

Temporal evolution and characterization of congenital syphilis cases in Minas Gerais, Brazil, 2007-2015

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Abstract *The objective was to analyze the temporal trend of the incidence of congenital syphilis (CS) and to characterize the disease in the state of Minas Gerais (MG) between 2007 and 2015. Quantitative study, of a time series analysis, with the database from the Information System of Diseases Notification, referring to cases of CS reported in MG between 2007 and 2015. It was used descriptive statistics, calculation of the incidence rate of CS and polynomial regression model for temporal trend analysis. The results showed that in the period 4,381 cases were registered. The incidence rate ranged from 0.61 to 5.08 per 1,000 live births (LB), with an increase in the temporal trend of the CS incidence coefficient in the period from 2007 to 2015, with an annual rate variation of 30.6% (95% CI: 21.0 – 41.0). There was a predominance of brown-skinned newborns (38.7%), up to 6 days old (94.7%) and the majority (63.6%) did not present any suggestive manifestations of CS, but definitive diagnosis for recent CS (95.2%). The number of reported cases is increasing, suggesting that it is necessary, for improvement in the prenatal care, diagnosis, appropriate treatment, health care and notification.*

Key words *Syphilis, Congenital syphilis, Pregnant women, Sexually transmitted diseases, Time series studies*

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Introduction

Syphilis in pregnant women (SPW) is an avoidable and easily diagnosed disease, however, it is still considered a serious public health problem due to its high transmissibility and frequency, which leads to serious complications^{1,2}. Congenital syphilis (CS) is a disease transmitted to the fetus by the untreated or inadequately treated infected mother through transplacental circulation³⁻⁵. The fetal infection usually occurs between the 16th and the 28th week of gestation⁶. Failure to treat the recent maternal infection implies fetal contamination in 80 to 100% of the cases⁷. The timely diagnosis of syphilis in pregnancy is the main challenge for the control of CS and its complications during and after pregnancy, as for example, preterm delivery, fetal and neonatal death^{8,9}. The occurrence of CS is recognized as a sensitive indicator of the quality of the prenatal care (PN)¹⁰.

Considering the CS serious and potentially fatal, Brazilian guidelines state that every pregnant woman should be submitted to at least two exams to diagnose syphilis during the PN care, the *Venereal Disease Research Laboratory* (VDRL). Usually the first at the beginning of the gestation (ideally in the first trimester) and the other at approximately the twenty-eighth week of gestation (beginning of the third trimester)¹¹. A VDRL should also be performed at the time of delivery, in order to provide the newborn (NB) with the possibility of early treatment in case the pregnant woman has not been treated or has been re-infected after treatment^{4,7}.

In Brazil, between January 1998 and June 2017, 159,890 cases of CS were reported in children under one year old, of whom 70,558 (44.1%) were residents of the southeast region. Regarding the infant mortality by CS, between 1998 and 2016, the number of deaths reported in the Mortality Information System (MIS) was 2,102, being 910 (43.3%) in the Southeast Region¹².

The importance of analyzing the temporal trend of CS in Minas Gerais (MG) is due to the scarcity of studies on this aspect in the state. Although it is a pathology of easy treatment and prevention, studies in different Brazilian regions show a significant increase in the incidence^{13,14}. It is relevant to know the behavior of the trend over the years, aiming to identify clinical and epidemiological characteristics, recognizing the critical nodes of maternal and child health interventions, in order to optimize the early diagnosis and treatment to reduce complications due

to this disease, as well as achieving the goal of reducing the incidence of CS proposed by the World Health Organization (WHO), which is less than 0.5 case/1,000 LB. Researches using state databases are necessary to evaluate the effectiveness of health actions and Health Information Systems (HIS), especially in the diagnosis and planning, in view of the continuous and weekly insertion of the data in the systems by the health care services. Therefore, this study intends to analyze the temporal trend of CS cases and to characterize the disease in the state of MG between 2007 and 2015.

Methods

It is a quantitative, retrospective and time-series analysis study. The research was developed with cases of CS of individuals notified and residing in the state of MG between 2007 and 2015. The database of the Information System of Diseases Notification (SINAN – “Sistema de Informação de Agravos de Notificação”, in Portuguese language) provided by the Minas Gerais State Health Department (SHD/MG) was used. The state of MG is the second most populous in Brazil, with a population of 21.1 million inhabitants.

Variables with incompleteness (data ignored or blank) above 20% were excluded, however, some relevant variables were analyzed with parsimony when above this established percentage. In order to analyze the completeness of the database variables, the criteria proposed by the Economic Commission for Latin America and the Caribbean (ECLAC) were used, which considers the proportion of information ignored, blank fields and codes assigned as specified ignored information, characterized as incompleteness of information. ECLAC classifies as *excellent* when there is less than 5% of incomplete information, *good* from 5% to 10%, *regular* from 10% to 20%, *bad* from 20% to 50% and *very bad* from 50% or over¹⁵. The first and last years of the series were used for completeness comparisons, 2007 and 2015 respectively.

Descriptive exploratory analyzes of the data were performed from simple absolute frequency and percentage to categorical variables. The data were analyzed in the statistical program *Statistical Package for Social Sciences* (SPSS®) version 21.0. The incidence coefficient was calculated by age group and year (2007 to 2015), expressed as number of cases per 1,000 LB/year, according to the formula¹²:

$$\text{Incidence rate of congenital syphilis} = \frac{\text{number of new cases of congenital syphilis in the year} \times 1.000}{\text{total number of live births in the year}}$$

For the analysis of the temporal trend, the generalized linear regression model of *Prais-Winsten* was used¹⁶. The rate of change and the respective confidence interval (95% CI) were determined. A stable rate is considered when the regression coefficient does not present a significant difference ($p > 0.05$), ascending when the annual change is positive and decreasing when it is negative.

Results

In MG, between 2007 and 2015, there were 4,381 reported cases of CS. It was observed that the incidence of infection increased in the period. The incidence rate ranged from 0.61 to 5.08 per 1,000 LB in the period (Table 1).

The quality of the completeness of the notification form was verified, in order to select the appropriate variables for analysis. The year 2015 was selected because it was the most recent year. The variables rated as 'excellent' (< 5% of incompleteness) were: if the pregnant woman underwent a non-treponemal test (NTT) at the childbirth/curettage and NTT of the child's peripheral blood. The variables rated as 'good' or 'regular' were: area of residence, PN during pregnancy, diagnosis of maternal syphilis, clinical diagnosis, presence of signs/symptoms, treatment plan for the child, case evolution(child)

and titration, confirmatory treponemal test (TT) at childbirth/curettage, mother's treatment plan and NTT from the child's cerebrospinal fluid. The variables rated as 'bad' were: ethnicity, schooling, if the partner was treated concomitantly with the pregnant woman, TT test in the child (after 18 months), evidence of *T. pallidum*, fluid alteration and radiological diagnosis of the child. Rated as 'very bad' was the occupation of mother (data not shown in table). With the exception of a few variables, the bank may be considered suitable for the analysis.

Considering the sociodemographic characterization, it was observed that the majority was resident in an urban area, 4,025 cases (91.9%); age group with a higher prevalence from 0 to 6 days (94.7%), there were practically no difference between sexes, 1,990 cases (47.9%) for women and 1,993 cases (48.0%) for men (Table 2).

In the period, 2,788 children (63.6%) did not present any clinical manifestation suggestive of CS in relation to the physical examination, only 614 (14.0%) presented it. 3,730 (85.1%) children evolved as alive at the time of notification, 115 (2.6%) died of CS, 44 (1.0%) died due to other causes, and 165 (3.8%) were miscarriages. According to the staging of the case, 95.2% of them were diagnosed as recent CS; 0.1% as late CS and 4.7% as stillborn with syphilis (Table 3).

Table 1. Distribution of frequency, proportion and incidence of cases (per 1,000 LB) of Congenital Syphilis, in the state of Minas Gerais, 2007 to 2015. (n = 4,381).

Diagnostic year	No. of LB	No. of reported cases	%	Incidence
2007	260,666	159	3.6	0.61
2008	261,626	189	4.3	0.72
2009	253,700	189	4.3	0.74
2010	255,443	224	5.1	0.88
2011	260,037	289	6.6	1.11
2012	260,744	479	10.9	1.84
2013	258,885	616	14.1	2.38
2014	267,075	873	19.9	3.27
2015	268,126	1363	31.1	5.08
Total	2,346,302	4381	100.0	1.9

Source: Elaborated by the author, 2016. Data from SINAN and SINASC: 2007 – 2015, obtained from the State Health Department/ MG.

Table 2. Sociodemographic characterization of Congenital Syphilis cases, in the state of Minas Gerais, 2007 to 2015. (n = 4,381).

	2007		2009		2011		2013		2015	
	N	%	N	%	N	%	N	%	N	%
Age group										
0 to 6 days	138	86.8	181	95.8	269	93.1	589	95.6	1295	95.0
7 to 27 days	13	8.2	4	2.1	11	3.8	10	1.6	28	2.1
28 to 364 days	8	5.0	4	2.1	9	3.1	17	2.8	37	2.7
365 days or over	0	0.0	0	0.0	0	0.0	0	0.0	3	0.2
Gender										
Female	84	52.8	89	47.1	133	46.0	293	47.6	629	46.1
Male	74	46.5	94	49.7	150	51.9	294	47.7	674	49.4
Ignored	1	0.6	6	3.2	6	2.1	29	4.7	60	4.4
Ethnicity										
Caucasian	39	24.5	44	23.3	68	23.5	94	15.3	241	17.7
Black	11	6.9	9	4.8	22	7.6	43	7.0	75	5.5
Asian	0	0.0	1	0.5	1	0.3	3	0.5	2	0.1
Brown-skinned	57	35.8	76	40.2	100	34.6	243	39.4	604	44.3
Indigenous	0	0.0	0	0.0	1	0.3	0	0.0	0	0.0
Ignored/Absent	52	32.7	59	31.2	97	33.6	233	37.8	441	32.4
Area of residence										
Area	146	91.8	169	89.4	267	92.4	561	91.1	1244	91.3
Rural	8	5.0	11	5.8	13	4.5	23	3.7	41	3.0
Peri-urban	2	1.3	1	0.5	3	1.0	2	0.3	2	0.1
Ignored/Absent	3	1.9	8	4.2	6	2.1	30	4.9	76	5.6

In order to facilitate the visualization of the temporal evolution of socio-demographic and epidemiological characteristics, tables (2 to 4) were presented in alternate years.

Source: Calculations made by the author, 2016. Data from SINAN: 2007 – 2015, obtained from the State Health Department/MG.

Table 3. Distribution of cases of Congenital Syphilis according to clinical aspects, in the state of Minas Gerais, 2007 to 2015. (n = 4,381).

Year	2007		2009		2011		2013		2015	
	N	%	N	%	N	%	N	%	N	%
Clinical Diagnosis										
Asymptomatic	13	8.2	118	62.4	175	60.6	396	64.3	971	71.2
Symptomatic	2	1.3	23	12.2	47	16.3	91	14.8	222	16.3
Does not apply	1	0.6	9	4.8	14	4.8	44	7.1	67	4.9
Ignored/Absent	143	89.9	39	20.6	53	18.3	85	13.8	103	7.6
Case evolution										
Alive	148	93.1	170	89.9	249	86.2	507	82.3	1181	86.6
Death due to CS	3	1.9	6	3.2	6	2.1	13	2.1	38	2.8
Death due to other causes	1	0.6	0	0.0	3	1.0	7	1.1	14	1.0
Miscarriage	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Stillborn	0	0.0	3	1.6	14	4.8	31	5.0	43	3.2
Ignored	7	4.4	10	5.3	17	5.9	58	9.4	87	6.4
Final diagnosis										
Recent CS	137	86.2	184	97.4	275	95.2	585	95.0	1320	96.8
Late CS	0	0.0	2	1.1	0	0.0	0	0.0	0	0.0
Stillborn	22	13.8	3	1.6	14	4.8	31	5.0	43	3.2

In order to facilitate the visualization of the temporal evolution of socio-demographic and epidemiological characteristics, tables (2 to 4) were presented in alternate years.

Source: Calculations made by the author, 2016. Data from SINAN: 2007 – 2015, obtained from the State Health Department/MG.

The NTT in the peripheral blood of the newborns was found to be reactive in 3115 cases (71.5%). Regarding the TT performed after 18 months of birth, there was 42.6% of information incompleteness, making the analysis impossible. In the NTT performed in the NB fluid, 139 cases (3.2%) were reactive, 1,968 (44.9%) non-reactive, and in 1617 (36.9%) cases it was not performed (data not shown in the table).

As for the ascending titer, which is the comparison of the non-treponemal serum titers of the child after each test performed during the follow-up (VDRL at 1, 3, 6, 12 and 18 months old), 82 cases (1.9%) had increase of the serological titer (ascending titration), 544 cases (12.4%) did not have it, and 49.4% did not compare the titers. Regarding the evidence of *T. Pallidum* on microscopic examination of placental material, cutaneomucous lesions, umbilical cord or necropsy, 111 (2.5%) cases had evidence, 701 (16%) cases did not have it, and no examination was performed in 1866 (42.6%) cases, this information was incomplete for 38.9% of the cases (data not shown in the table).

Regarding the changes in relation to the examination of the fluid, characterized by cellularity greater than 10/fields and protein concentration greater than 100mg/ml, in the newborn, 1,856 (42.4%) cases presented no alterations and 193 (4.4%) presented it. According to laboratory data, 2.7% had a radiological diagnosis (examination of the long bones) with bone changes observable to X-rays (Xr), such as osteochondritis, osteoarthritis, periostitis (productive diaphysitis), rarefaction of bone, tibia in "saber blade" and 48.0% of the cases were free of observable bone changes (data not shown in the table).

The majority did not show signs and symptoms at the physical examination at the time of the notification, 2,978 did not present jaundice (68.0%); were free from rhinitis (75.3%); anemia (73.9%), splenomegaly (73.4%), hepatomegaly (73.1%), osteochondritis (74.5%), cutaneous lesions (74.0%) and pseudoparalysis (74.9%).

The predominant age group of mothers was from 20 to 39 years old (72.1%). PN care was performed by 82.2% of the pregnant women. 2,463 (56.2%) pregnant women received a diagnosis of syphilis during the PN care, while 1,233 (28.1%) received it at the time of delivery or curettage (Table 4).

The NTT at the time of delivery or curettage was reactive for 3,880 (88.6%) pregnant women.

The confirmatory TT at delivery or curettage was reactive for 1,299 (29.7%) pregnant women, and it was not performed in 2,063 (47.1%). Regarding the treatment plan, this was inadequate for 2,418 (55.2%) pregnant women, and adequate for only 203 (4.6%) cases. The proportion of not performed was 25.9%. Most sexual partners were not treated concomitantly (55.8%), 587 (13.4%) cases were treated timely (Table 4).

It was observed an increase in the temporal trend of the incidence rate of CS in the period between 2007 and 2015, with an annual rate variation of 30.6% (95% CI: 21.0 – 41.0) (Figure 1).

Discussion

The completeness of the information facilitates the characterization of the studied population and the planning of actions for the confrontation of the public health allows to identify the critical nodes. The quality and pertinence of the information produced, in order to know the health conditions of the population, may be compromised when there are variables with inadequate completeness¹⁷. Magalhães et al.¹⁸ reinforce the importance of records relating to notifications and the follow-up of cases, however, the underreporting, incomplete filling and/or conflicting or ignored information were observed in a significant part of the records consulted in a study carried out with reactive VDRL pregnant women in public maternity hospitals of the Federal District between November 2009 and December 2010.

The incompleteness of the SIS variables was also observed in the studies that evaluated the quality of the SINAN notification data of HIV positive pregnant women in the State of Ceará between 2000 and 2009¹⁹ and of the work-related injuries in the municipality of Betim, MG, between 2007 and 2011²⁰. One possibility for disengagement with the adequate completion may be the significant amount of fields from the SINAN notification/inquiry forms and the excessive amount of forms to be filled in by the health services.

SINAN aggregates information on several characteristics of the diseases related to CS, which are important in guiding health care and surveillance, epidemiological surveillance and maternal and child health services, contributing to the planning of actions that seek to eradicate or reduce the infection in Brazil. Despite

Table 4. Distribution of the clinical-epidemiological profile of the mothers of newborns with Congenital Syphilis, in the state of Minas Gerais, from 2007 to 2015. (N = 4,381).

	2007		2009		2011		2013		2015	
	N	%	N	%	N	%	N	%	N	%
Mother's age										
10 to 14 years old	0	0.0	0	0.0	2	0.7	6	1.0	16	1.2
15 to 19 years old	29	18.2	41	21.7	67	23.2	160	26.0	336	24.7
20 to 39 years old	121	76.1	140	74.1	208	72.0	430	69.8	948	69.6
40 to 59 years old	3	1.9	8	4.2	9	3.1	13	2.1	24	1.8
Absent	6	3.8	0	0.0	3	1.0	7	1.1	39	2.9
Performed prenatal care during gestation										
Yes	136	85.5	162	85.7	232	80.3	484	78.6	1145	84.0
No	18	11.3	23	12.2	43	14.9	99	16.1	139	10.2
Ignored	5	3.1	4	2.1	14	4.8	33	5.4	79	5.8
Diagnosis of maternal syphilis										
During prenatal care	83	52.2	98	51.9	147	50.9	333	54.1	829	60.8
At delivery/curettage	48	30.2	54	28.6	87	30.1	188	30.5	345	25.3
After delivery	16	10.1	30	15.9	45	15.6	73	11.9	103	7.6
Not performed	3	1.9	2	1.1	1	0.3	5	0.8	7	0.5
Ignored	9	5.7	5	2.6	9	3.1	17	2.8	79	5.8
Non-treponemal test at delivery/curettage										
Reactive	125	78.6	160	84.7	255	88.2	562	91.2	1201	88.1
Non-reactive	13	8.2	12	6.3	14	4.8	19	3.1	69	5.1
Not performed	14	8.8	10	5.3	7	2.4	16	2.6	50	3.7
Ignored	7	4.4	7	3.7	13	4.5	19	3.1	43	3.2
Confirmatory treponemal test at delivery/curettage										
Reactive	41	25.8	31	16.4	71	24.6	162	26.3	530	38.9
Non-reactive	8	5.0	3	1.6	11	3.8	34	5.5	59	4.3
Not performed	74	46.5	117	61.9	148	51.2	301	48.9	543	39.8
Ignored	36	22.6	38	20.1	59	20.4	119	19.3	231	16.9
Treatment plan										
Adequate	13	8.2	8	4.2	14	4.8	28	4.5	64	4.7
Inadequate	62	39.0	92	48.7	127	43.9	327	53.1	829	60.8
Not performed	47	29.6	59	31.2	83	28.7	164	26.6	321	23.6
Ignored	37	23.3	30	15.9	65	22.5	97	15.7	149	10.9
Partner treated concomitantly to the pregnant woman										
Yes	21	13.2	20	10.6	33	11.4	78	12.7	211	15.5
No	70	44.0	101	53.4	155	53.6	360	58.4	818	60.0
Ignored	68	42.8	68	36.0	101	34.9	178	28.9	334	24.5

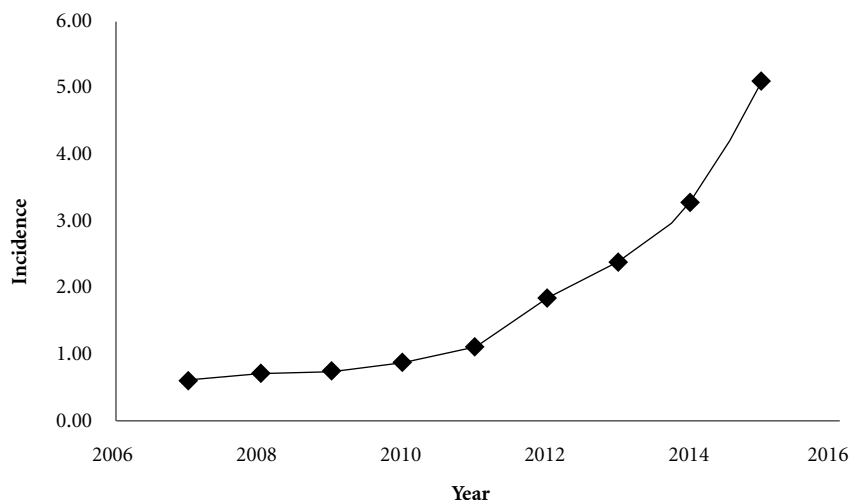
In order to facilitate the visualization of the temporal evolution of socio-demographic and epidemiological characteristics, tables (2 to 4) were presented in alternate years.

Source: Calculations made by the author, 2016. Data from SINAN: 2007 – 2015, obtained from the State Health Department/MG.

the prerogative that all fields should be filled in, the SIS mechanisms that reinforce this requirement reach only a few fields as mandatory²⁰. Most of the variables that make up the notification forms are essential, that is, they are necessary for the investigation of the case, its epidemiological chain and for the calculation

of epidemiological or operational indicators. The volume of data to be filled in, added to the absence of mandatory information when typing, favors the lack of completeness or the option of information ignored by health professionals^{20,21}.

The incidence of CS in the state of Minas Gerais in 2015 was 5.08 cases/1000 LB, higher



Incidence of congenital syphilis	Percentage of annual change	Confidence Interval (95%)	Trend
Incidence	30.62	21.03 - 40.96	Ascending

Figure 1. Time series (annual) of the incidence of reported cases of CS adjusted by the generalized linear regression model of Prais-Winsten, MG, between 2007 and 2015.

Source: Elaborated by the author, 2016.

than that recommended by the Health Department, which determines the education to ≤ 0.5 case/1,000 LB¹². A progressive increase was observed throughout the period, which corroborates the studies carried out in the state of Goiás between 2009 and 2012²² and in the state of Rio Grande do Sul between 2001 and 2012²³. A study carried out in Alagoas²⁴ observed an increase in the incidence of 41.3% in 2011 (6.5 cases/1,000 LB), in relation to the average incidence of the period between 2007 and 2011 (4.8 cases/1,000 LB). This evidences an effective increase in the number of cases or an improvement of the information due to the reduction of underreporting²⁴. For Magalhães et al.¹⁸, poor prenatal care leads to failures in the treatment of pregnant women with syphilis and may result in an increase in the number of cases of CS. For the authors¹⁸, although CS is not an issue restricted to the less favored classes, low schooling and low income can be important markers of poor access to the health services. There was an increase in the incidence in other regions of Brazil, as in the South region, between 2001 and 2009²⁵ and in the municipality of Natal, in Rio Grande do Norte, between 2004 and 2007²⁶. In a study conducted in the United States, between 2012

and 2014, there was also an increase in the incidence²⁷. For Bowen et al.²⁷, a substantial percentage of the increase in cases is attributable to deficiency in the prenatal care. And even among those who received some prenatal care, the detection and treatment of maternal syphilis occurred late to prevent CS. A study conducted in Colombia found that the incidence increased from 2.15/1,000 LB in 2005 to 3.28/1,000 LB in 2011, the authors also point out that this increase reflects failures in the systematic implementation of actions to promote maternal and child health, indicating a real problem in the prenatal access and quality²⁸. In a study carried out in Mexico between 1990 and 2009, there was an increase of 51.6% of cases²⁹.

On the contrary, studies in other countries showed a decline in the number of cases. In a study conducted in China, the annual incidence decreased from 1.15/1000 LB in 2002 to 0.10/1000 LB in 2011³⁰. In the United Kingdom, in the period from 2010 to 2015, there was a decrease in the incidence of 0.0149 cases/1,000 LB in 2010 to 0.0013 cases/1,000 LB in 2014³¹. In Brazil, there was also a decline in the incidence in some regions. In Campo Grande - Mato Grosso do Sul, the comparative incidence analy-

sis showed that the number of CS in 2011 (5.85 cases/1,000 LB) was lower than in 2006 (23.4 cases/1,000 LB)³². In the state of Rio Grande do Norte, the incidence rate was 4.3 and 0.9 in the years of 2008 and 2010, respectively⁶.

In the MG state, there was an increase in the temporal trend of the incidence with an annual variation of 30.6%. This scenario can also be observed in a study carried out in the state of Mato Grosso between 2001 and 2011³³ and in Aracaju/SE between 2008 and 2012³⁴. In Brazil, in the last five years, there was a constant increase in the number of cases of syphilis in pregnant women, congenital and acquired, which can be attributed, in part, to the improvement of the epidemiological surveillance system, as well as the increase in serological testing coverage, with the expansion of the use of rapid tests, reduction of condom use, resistance of health professionals to the administration of penicillin in Primary Care, worldwide shortage of penicillin, among others¹².

The increasing temporal evolution for CS cases is suggestive of improvement in the reporting over the years. The underreporting may be considered as an indirect indicator of the fragility of health care provided³³. The persistence of a high disease incidence and vertical transmission rates, even after a considerable increase in the PN care coverage and the average number of consultations with the SUS implementation, indicates that the quality of care should be improved³⁵. Serruya *et al.*³⁶ highlight, in studies carried out in the countries of Latin America and the Caribbean, that a high-level political commitment with the support of the Health Department is necessary to eliminate CS.

Studies carried out in Rio Grande do Norte⁶ and south of Brazil²⁵ observed a higher prevalence up to 6 days of life (96.7%) and (94.9%) respectively, corroborating the present study. This infers a timely completion of the notification shortly after birth. The diagnosis of CS of the newborn, done in a timely manner, up to 6 days old, allows the possibility of initiating the early treatment³⁷. Regarding the area of residence, the results were similar to studies performed in the state of Rio Grande do Norte (83.4%)⁶, and in Campo Grande – Mato Grosso do Sul (91.3%) where the majority of the infected pregnant women resided in urban areas³².

Analyzing the distribution of CS cases, according to laboratory data, it was verified that NTT in the peripheral blood of the NB was reactive for 71.5%, higher than that observed in

the municipality of Natal - Rio Grande do Norte between 2004 and 2007, with a percentage of 51.1%²⁶. Results lower than the state of Minas Gerais were observed for changes in the fluid exam, results with no alterations and exams not performed.

Regarding the observed bone alterations in the X-ray test, 2.7% had alterations and 48.0% did not. A study³⁸ found consonance in the absence of radiological alterations in the majority (57.4%). In cases suspected of CS, radiography of the long bones may offer diagnostic assistance²⁶. It is justified to carry out the test for suspected cases, since in 4 to 20% of the infected newborns, the only alteration found is usually the radiographicone³³.

Regarding the definitive diagnosis, 95.2% of the cases were recent CS, similar to studies conducted in the southern region of Brazil between 2001 and 2009 (86.9%)²⁵, and in the Amazon region between 2007 and 2009 (83.3%)³⁹. The recent CS appears by the second year of life and must be diagnosed through a careful epidemiological assessment of the maternal situation and clinical, laboratory and imaging studies of the child³³. Most of the children with recent CS are asymptomatic at birth; therefore, the diagnosis is not always obvious and depends on high clinical suspicion for the investigation of the maternal history, as well as careful examinations on the exposed child¹¹.

Analyzing the distribution of the epidemiological and clinical profile of the mothers, it was verified that 82.2% had performed the PN care during gestation, corroborating other studies^{1,6,26,34}. Although most of the mothers performed the PN care, an expressive number obtained the outcome for CS, which is a sentinel indicator of the PN care quality. The notification of the disease should serve to trigger a timely investigation of the causes of the event among the health units and professionals, as well as among pregnant women, in order to correct failures in the disease prevention program².

Most were diagnosed with maternal syphilis during the PN care (56.2%), while 39.1% were informed at the time of delivery/curettage or after delivery, divergent from the study conducted in Aracaju - Sergipe between 2008 and 2012, in which 73.5% of the pregnant women were diagnosed only at the time of delivery/curettage or after delivery and 26.5% during gestation³⁴ and of the study in the city of Montes Claros, MG, between 2007 and 2013, which evidenced that most of the pregnant women had

performed the PN care at the beginning of the first trimester, but with persistent late diagnosis⁴⁰.

The difficulty in preventing the vertical transmission remains at the barrier of the early and appropriate diagnosis and treatment³⁴. It is inferred that the pregnant woman, when receiving the diagnosis of syphilis during pregnancy, allows that the infection to the concept does not evolve to CS if treated appropriately. It is considered appropriate treatment of the pregnant woman when it is performed with penicillin and has been completed 30 days before delivery, using the correct dose of the medication according to stage of the disease and considering the fact that the sexual partner is properly medicated concomitantly^{40,41}.

The attention to the PN care aims at welcoming women from the beginning of the pregnancy in a qualified and humanized way, adopting as a primary objective to offer welcoming behaviors and timely interventions. Regarding the NTT at the time of delivery or curettage, it was reagent for 88.6% of the cases, similar to the study carried out in Alagoas between 2007 and 2011²⁴. The results found refer to a question about the quality of the PN care offered, since the number of pregnant women who performed the PN care showed an increase in the number of cases of CS reported, indicating failures to perform timely examinations.

The nurse has a key role in the prevention of CS, because when acting in the early approach of the pregnant woman, one has the possibility to perform the rapid test and/or to request the serological examination, in addition to the active search of the partner and follow-up of the appropriate treatment of the couple. The CS control requires greater commitment of the professionals working in primary care, since it is at this level of care that the PN care follow-up is expected, early request for the VDRL examination and the first care related to the prevention of vertical transmission⁴².

Regarding the treatment plan of these mothers, only 4.6% followed it adequately, 55.2% inadequately and 25.9% did not follow it. Regarding the partners of pregnant women, 55.8% were not treated concomitantly. In a study conducted in Aracaju - Sergipe between 2008 and 2012, most of the pregnant women also did not follow the treatment (50.8%), 47.3% followed it inadequately and only 3.8% followed it adequately, with 84.6% of the partners not treated concomitantly³⁴. In order for the treatment of

the pregnant woman with syphilis to be considered appropriate and ensure that there is no possibility of vertical transmission, the woman should be given benzathine penicillin G (in appropriate doses regarding the stage of infection), the partner should be treated simultaneously, and the woman must be monitored monthly and finish the treatment up to 30 days before delivery⁴³.

Recognizing the limitation of using secondary data sources, especially with regards to probable under-registrations, under-notifications, rating errors and filling-in errors, in addition to restricting the selected variables to what has already been collected, an increasing number of reported cases of CS were identified in the period, and information was obtained pertinent to the planning and organization of the health services in relation to the disease in the state. The incompleteness of the registers was a limitation of this study, as well as the lack of access to patients/medical records to complement information, since it is a database of statewide coverage.

Conclusion

The temporal trend of the CS incidence was increasing in the period, which may be related to the greater sensitivity of the notification system regarding the cases registration, inadequate treatment by the majority of pregnant women and little adherence of the partner to the treatment. Because, despite the number of adequate PN care consultations, there was a significant amount with outcome for CS, indicating a failure in the care provision. Although the problem is easy to prevent and effectively treat, there is still a long way to go to reach the national goal of disease control. The findings of this study are important, since they highlight the need for adjustments of the actions aimed at reducing the cases of congenital syphilis in the state of Minas Gerais. In order to change this scenario, it is necessary that, in addition to the governmental spheres, health professionals and all civil society are actively involved in actions that aim at empowering the sexual education of adolescents and adults, especially regarding the use of condoms and other safe sex practices. It is necessary to reinforce health actions so that this problem can be mitigated, especially with the optimization of the prenatal care and women's health strategies.

Collaborations

PIC Alves and SS Castro: Conception, analysis and interpretation of data; Writing of the article or relevant critical review of the intellectual content; Final approval of the version to be published. LM Scatena: time trend analysis of the data. Relevant critical review of intellectual content; Final approval of the version to be published. VJ Haas: organization of the database and statistical analysis. Relevant critical review of intellectual content; Final approval of the version to be published.

Acknowledgment

To the State Health Department of Minas Gerais –Sub-secretary for Health Surveillance and Protection–IST/AIDS and Viral Hepatitis State Coordination, for the availability of the computerized database.

References

- Costa CC, Freitas LV, Sousa DM, Oliveira LL, Chagas AC, Lopes MV, Damasceno AK. Sífilis congênita no Ceará: análise epidemiológica de uma década. *Rev Esc Enferm USP* 2013; 47(1):152-159.
- Lima MG, Santos RF, Barbosa GJ, Ribeiro GS. Incidência e fatores de risco para sífilis congênita em Belo Horizonte, Minas Gerais, 2001-2008. *Cien Saude Colet* 2013; 18(2):499-506.
- Kirkcaldy RD, Su JR, Taylor MM, Koumans E, Mickey T, Winscott M, Kenney K, Weinstock HS. Epidemiology of syphilis among hispanic women and associations with congenital syphilis, Maricopa County, Arizona. *Sex Transm Dis* 2011; 38(7):598-602.
- Campos ALA, Araújo MAL, Melo SP, Andrade RFV, Gonçalves MLC. Sífilis em parturientes: aspectos relacionados ao parceiro sexual. *Rev bras ginecol obstet*. 2012; 34(9):397-402.
- Corrales SC. Importancia epidemiológica del diagnóstico temprano en el manejo de sífilis gestacional y congénita, falla terapéutica del tratamiento secundaria a demora en el diagnóstico. *Rev salud bosque* 2013; 3(2):43-48.
- Carvalho IS, Brito RS. Sífilis congênita no Rio Grande do Norte: estudo descritivo do período 2007-2010. *Epidemiol Serv Saúde* [Internet]. 2014 Jun [acessado 2018 Fev 01];23(2):287-294. Disponível em: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S2237-96222014000200287&lng=en.
- Magalhães DMS, Kawaguchi IAL, Dias A, Calderon IMP. A sífilis na gestação e a sua influência na morbimortalidade materno-infantil. *Comum Ciênc Saúde* 2011; 1(22):43-54.
- Blencowe H, Cousens S, Kamb M, Berman S, Lawn JE. Lives saved tool supplement detection and treatment of syphilis in pregnancy to reduce syphilis related stillbirths and neonatal mortality. *BMC Public Health* 2011; 11(3 Supl.):S9.
- Domingues RMSM, Szwarcwald CL, Souza Junior PRB, Leal MC. Prevalência de sífilis na gestação e testagem pré-natal: Estudo Nascir no Brasil. *Rev Saude Publica* 2014 Out [citado 2017 Ago 30];48(5):766-74. Disponível em: http://www.scielo.br/pdf/rsp/v48n5/pt_0034-8910-rsp-48-5-0766.pdf
- Melo NGDO, Melo Filho DA, Ferreira LOC. Diferenciais intraurbanos de sífilis congênita no Recife, Pernambuco, Brasil (2004-2006). *Epidemiol serv saúde* 2011; 20(2):213-222.
- Brasil. Ministério da Saúde (MS). *Protocolo Clínico e Diretrizes Terapêuticas Para Prevenção da Transmissão Vertical de HIV, Sífilis e Hepatites Virais*. Brasília: MS; 2018. [citado 2018 Jun 05]. Disponível em: <http://www.aids.gov.br/pt-br/pub/2015/protocolo-clinico-e-diretrizes-terapeuticas-para-prevencao-da-transmissao-vertical-de-hiv>
- Brasil. Ministério da Saúde (MS). *Sífilis 2017*. [Internet]. Brasília: MS; 2017. [citado 2018 Jan 05]. (Boletim Epidemiológico, v.48, n.36). Disponível em: <http://portalarquivos.saude.gov.br/images/pdf/2017/novembro/13/BE-2017-038-Boletim-Sifilis-11-2017-publicacao-.pdf>

13. Lima VC, Mororó RM, Martins MA, Ribeiro SM, Linhares MSC. Perfil epidemiológico dos casos de sífilis congênita em um município de médio porte no nordeste brasileiro. *J Health Biol Sci* [periódico na Internet].2017 [citado 2018 Jan 18];5(1):56-61. Disponível em: <http://dx.doi.org/10.12662/2317-3076jhbs.v5i1.1012.p56-61.2017>
14. Cardoso A, Griep R. Perfil epidemiológico da sífilis congênita no município de cascavel/PR no ano de 2015. *Rev Thêma et Sci* [periódico na Internet].2017 jun./jul. [citado 2017 Dez 20];7(1):[cerca de 6 p.]. Disponível em: <http://www.themaetscientia.fag.edu.br/index.php/RTES/article/view/501/520>.
15. Romero DE, Cunha CB. Avaliação da qualidade das variáveis sócio-econômicas e demográficas dos óbitos de crianças menores de um ano registrados no Sistema de Informações sobre Mortalidade do Brasil (1996/2001). *Cad Saude Publica* 2006; 22(3):673-684.
16. Antunes JLF, Cardoso MRA. Uso da análise de séries temporais em estudos epidemiológicos. *Epidemiol. Serv. Saúde* 2015; 24(3):565-576.
17. Correia LOS, Padilha BM, Vasconcelos SMV. Métodos para avaliar a completude dos dados dos sistemas de informação em saúde do Brasil: uma revisão sistemática. *Cien Saude Colet* 2014; 19(11):4467-4478.
18. Magalhães DM, Kawaguchi IA, Dias A, Calderon IM. Sífilis materna e congênita: ainda um desafio. *Cad Saude Publica* 2013; 29(6):1109-1120.
19. Lima DJM, Chagas ACMA, Mendes IC, Oriá MOB, Aquino PS, Pinheiro AKB. Completude e consistência dos dados de gestantes HIV positivas notificadas. *Rev Enferm UERJ* 2014; 22(3):321-326.
20. Alvares JK, Pinheiro PMM, Santos AF, Oliveira GL. Avaliação da completude das notificações compulsórias relacionadas ao trabalho registradas por município polo industrial no Brasil, 2007-2011. *Rev bras epidemiol* 2015; 18(1):123-136.
21. Brasil. Ministério da Saúde (MS). *SINAN: Sistema de Informação de Agravos de Notificação*. [Internet]. Brasília: MS; [2020]. [acessado 2017 Mar 07]. Disponível em: <http://portalsinan.saude.gov.br/>
22. Rezende EMA, Barbosa NB. A sífilis congênita como indicador da assistência de pré-natal no estado de Goiás. *Rev APS* 2015; 18(2):220-232.
23. Teixeira LO, Vitola C, Mendoza-Sassi RA, Belarmino, V. Tendência temporal e distribuição espacial da sífilis congênita no estado do Rio Grande do Sul entre 2001 e 2012. *Cien Saude Colet* 2016; 23(8):2587-2597.
24. Alves WA, Cavalcanti GR, Nunes FA, Teodoro WR, Carvalho LM, Domingos RS. Sífilis Congênita: epidemiologia dos casos notificados em Alagoas, Brasil, 2007 a 2011. *Rev port saúde soc* 2016; 1(1):27-41.
25. Serafim AS, Moretti GP, Serafim GS, Niero CV, Rosa MI, Pires MM, Simões PWT. Incidence of congenital syphilis in the South Region of Brazil. *Rev Soc Bras Med Trop* [periódico na Internet].2014 Abr [acessado 2017 Mar 05];47(2):170-178. Disponível em: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0037-86822014000200170&lng=pt&nrm=iso
26. Holanda MTCG, Barreto MA, Machado RMM, Peireira RC. Perfil epidemiológico da sífilis congênita no município de Natal, Rio Grande do Norte - 2004 a 2007. *Epidemiol serv saúde* 2011; 20(1 Supl.):69-78.
27. Bowen V, Su J, Torrone E, Kidd S, Weinstock H. Increase in incidence of congenital syphilis – United States, 2012-2014. *Weekly* 2015; 64(44):1241-1245.
28. Alzate-Granados JP, Sánchez-Bello NF, Amaya-Arias AC, Peralta-Pizza F, Eslava-Schmalbach J. Disparidades en la incidencia de sífilis congênita en Colombia 2005 a 2011: un estudio ecológico. *Rev salud pública* 2012; 14(6):965-977.
29. Reyna-Figueroa J, Esparza-Aguilar M, Hernández-Hernández LC, Fernández-Canton S, Richardson-Lopez Collada VL. Congenital syphilis, a reemerging disease in Mexico: its epidemiology during the last 2 decades. *Sex Transm Dis* 2011; 38(9):798-801.
30. Hong FC, Yang YZ, Liu XL, Feng TJ, Liu JB, Zhang CL, Lan LN, Yao MZ, Zhou H. Reduction in mother-to-child transmission of syphilis for 10 years in Shenzhen, China. *Sex Transm Dis* 2014; 41(3):188-193.
31. Simms I, Tookey PA, Goh BT, Lyall H, Evans B, Townsend CL, Fifer H, Ison C. The incidence of congenital syphilis in the United Kingdom: February 2010 to January 2015. *BJOG* [periódico na Internet] 2016 Mar [acessado 2018 Jul 9];67(2). Disponível em: <http://onlinelibrary.wiley.com/doi/10.1111/1471-0528.13950/pdf>
32. Figueiró-Filho EA, Freire SSA, Souza BA, Agueña GS, Maedo CM. Sífilis e gestação: estudo comparativo de dois períodos (2006 e 2011) em população de puérperas. *DST j bras doenças sex transm* 2012; 24(1):32-37.
33. Oliveira LR, Costa MR, Barreto FR, Pereira SM, Dourado I, Teixeira MG. Evaluation of preventative and control measures for congenital syphilis in State of Mato Grosso. *Rev Soc Bras Med Trop* [serial on the Internet]. 2014 June [acessado 2017 Mar 0];47(3):334-340. Disponível em: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0037-86822014000300334-&lng=en&nrm=iso
34. Santos GS, Oliveira LX, Guimarães AMDN, Nardello DM, Matos B, Carvalho, BID. Aspectos epidemiológicos da sífilis congênita associados à escolaridade materna. *Rev enferm UFPE on line* 2016; 10(8):2845-2852.
35. Domingues RMSM, Saraceni V, Hartz ZMA, Lea MC. Sífilis congênita: evento sentinela em saúde. *Rev Saude Publica* 2013; 47(1):147-157.
36. Serruya SJ, Duran P, Martinez G, Romero M, Caffé S, Alonso M, Silveira MF. Maternal and congenital syphilis in selected Latin America and Caribbean countries: a multi-country analysis using data from the perinatal information system. *Sex health* 2015; 12(2):164-169.
37. Signor M, Spagnolo LML, Tomberg JO, Gobatto M, Stofel NS. Distribuição espacial e caracterização de casos de sífilis congênita. *Rev enferm UFPE on line* [periódico na Internet] 2018. [acessado 2018 jul 14];12(2):398-406. Disponível em: <https://doi.org/10.5205/1981-8963-v12i2a230522p398-406-2018>

38. Cavalcante PM, Pereira RBL, Castro JGD. Syphilis in pregnancy and congenital syphilis in Palmas, Tocantins State, Brazil, 2007-2014. *Epidemiol. Serv. Saúde* 2017; 26(2):255-264.
39. Soeiro CMO, Miranda AE, Saraceni V, Santos MC, Talhari S, Ferreira LC. Syphilis in pregnancy and congenital syphilis in Amazonas State, Brazil: an evaluation using database linkage. *Cad Saude Publica* 2014; 30(4):715-723.
40. Lafetá KRG, Martelli Júnior H, Silveira MF, Paranaíba LMR. Sífilis materna e congênita, subnotificação e difícil controle. *Rev bras epidemiol* 2016; 19(1):63-74.
41. Brasil. Ministério da Saúde (MS). *Diretrizes para o controle da sífilis congênita*. Brasília: MS; 2005. (Série Manuais, v. 62)
42. Silva DMA, Araújo MAL, Silva RM, Andrade RFV, Moura HJ, Esteves ABB. Knowledge of healthcare professionals regarding the vertical transmission of syphilis in Fortaleza -CE, Brazil. *Texto contexto - enferm.* 2014; 23(2):278-285.
43. Brasil. Ministério da Saúde (MS). *Diretrizes para o controle da sífilis congênita: manual de bolso*. Brasília: MS; 2006. [acessado 2017 Mar 07]. Disponível em: http://www.aids.gov.br/sites/default/files/manual_sifilis_bolso.pdf

Article submitted 30/03/2018

Approved 25/09/2018

Final version submitted 27/09/2018