morbidity by congenital syphilis.^{12,13,20}

The morbidity profile of congenital syphilis expresses the severity of this disease for newborns and children up to two years of age. This was observed in the total specific mortality rate and the specific mortality rate according to sex. It is worth mentioning that the very low results of these indicators, found in the present

research, suggested that the State of Santa Catarina adopted efficient control measures. This is particularly relevant for prenatal care of pregnant women and for strategies to provide prompt treatment and follow-up the newborns diagnosed with congenital syphilis at the maternity hospital.

When the total mean specific mortality rate and the mean specific mortality rates of each of the five Health Regions in this study were compared to national indicators of Brazil, great disparities were observed in these results. The Health Regions analyzed in this research, especially the Serra Catarinense and the West, displayed very high mortality rates, almost 24 times greater than national rates for Brazil. In the last ten years, Brazil reported a national mortality rate of 1.9/100,000 live births in 2008 and notified an increase for 8.2/100,000 live births in 2018.²

One of the consequences of congenital syphilis is perinatal death, which could be related to incorrect dosages of antibiotic treatment or untreated maternal syphilis.²¹

In order to reduce the transmission of congenital syphilis, it is necessary to adopt control measures. Some of these strategies include the expansion of access to basic health units, the improvement of prenatal care quality, increasing the number of screening tests in the first prenatal care visit, the access to adequate treatment for infected women and their partners, and the expansion of intervention programs targeted to groups at high risk for syphilis infection.²²

Public policies and programs for maternal and infant health need to be implemented to guarantee the quality of health assistance during the delivery and postpartum period. These strategies assure the newborn's right to be born with safety and guaranteed healthy growth and development.²³

Another important factor in modifying the morbidity/mortality profile of congenital syphilis is improving participation and educating primary care teams. These professionals work in the frontlines of public health assistance, directly with the families at risk, and are extremely important for health promotion, which is needed to reduce the spread of congenital syphilis and to achieve the goals set by public health agencies.²⁴

Conclusions

This study helped outline the morbidity/mortality profile of congenital syphilis and identify the differences among five Health Regions in the State of Santa Catarina between the years 2010 and 2019. The lack of systematic testing for syphilis during pregnancy could have increased the number of newborns diagnosed with congenital syphilis in the last few years. These confirmed diagnoses were more prevalent in asymptomatic newborns.

Two Health Regions were featured among the highest morbidity rates, and both of them were located away from urban centers. Meanwhile, the mortality profile maintained low rates from 2010 to 2017 and did not register deaths in several years in the time series analyzed. However, the years 2018 and 2019 registered a change in the mortality profile, with higher rates reported in the Serra Catarinense (2019) and West Region during all the analyzed periods.

Congenital syphilis is a disease with high impact and unfavorable health indicators. Therefore, the Health Council of the State of Santa Catarina needs to adopt a new organizational plan for Primary Care, with new control measures to halt the advance of this disease. This plan also needs to offer health services and implement new strategies in every city part of the Health Regions in our State, so we can effectively reach the goal of 0.5 cases of congenital syphilis per 1,000 live births.

This study could assist in the evaluation of health indicators of every Health Region of Santa Catarina. As a result, the Government could develop adequate control measures for each demographic profile and expand the offer of health services to reach the most vulnerable population to syphilis infection.

The strengths of this study were the availability of updated data in the TabNET system, from the Mortality Information System (SIM) and the Notifiable Diseases Information System (SINAN), assessed in the website of the Epidemiological Surveillance Board in the Secretary of Health of Santa Catarina. This was a pioneer study that demonstrated the magnitude of congenital syphilis in the State of Santa Catarina. This analysis could contribute to expand the strategies and implement Municipal Programs for the Control of Sexually Transmitted Infections in our State.

Author contributions

Nass SL and Santos VC participated in the conception/design of the study/research, data collection, search and statistical analysis of research data, interpretation of results, and writing of the manuscript. Schultz LF participated in the conception/design of the study/research, interpretation of results, and writing of the manuscript. Moreira TMA participated in the conception/design of the study/research, statistical analysis of research data, interpretation of results, and writing of the manuscript.

Conflict of interests

No financial, legal or political conflicts involving third parties (Government, enterprises, private companies, etc.) were declared in any aspects of the submitted manuscript (including, but not limited to subventions and financing, participation in consulting committees, design of the study, writing of the manuscript, statistical analysis, etc.).

References

1. Radolf JD, Deka RK, Anand A, Smajs D, Norgard MV, Yang XF. *Treponema pallidum*, the syphilis spirochete: making a living as a stealth pathogen. *Nat Rev Microbiol.* 2016;14(12):744-59. <https://doi.org/10.1038/nrmicro.2016.141>
2. Ministério da Saúde (Brazil), Secretaria de Vigilância em Saúde. *Vigilância em saúde no Brasil 2003 | 2019: da criação da Secretaria de Vigilância em Saúde aos dias atuais.* Boletim Epidemiológico [Internet]. Brasília: Ministério da Saúde; 2019 [cited 2021 Jun 19]. Available from: <https://www.gov.br/saude/pt-br/assuntos/boletins-epidemiologicos>
3. Moline HR, Smith JF. The continuing threat of syphilis in pregnancy. *Curr Opin Obstet Gynecol.* 2016;28(2):101-4. <https://doi.org/10.1097/gco.000000000000258>
4. Galvis AE, Arrieta A. Congenital Syphilis: A U.S. Perspective. *Children.* 2020;7(11): 203. <https://doi.org/10.3390/children7110203>
5. Kimball A, Miele K, Bachmann L, Thorpe P, Weinstock H, Bowen V. Missed Opportunities for Prevention of Congenital Syphilis. *MMWR Morb. Mortal. Wkly. Rep.* 2020;69(22):661-5. <https://dx.doi.org/10.15585%2Fmmwr.mm6922a1>
6. World Health Organization. Guidelines for the treatment of *Treponema pallidum* (syphilis) [Internet]. Geneva: WHO; 2016. [cited 2021 Jun 20]. Available from: <https://www.who.int/reproductivehealth/publications/rtis/syphilis-treatment-guidelines/en/>

7. Korenromp EL, Rowley J, Alonso M, Mello MB, Wijesooriya NS, Mahiané SG, et al. Global burden of maternal and congenital syphilis and associated adverse birth outcomes—Estimates for 2016 and progress since 2012. *PLoS ONE*. 2019;14(2):e0211720. <https://doi.org/10.1371/journal.pone.0211720>
8. Secretaria de Estado da Saúde de Santa Catarina (Brasil), Diretoria de Vigilância Epidemiológica. Informativo Epidemiológico Barriga Verde. Boletim epidemiológico sífilis em Santa Catarina 2018 [Internet]. Florianópolis: Diretoria de Vigilância Epidemiológica da Secretaria de Estado da Saúde de Santa Catarina; 2019. [cited 2021 Jun 20]. Available from: http://www.dive.sc.gov.br/barrigaverde/pdf/BV_Sifilis.pdf
9. Governo do Estado de Santa Catarina (Brazil), Secretaria de Estado da Saúde. Sistema Único de Saúde. Plano diretor de regionalização: PDR. 2012 [Internet]. Florianópolis: IOESC; 2012. [cited 2021 Apr 10]. Available from: <https://www.saude.sc.gov.br/index.php/documentos/informacoes-gerais/planejamento-em-saude/instrumentos-de-gestao-estadual/plano-diretor-de-regionalizacao/8141-plano-diretor-de-regionalizacao-2012/file>
10. Resolução n. 466, de 12 de dezembro de 2012 (Brazil). Aprova as diretrizes e normas regulamentadoras de pesquisas envolvendo seres humanos e revoga as Resoluções CNS nos. 196/96, 303/2000 e 404/2008. [Internet]. 2012 dez 12. Available from: <http://conselho.saude.gov.br/resolucoes/2012/Reso466.pdf>
11. Silva IMD, Leal EMM, Pacheco HF, Souza Júnior JG, Silva FS. Epidemiological profile of congenital syphilis. *Rev enferm UFPE online* [Internet]. 2019;13(3):604–13. Available from: <https://periodicos.ufpe.br/revistas/revistaenfermagem/article/view/236252/31536>
12. Maschio-Lima T, Machado ILL, Siqueira JPZ, Almeida MTG. Epidemiological profile of patients with congenital and gestational syphilis in a city in the State of São Paulo, Brazil. *Rev. Bras. Mater. Infant.* 2019;19(4):865-72. <https://doi.org/10.1590/1806-93042019000400007>
13. Cavalcante PAM, Pereira RBL, Castro JGD. Syphilis in pregnancy and congenital syphilis in Palmas, Tocantins State, Brazil, 2007-2014. *Epidemiol. Serv. Saúde*. 2017;26(2):255-64. <https://doi.org/10.5123/S1679-49742017000200003>
14. Ministério da Saúde (Brazil), Secretaria de Atenção à Saúde, Departamento de Atenção Básica. Atenção ao pré-natal de baixo risco [Internet]. Brasília: Editora do Ministério da Saúde; 2012. [cited 2020 Oct 18]. Available from: https://bvsmms.saude.gov.br/bvs/publicacoes/cadernos_atencao_basica_32_prenatal.pdf
15. Lima VC, Mororó RM, Martins MA, Ribeiro SM, Linhares MSC. Epidemiological profile of cases of congenital syphilis a mid-sized municipality of Brazilian northeast. *J Health Biol Sci*. 2017;5(1):56–61. <http://dx.doi.org/10.12662/2317-3076jhbs.v5i1.1012.p56-61.2017>
16. Rocha RPS, Terças ACP, Nascimento VF, Silva JH, Gleriano JS. Analysis of epidemiological profile of syphilis in pregnant women and children in Tangará da Serra, from 2007 to 2014. *Rev Norte Mineira Enf* [Internet]. 2016;5(2):03-21. Available from: <https://www.periodicos.unimontes.br/index.php/renome/article/view/1246/1295>
17. Pan American Health Organization (PAHO). Elimination of Mother-to-Child Transmission of HIV and Syphilis in the Americas - Update 2015 [Internet]. Washington, DC: PAHO; 2015. [cited 2020 Oct 25]. Available from: <https://iris.paho.org/handle/10665.2/18372>
18. Rego AS, Costa LC, Rodrigues LS, Garcia RAS, Silva FMAM, D'êça Junior, et al. Congenital syphilis in Brazil: distribution of cases notified from 2009 to 2016. *Rev Soc Bras Med Trop*. 2020;53:(e20200338). <https://doi.org/10.1590/0037-8682-0338-2020>
19. Mesquita KO, Lima GK, Filgueira AA, Flôr SMC, Freitas CASL, Linhares MSC, et al. Analysis of Cases of Congenital Syphilis in Sobral, Ceará: Contributions to Prenatal Care. *DST-J Bras Doenças Sex Transm*. 2012;24(1):20–7. <http://dx.doi.org/10.5533/2177-8264-201224107>
20. Saraceni V, Pereira GFM, Silveira MF, Araujo MAL, Miranda AE. Vigilância epidemiológica da transmissão vertical da sífilis: dados de seis unidades federativas no Brasil. *Rev Panam Salud Publica*. 2017;41:e44. <https://dx.doi.org/10.26633/2FRPSP.2017.44>
21. Bezerra MLMB, Fernandes FECV, Nunes JPO, Baltar SLSMA, Randau KP. Congenital Syphilis as a Measure of Maternal and Child Healthcare, Brazil. *Emerg Infect Dis*. 2019;25(8):1469-76. <https://doi.org/10.3201/eid2508.180298>
22. Costa CV, Santos IAB, Silva JM, Barcelos TF, Guerra HS. Congenital syphilis: repercussions and challenges. *Arq. Catarin Med* [Internet]. 2017;46(3):194-202. Available from: <https://pesquisa.bvsalud.org/portal/resource/pt/biblio-849511>
23. Domingues RMSM, Leal MC. Incidence of congenital syphilis and factors associated with vertical transmission: data from the Birth in Brazil study. *Cad. Saúde Pública*. 2016;32(6):e0008241. <https://doi.org/10.1590/0102-311X00082415>
24. Lazarini FM, Barbosa, DA. Educational intervention in Primary Care for the prevention of congenital syphilis. *Rev Latino-Am Enfermagem*. 2017;25:e2845. <https://doi.org/10.1590/1518-8345.1612.2845>