









Syphilis in the state of São Paulo, Brazil, 2011–2017

Sífilis no estado de São Paulo, Brasil, 2011–2017

Carla Gianna Luppi¹ , Angela Tayra¹ , Carmen Silvia Bruniera Domingues¹ ,
Solange Eduardo Chabu Gomes¹ , Valdir Monteiro Pinto¹ , Maria Aparecida da Silva¹ ,
Roberto José Carvalho da Silva¹ , Mariza Vono Tancredi¹ 

ABSTRACT: *Objective:* To analyze how syphilis detection rates evolved from 2011 to 2017 according to sex, age and place of residence in the state of São Paulo. *Methods:* A historical series was organized with data from the Notification Disease Information System. The acquired syphilis detection rates (ASDR) per 100,000 inhabitants and the acquired syphilis detection rates including pregnant women with syphilis (PASDR) per 100,000 inhabitants were described. For a trend analysis of the rates in the studied period, the Poisson Jointpoint (inflection point) model was performed, and the annual percentage change (APC) per segment and the average annual percentage change (AAPC) were estimated, with respective 95% confidence intervals (95%CI). *Results:* A total of 205,424 cases of acquired syphilis and syphilis in pregnant women in the period were reported. The ASDR per 100,000 inhabitants ranged from 26.0 to 84.6 between 2011 and 2017 and the PASDR per 100,000 inhabitants ranged from 33.7 to 108.9; the trend was increasing in both, and an inflection point was identified dividing the ASDR and PASDR curve into two periods: 2011 to 2013 and 2013 to 2017: the AAPC found for ASDR was 21.0% (95%CI 15.5 – 26.4) and the PASDR was 21.2% (95%CI 16.4 – 26.1), in the age groups up to 24 years old, there was a significant growth in both sexes. A heterogeneity in the evolution of rates by region of the state was observed between 2011 and 2017. *Conclusions:* The increasing trend in acquired syphilis detection rates can be attributed to better adherence to notification and disproportionate involvement of young people.

Keywords: Syphilis. Epidemiological monitoring. Disease prevention. Epidemiology, descriptive. Public health surveillance.

¹Reference and Training Center for Sexually Transmitted Diseases and AIDS, STI/AIDS State Program, Coordination of Disease Control, São Paulo State Department of Health – São Paulo (SP), Brazil.

Corresponding author: Carla Gianna Luppi. Rua Santa Cruz, 81, Vila Mariana, CEP: 04121-000, São Paulo, SP, Brazil. E-mail: cgluppi@yahoo.com.br

Conflict of interests: nothing to declare – **Financial support:** none.

RESUMO: *Objetivo:* Analisar a evolução, de 2011 a 2017, das taxas de detecção de sífilis notificada por sexo, faixa etária e região de residência no estado de São Paulo (ESP). *Métodos:* Foi organizada série histórica com dados do Sistema de Informação de Agravos de Notificação (SINAN). Foram descritas as taxas de detecção de sífilis adquirida (TDSA) e de sífilis adquirida incluindo as gestantes com sífilis (TDSAG), por 100.000 hab. Para análise de tendência da evolução das taxas no período estudado, foi empregado o modelo *Jointpoint* (ponto de inflexão), bem como foram estimadas a variação percentual anual (VPA) por segmento e a média da variação percentual anual (MVPA), com os respectivos intervalos de confiança de 95% (IC95%). *Resultados:* Foram notificados 205.424 casos de sífilis adquirida e sífilis em gestantes no período. Entre 2011 e 2017, a TDSA por 100 mil habitantes variou de 26,0 a 84,6 e a TDSAG por 100 mil habitantes, de 33,7 a 108,9; a tendência foi crescente em ambas as curvas e identificou-se um ponto de inflexão dividindo a curva de TDSA e de TDSAG em dois períodos: de 2011 a 2013 e de 2013 a 2017. A MVPA encontrada da TDSA foi de 21,0% (IC95% 15,7 – 26,4) e da TDSAG, de 21,2% (IC95% 16,4 – 26,1). Nas faixas etárias até 24 anos ocorreu crescimento expressivo em ambos os sexos. Observou-se heterogeneidade na evolução das taxas segundo região do Estado. *Conclusões:* A tendência crescente das taxas de detecção de sífilis adquirida pode ser atribuída a melhor adesão à notificação e ao acometimento desproporcional dos jovens.

Palavras-chave: Sífilis. Monitoramento epidemiológico. Prevenção de doenças. Epidemiologia descritiva. Vigilância em saúde pública.

INTRODUCTION

Syphilis is a sexually transmitted infection (STI) that continues to be a serious public health problem in Brazil and around the world, despite effective measures for diagnosis, treatment, prevention and control that have been around since the 1950s¹⁻³. During pregnancy, congenital syphilis can occur, causing serious consequences for the fetus, such as: fetal death, stillbirth, abortion, malformations, prematurity and low birth weight³⁻⁶. Syphilis is also associated with the human immunodeficiency virus (HIV), as it increases the risk of getting it, especially if there lesions appear in the primary and secondary stages of the disease^{3,6}.

In 2012, approximately six million cases of syphilis were estimated to have occurred worldwide⁷. The Sustainable Development Goals (SDGs) set for 2030 aim at establishing strategies that prevent and control STIs, by reducing the worldwide incidence of infection of *Treponema pallidum*, in relation to the estimated incidence in 2018, and the elimination of congenital syphilis. In order to obtain accurate information about the scope of the disease, an STI surveillance system based on case notification is necessary. Such a surveillance system is capable of analyzing the population with reported cases according to age, sex and location⁸.

In Brazil, the National Compulsory Notification List (*Lista Nacional de Notificação Compulsória* - LNNC)⁹ contains the following diseases related to syphilis: congenital syphilis, syphilis in pregnant women, and acquired syphilis.

In 2017, 119,800 cases of acquired syphilis were reported and the detection rate was 58.1 per 100 thousand inhabitants. In that year, the state of São Paulo (SSP) was responsible for 30% of notified cases of acquired syphilis and 21.5% of syphilis cases in pregnant women in the country¹⁰.

Despite being the same disease, syphilis in pregnant women and acquired syphilis are treated as different diseases in the Notifiable Diseases Information System (*Sistema de Informação de Agravos de Notificação* - SINAN)¹¹. Consequently, to estimate the magnitude of syphilis and analyze the trend of it in the general population, excluding congenital syphilis, one must take into account the set of cases of acquired syphilis and syphilis in pregnant women. The aim of this study was to analyze how it evolved from 2011 to 2017, in addition to the detection rates of syphilis reported by sex, age group and region of residence in the SSP.

METHODS

An ecological study of a historical series was conducted with secondary notification data including all cases of acquired syphilis and syphilis in pregnant women in the SSP from 2011 to 2017. The main source of data for this study was the SINAN. Data on population estimates were obtained from the São Paulo State Data Analysis Foundation (*Fundação Sistema Estadual de Análise de Dados* - SEADE) in São Paulo.

SINAN is a nationwide information system, used in Health Surveillance and it has been managed by the Ministry of Health (MoH) since 1998¹². The municipality is responsible for putting data entry into the system and the data are extracted from notification and investigation forms that are specific to each disease, and which are included in the LNNC of diseases, grievances and public health events⁹. The information is subsequently consolidated and analyzed by local, municipal, state and national levels. The data in this study are related to notifications of acquired syphilis and syphilis in pregnant women. SINAN presents data related to identifying cases of syphilis and syphilis in pregnant women. However, more information about the case only appears for cases of syphilis in pregnant women

All reported cases of acquired syphilis (International Classification of Diseases [ICD10] — A53.9) and syphilis in pregnant women (ICD10 — O98.1) were included.

For reporting purposes, the definition of acquired syphilis used was “Every asymptomatic individual or every individual with clinical evidence of primary or secondary syphilis (presence of a hard chancre or lesions compatible with secondary syphilis), with a non-treponemal test reagent and any titration and test treponemal reagent”¹¹. The definition of syphilis in pregnant women was: “Suspected case — pregnant woman who during the prenatal period presented clinical evidence of syphilis, or a non-treponemal reagent test with any titration. Confirmed case — pregnant woman who had a non-treponemal reagent test and any titration and reagent treponemal test, regardless of any clinical evidence of syphilis, performed during prenatal care; and pregnant woman who had a reactive treponemal test and a non-reactive or unreactive non-treponemal test, with no previous treatment record”⁶.

The variables used in the study were: detection rates of acquired syphilis (ASDR) per 100 thousand inhabitants, detection rates of acquired syphilis including pregnant women with syphilis (PASDR) per 100 thousand inhabitants, sex, age group, year of diagnosis (2007 to 2017) and place of residence, considering the Regional Health Department (*Departamento Regional de Saúde* - DRS).

General and sex-specific detection rates were calculated. To calculate the PASDR per 100 thousand inhabitants, the quotient between the number of all cases of acquired syphilis was performed. All cases of syphilis in pregnant women in a given population and year (numerator) were added up, with the respective population and the corresponding year as the denominator. This result was then multiplied by a constant 100 thousand¹³.

The data were disaggregated for analysis according to the following subpopulations:

- All cases reported with acquired syphilis;
- All cases of acquired syphilis added to all cases of syphilis in pregnant women.

When disaggregating by sex, the following results were obtained:

- All female cases of acquired syphilis;
- All female cases of acquired syphilis plus cases of syphilis in pregnant women;
- All male cases of acquired syphilis;

The municipalities of residence were grouped according to the areas covered by the 17 Regional Health Departments (DRS) that make up the administrative structure of the São Paulo State Department of Health: Araçatuba, Araraquara, Baixada Santista, Barretos, Bauru, Campinas, Franca, Greater São Paulo, Marília, Piracicaba, Presidente Prudente, Registro, Ribeirão Preto, São João da Boa Vista, São José do Rio Preto, Sorocaba and Taubaté.

The data used for syphilis came from SINAN — State Program STI/ AIDS-SP¹³. Microsoft® Excel was used to organize the data.

The first stage of the analysis included the creation of dispersion diagrams generated by STATA software, version 14.0. A residual analysis was performed, fulfilling the assumptions of independence and constant error variance (assumption of true homoscedasticity). The trend analysis of the detection rate curves was conducted using Poisson's Jointpoint (inflection point) model, using the Jointpoint Regression Program, version 4.7.0.0 (<http://surveillance.cancer.gov/joinpoint/>)¹⁴. To assess trends in detection rates, the *Joinpoint* regression analysis (with up to three inflection points) was used to identify the years (independent variable) in which statistically significant changes in the detection rate trend occurred (variable dependent). This method identified the number of inflection points in a historical series. Each inflection point denoted a statistically significant change in the trend. The degree of this change is presented by means of the annual percentage change (APC). The degree of the general change, over the entire period, is presented by means of the average of the annual percentage change (AAPC). The significance test used was the Monte Carlo permutation method with a Bonferroni adjustment for multiple comparisons and $p < 0.050$ as statistically significant¹⁵.

Using the number of inflections and the respective segments of a curve, the APC per segment and the AAPC of a segmented linear regression of all segments were estimated, including the respective 95% confidence intervals (95%CI).

All data contained in this publication is open and public. Only aggregated data will be presented and no subjects will be identified. It will be freely available for consultation. Due to these characteristics, it was not necessary to undergo an evaluation from the Research Ethics Committee (REC) system under the terms of Law No. 12,527, of November 18, 2011.

RESULTS

In 2017, 516 (80.0%) of the 645 municipalities in São Paulo presented at least one notified case of syphilis (Table 1). Between 2011 and 2017, there was an increase of 86.3% in the number of municipalities with notifications of acquired syphilis and an 78.8% increase in the number pregnant women with syphilis. There was an increase of 119.5% with regard to reporting units.

In 2017, the ASDR was 84.6 per 100 thousand inhabitants, an increase of 225.4% compared to 2011. When adding the numbers of syphilis cases in pregnant women and those

Table 1. Cases of acquired syphilis, syphilis in pregnant women, and respective detection rates per 100,000 inhabitants, number of municipalities with resident cases and notification services, according to year of diagnosis. State of São Paulo, 2011 to 2017*.

Disease	Year of diagnosis		Increment (%)	
	2011	2017		
Acquired syphilis	Cases	10,812	36,964	241.9
	Acquired syphilis of DR	26.0	84.6	225.4
	No. of municipalities where the cases are resident	277	516	86.3
	No. of notification services	1,409	3,093	119.5
Syphilis in pregnant women	Cases	3,186	10,606	232.9
	No. of municipalities with cases	245	438	78.8
	No. of notification services	1,229	2,429	97.6
Acquired syphilis + syphilis in pregnant women	Cases	13,998	47,570	239.8
	DR Acquired syphilis + syphilis in pregnant women	33.7	108.9	223.1

*Preliminary data up until June 30, 2018 subject to a monthly review.
Source: São Paulo¹³.

of acquired syphilis, a PASDR of 108.9 per 100 thousand inhabitants was calculated in 2017, representing an increase of 223.1% in relation to 2011.

The evolution of detection rates according to sex and age group showed a positive percentage increase in all age groups in both sexes between 2011 and 2017. The greatest increase occurred in the age group of up to 24 years old (male — 387.1% — and female — 570.9%). For PASDR, the greatest increase also occurred in the age group of up to 24 years old (417.0%) (Table 2).

By analyzing the trend curves of detection rates from 2011 to 2017, there was an inflection point that divided the ASDR and PASDR curve into two periods: from 2011 to 2013 and from 2013 to 2017. In the first period, the APC was 31.8% (95%CI 3.1 — 68.6) for

Table 2. Detection rate of syphilis acquired per 100 thousand inhabitants and detection rate of acquired syphilis including pregnant women with syphilis per 100 thousand inhabitants, according to sex, age group and year of diagnosis. State of São Paulo, 2007 to 2017*.

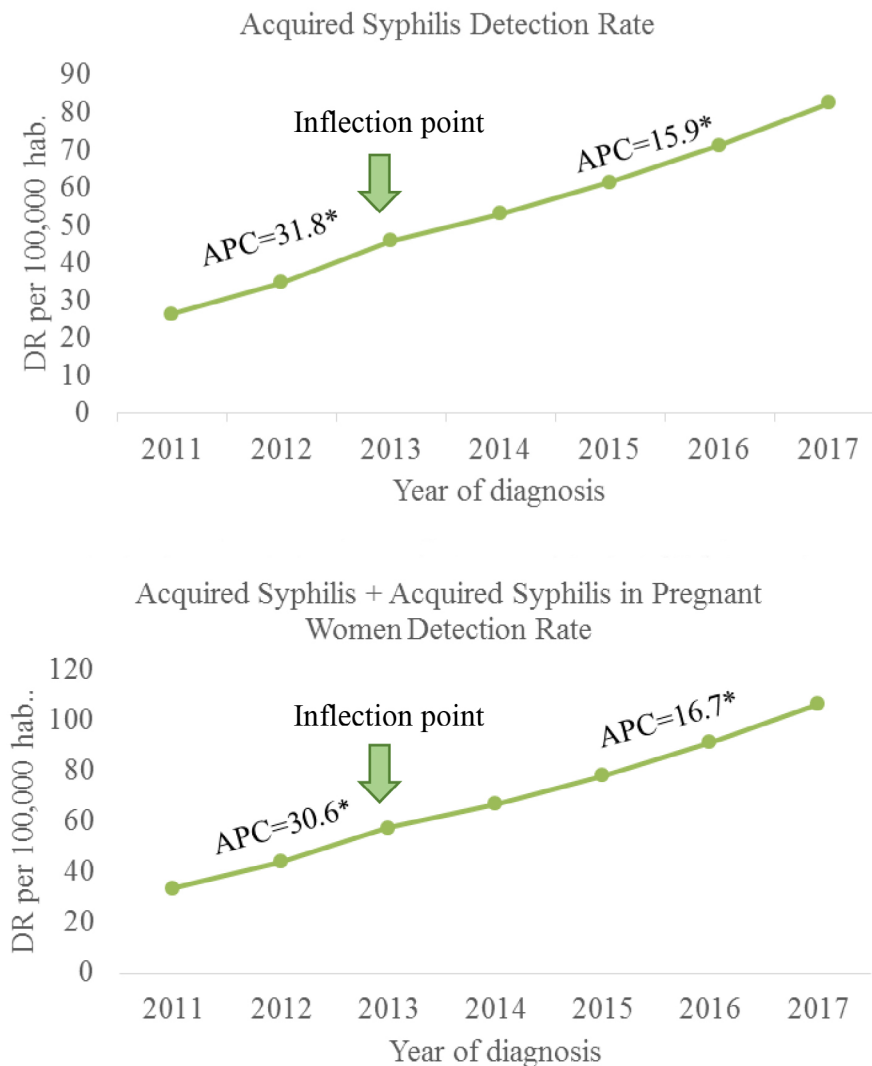
Age range (years)	Year of diagnosis							Increment (%) 2011 - 2017
	2011	2012	2013	2014	2015	2016	2017	
Male acquired syphilis (ASDR)								
up to 24	15.5	21.8	31.7	40.7	50.1	56.3	75.5	387.1
25 to 39	44.6	64.6	81.7	104.1	121.8	129.9	162.2	263.7
40 or more	42.5	53.1	64.5	73.7	77.9	83.4	97.4	129.2
Total	32.6	44.2	56.7	69.5	79.4	85.9	106.7	227.3
Female acquired syphilis (ASDR)								
up to 24	8.6	13.1	19.8	27.3	33.4	40.9	57.7	570.9
25 to 39	21.8	30.4	42.8	53.2	55.1	65.7	79.4	264.2
40 or more	28.7	34.7	41.0	44.4	42.4	52.1	58.3	103.1
Total	19.6	26.1	34.2	40.9	42.8	52.0	63.6	224.5
Female acquired syphilis and syphilis in pregnant women (PASDR)								
up to 24	27.1	37.1	53.4	71.2	85.1	108.3	140.1	417.0
25 to 39	51.6	64.4	85.0	103.5	109.4	129.9	156.6	203.5
40 or more	30.4	36.4	42.4	46.4	44.1	54.2	60.6	99.3
Total	34.6	43.7	57.0	69.4	74.5	91.3	110.6	219.7

*Preliminary data up until June 30, 2018; ASDR: acquired syphilis detection rate; PASDR: acquired syphilis detection rate including pregnant women with syphilis.

Source: São Paulo¹³.

ASDR and 30.6% (95%CI 4.5 — 63.1) for ASDRP; in the second period, the APC was 15.9% (95%CI 7.2 — 25.3) for ASDR and 16.7% (95%CI 8.8 — 25.2) for PASDR (Figure 1).

Table 3 shows the AAPCs found from 2011 to 2017 for ASDR and PASDR: 21.0% (95%CI 15.7 — 26.4) and 21.2% (95%CI 16.4 — 26.1), respectively. The trend curve of ASDR in males also showed an inflection point from 2011 to 2013, with APC = 33.2 (95%CI 2.8 — 72.8), and from 2013 to 2017, with APC = 15.8 (95%CI 6.6 — 25.7). In the female sex, the



*Preliminary data until June 30, 2018; *statistically significant annual percentage change.

Source: São Paulo¹³.

Figure 1. Trend curves of the detection rate of acquired syphilis and acquired syphilis including pregnant women and respective annual percentage changes. State of São Paulo, 2011 to 2017#.

Table 3. Average of the annual percentage and annual percentage variation of the acquired syphilis detection rate and acquired syphilis detection rate including pregnant women with syphilis per 100 thousand inhabitants, according to sex and age group. State of São Paulo, 2011 to 2017*.

Period	AAPC (95%CI) 2011-2017	APC (95%CI) 2011-2017	APC (95%CI) 2011-2017
AS	21.0 (15.7 – 26.4)*	31.8 (3.1 – 68.6)*	15.9 (7.2 – 25.3)*
Male AS	21.3 (15.8 – 27.1)*	33.2 (2.8 – 72.8)*	15.8 (6.6 – 25.7)*
up to 24	29.9 (22.7 – 37.4)*	44.5 (5.3 – 98.2)*	23.1 (11.4 – 36.0)*
25 to 39	22.4 (15.4 – 29.9)*	31.5 (9.5 – 57.9)*	14.0 (-0.5 – 36.9)
40 or more	14.3 (9.7 – 19.1)*	23.7 (-1.4 – 55.1)	9.9 (2.3 – 18.1)*
Female AS	20.0 (15.7 – 24.5)*	-	-
up to 24	36.5 (28.5 – 45.1)*	53.2 (9.6 – 114.1)*	29.0 (16.1 – 43.3)*
25 to 39	23.6 (16.0 – 31.7)*	41.2 (-0.8 – 101.8)_	15.7(3.4 – 29.3)*
40 or more	11.2 (7.56 – 15.0)*	-	-
SA e SG	21.2 (16.4 – 26.1)	30.6 (4.6 – 63.1)*	16.7 (8.8 – 25.2)
Female AS and SP	20.5 (17.2 – 23.9)*	-	-
up to 24	31.6 (27.5 – 35.7)*	41.6 (19.0 – 68.5)*	26.8 (20.0 – 34.0)*
25 to 39	19.5 (15.7 – 23.4)*	-	-
40 or more	10.9 (7.5 – 14.5)*	-	-

*Preliminary data up until June 30, 2018; *statistically significant; AAPC: average annual percentage change; 95%CI: 95% confidence interval; APC: annual percentage change; AS: acquired syphilis; SP: syphilis in pregnant women. Source: São Paulo¹³.

trend curve of ASDR and PASDR did not present an inflection point throughout the period, with an AAPC, respectively, of 20.0 (95%CI 15.7 — 24.5) and 20.5 (95%CI 17.2 — 23.9).

In both sexes, the age group with the highest APC was up to 24 years old, with an inflection point: from 2011 to 2013, APC = 44.5 (95%CI 5.3 – 98.2) was found in the males, APC = 53.2 (95%CI 9.6 – 114.1) in females and APC = 41.6 (95%CI 19.0 – 68.5) in females plus syphilis in pregnant women. In the second period (from 2013 to 2017), APC = 23.1 (95%CI 11.4 – 36.0) were found in males, APC = 29.0 (95%CI 16.1 – 43.3) in females and APC = 26.8 (95%CI 20.0 – 34.0) in the female sex plus syphilis in pregnant women.

Throughout the period, the highest AAPC found was found in females up to 24 years old (36.5%; 95%CI 28.5 — 45.1).

Table 4 shows the distribution of ASDR and PASDR in 2011 and 2017, according to place of residence — classified by DRS. It was observed that the DRS of São João da Boa Vista and

Table 4. Detection rate of acquired syphilis and detection rate of acquired syphilis including pregnant women with syphilis per 100 thousand inhabitants by Regional Health Department (DRS) of residence*. State of São Paulo, 2011 to 2017*.

DRS	ASDR 2011	ASDR 2017	Increment %	PASDR 2011	PASDR 2017	Increment %
Araçatuba	10.2	51.8	406.1	14.2	68.6	382.3
Araraquara	11.0	38.4	248.9	21.2	57.5	170.7
Baixada Santista	20.8	137.3	560.8	29.9	170.4	470.0
Barretos	5.6	55.8	897.3	8.0	82.4	926.4
Bauru	21.6	77.8	260.5	27.5	99.3	260.9
Campinas	24.0	65.3	172.7	28.0	83.9	199.5
Franca	3.8	23.4	512.9	9.0	33.5	271.7
Grande São Paulo	36.8	96.4	162.0	46.9	125.2	166.9
Marília	14.8	63.7	329.5	19.9	86.6	335.7
Piracicaba	9.8	52.2	431.3	15.3	69.9	356.8
Presidente Prudente	3.9	55.8	1,345.2	6.9	74.6	982.3
Registro	8.0	40.5	404.3	10.6	57.9	446.5
Ribeirão Preto	17.1	128.8	654.7	22.6	147.8	552.8
São João da Boa Vista	17.8	41.3	132.4	23.2	55.4	139.2
São José do Rio Preto	22.3	98.1	340.8	27.5	113.4	312.8
Sorocaba	10.8	55.4	412.1	17.5	74.6	326.0
Taubaté	14.0	88.1	527.4	17.8	108.5	511.0
Total SSP	26.0	84.6	225.4	33.7	108.9	223.2

*Excluded cases with unclassified DRS; #preliminary data until June 30, 2018; ASDR: acquired syphilis detection rate; PASDR: acquired syphilis detection rate including pregnant women with syphilis; SSP: state of São Paulo. Source: São Paulo¹³.

Campinas showed the smallest increases in ASDR and PASDR between 2011 and 2017, in addition to presenting lower rates than those seen in the SSP. The three largest increases were observed in the DRS which had low rates in 2011: DRS for Barretos (ASDR = 897.3% and PASDR = 926.4%), DRS for Presidente Prudente (ASDR = 1,345.2% and PASDR = 982.3%) and the DRS from Ribeirão Preto (ASDR = 654.7% and PASDR = 552.8%). The DRS of

Baixada Santista stood out with the highest rates in the SSP in 2017: ASDR = 137.3 and PASDR = 170.4 per 100 thousand inhabitants, corresponding to a ratio of 1.6 in relation to the rates observed in the SSP.

DISCUSSION

This study showed an increasing trend and similar behavior of the curves with regards to the rates of detection of acquired syphilis, regardless of the inclusion of syphilis cases in pregnant women, between 2011 and 2017 in the SSP. Additionally, it was highlighted that the period that had the highest APC was from 2011 to 2013. The trend of Detection Rate (DR) in females increased throughout the period from 2011 to 2017, with no inflection point in the curve. The trend curves of DR in young people presented the highest APC averages over the entire period analyzed, in both sexes.

There was an increasing trend in DR, between 2011 and 2017, in the SSP that accompanied the increase in rates throughout Brazil and in the federation units (FU)¹⁰. The DR of syphilis acquired in the SSP was 1.7 times higher than that reported in all of Brazil and corresponded to the fifth highest rate in the country in 2017¹⁰. The number of municipalities with resident cases and the number of reporting services also increased positively, pointing to a reduction in underreporting as an explanation for this trend. Another possible explanation is related to the expansion of testing availability in the SSP^{16,17}.

The syphilis DR in the SSP was much higher than that found in other countries: the median incidence rate per 100 thousand inhabitants, in 2014, was 25.1 (0.1–1.664) in 55 countries around the globe, and 34.1 (4.3–227.7) specifically in 18 countries in the Americas¹⁸. In 2016, in Europe, the incidence rates of syphilis in adults ranged from 0.6, in Portugal, to 9.9 per 100 thousand inhabitants, in the United Kingdom¹⁹. In the United States, the incidence rates of primary and secondary syphilis in 2016 were 27.3 and 9.5 cases per 100 thousand inhabitants, respectively²⁰.

It must be taken into account that comparing syphilis notification data between countries is very difficult, especially due to the different definitions of a case and the differences in relation to adherence to reporting. In Brazil, the definition of a case of syphilis includes active cases of the disease, and excludes cases of serological scarring and false positives; however, it was not possible to check for the consistency of compliance with this definition, as there is no data entry for the investigation carried out regarding the reported cases of acquired syphilis⁶. Another issue that must be taken into account in order to make comparisons is that, in Brazil, syphilis notification is subdivided into two conditions: acquired syphilis and syphilis in pregnant women. Therefore, in order to assess the real magnitude of the condition and make comparisons with estimates from other countries, it is important to add the reported cases into these different databases.

The trend curve of the syphilis DR showed the highest APC in the period from 2011 to 2013, which is attributed, especially, to the reduction in underreporting. However, despite

the reduction in the second period, the APC increase annually. A possible explanation for this change in the trend in the second period may be due to the expansion of rapid testing coverage for syphilis in the SSP, carried out starting in 2012. In 2017, the state testing campaign was focused initially on the diagnosis of HIV. However, it was expanded to offer syphilis tests. Of the 380,000 rapid tests performed, 31.3% were for syphilis, and 383 municipalities reported at least one reagent syphilis test^{16,17}. The expansion of access to the rapid test for syphilis in campaigns and in the routines of basic health units may have increased the detection of this condition and, consequently, the reporting of cases of syphilis in pregnant women and the reporting of acquired syphilis. The hope is that by increasing testing for syphilis, it will be possible to stabilize the rising curve of syphilis.

When disaggregating the analysis by sex and age, it was observed that the behavior of the trend curve was different for females, who did not present an inflection point during the entire period investigated.

The disproportionate involvement of young people up to 24 years of age in both sexes was worth noting. This included pregnant women who reported having syphilis, and who had a higher APC of the detection rate in the observed period, which is very similar to the pattern observed in the entire country¹⁰. The United Nations (UN) considers young people to be those aged between 10 and 24 years old²¹.

In a study conducted in Brazil, between 2016 and 2017, with 8,562 participants aged up to 25 years old in the 26 Brazilian state capitals and in the Federal District, the prevalence of reporting having syphilis at least once was 12.8%: 10.7% in women and 14.2% in men. The factors associated with STI reporting were: men who have sex with men (MSM) and use of drugs and alcohol²². In Brazil, in 2016, a study carried out with 38,247 conscripts, aged 17 to 22 years old, found a prevalence of 1.09% of confirmed syphilis. The following factors were independently associated with syphilis: early sexual activity, report of a previous STI and MSM²³. In this population, there was an increase in the prevalence of positive syphilis test results from 0.53%, in 2007, to 1.63%, in 2016^{23,24}. Another population-based study conducted in the city of São Paulo found 6.3% of participants with a history of STIs (4.3% among women and 8.2% among men)²⁵.

One of the main prevention strategies for syphilis transmission is the use of condoms. In research on behavior, attitudes and practices covering the entire country, it was found that there was little variation in the frequency of condom use in young people in all sexual relations in the last 12 months: a reduction from 39.0%, in 2004, to 36.9%, in 2013^{26,27}.

In the SSP, in 2017, 80% of the municipalities reported at least one case of acquired syphilis, but when disaggregating by place of residence — DRS of residence — there was heterogeneity in the reporting of the disease. The highest rates were observed in the metropolitan regions of the SSP, and especially in Baixada Santista. With regard to the percentage increase between the detection rates of 2011 and 2017, there was important variability. In two regions of the SSP, percentage increases and rates below the state average were observed. The increase in DR did not occur homogeneously, with possible continuation of

underreporting in some regions of the State, or regional differences in the expected prevalence. A representative sample study conducted in Brazil from 2011 to 2012, with 23,894 hospital-based parturients, found a prevalence of cases of 1.03% in the Southeast Region²⁸, however there are no regional studies on the prevalence of syphilis with a sample that is representative of the general population.

The heterogeneity in the detection rates observed in the SSP regions can also be attributed to the differentiated adherence to other prevention actions developed in the State, such as the expansion of testing for syphilis, in addition to the commitment and adherence of municipal surveillance to notification^{16,17}.

One of the main limitations of this study was related to the source of information and the type of study.

The SINAN only includes case identification data: date of diagnosis, date of reporting, sex, date of birth, race and education, and it is not possible to verify compliance with the definition of a “case”. When reporting acquired syphilis, it is important to distinguish the primary, secondary and recent latent phases from the others, as these are phases that correspond to the acute disease, approximating the estimated incidence of the disease in the population — as occurs in the surveillance of syphilis in United States²⁰.

Additionally, another existing limitation is related to the difference between the case definitions of syphilis in pregnant women and acquired syphilis. In this study, the populations who reported acquired syphilis and syphilis in pregnant women were added together. In the data published on syphilis in pregnant women in 2016 in the SSP, only 641 pregnant women with syphilis did not meet the same case definition criteria for acquired syphilis¹³, which corresponded to only 3% of the women who reported, and did not influence the analysis of the disease trend.

Despite the limitations mentioned, the results obtained are consistent with the literature and support public policies and control strategies, such as expanding the coverage of rapid testing for syphilis, especially in the young population.

This growing trend in syphilis detection rates observed in the period studied can be attributed to the increased availability and implementation of rapid testing in the SSP and better adherence to reporting. The disproportionate increase in the detection of syphilis in young men and women, over the entire period, may represent a real increase in the incidence of the infection in young people. It is urgent to formulate more effective public policies aimed at preventing STIs in young people and actions aimed at reducing the underreporting of syphilis in some regions of the state.

ACKNOWLEDGMENTS

Celsis Jesus Pereira, Eunice Francisco da Silva, Magda Cristina Bezerra de Queiroz, Marilene Batista Santos Canuto, Paulo de Tarso Celebrone, Tereza Mitiko Omoto and Wong Kuen Alencar (*in memoriam*).

REFERENCES

- Smith CA, Kamp M, Olansky S, Price ES. Benzathine penicillin G in the treatment of syphilis. *Bull World Health Organ* [Internet] 1956 [Accessed on Sep 1, 2019]; 15(6): 1087-96. Available at <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2538177/pdf/bullwho00534-0245.pdf>
- LaFond RA, Lukehart SA. Biological Basis for Syphilis. *Clin Microbiol Rev* 2006; 19(1): 29-49. <https://doi.org/10.1128/CMR.19.1.29-49.2006>
- Hook 3rd EW. Syphilis. *Lancet* 2017; 389(10078): 1550-7. [https://doi.org/10.1016/S0140-6736\(16\)32411-4](https://doi.org/10.1016/S0140-6736(16)32411-4)
- Stoltey JE, Cohen SE. Syphilis transmission: a review of the current evidence. *Sex Health* 2015; 12(2): 103-9. <http://doi.org/10.1071/SH14174>
- Workowski KA, Bolan GA. Sexually Transmitted Diseases Treatment Guidelines, 2015. *MMWR* [Internet] 2015 [Accessed on Sep 1, 2019]; 64(3): 34-53. Available at: <https://www.cdc.gov/std/tg2015/tg-2015-print.pdf>
- Lynn WA, Lightman S. Syphilis and HIV: a dangerous combination. *Lancet Infect Dis* 2004; 4(7): 456-66. [https://doi.org/10.1016/S1473-3099\(04\)01061-8](https://doi.org/10.1016/S1473-3099(04)01061-8)
- Newman LM, Rowley J, Vander Hoorn S, Wijesooriya NS, Unemo M, Low N, et al. Global estimates of the prevalence and incidence of four curable sexually transmitted infections in 2012. *PLoS One* 2015; 10(12): e0143304. <https://doi.org/10.1371/journal.pone.0143304>
- World Health Organization. Global Health Sector Strategy on sexually transmitted infections 2016–2021 towards ending STIs. World Health Organization [Internet]; 2016 [Accessed on Sep 1, 2019]. Available at: <https://apps.who.int/iris/bitstream/handle/10665/246296/WHO-RHR-16.09-eng.pdf?sequence=1>
- Brasil. Portaria de Consolidação nº 4, de 28 de setembro de 2017. Consolidação das normas sobre os sistemas e os subsistemas do Sistema Único de Saúde [internet]. Brasil; 2017 [Accessed on Sep 1, 2019]. Available at: http://bvsms.saude.gov.br/bvs/saudelegis/gm/2017/prc0004_03_10_2017.html
- Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. Boletim Epidemiológico de Sífilis [Internet]. 2018 [Accessed on Sep 1, 2019]; 49(45). Available at: <http://www.aids.gov.br/pt-br/pub/2018/boletim-epidemiologico-de-sifilis-2018>
- Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. Guia de Vigilância em Saúde: volume único [Internet]. 2. ed. Brasília: Ministério da Saúde; 2017 [Accessed on Sep 1, 2019]. Available at: <http://portalarquivos.saude.gov.br/images/pdf/2017/outubro/06/Volume-Unico-2017.pdf>
- Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. Departamento de Vigilância Epidemiológica. Sistema de Informação de Agravos de Notificação – Sinan: normas e rotinas. 2. ed. Brasília: Editora do Ministério da Saúde; 2007.
- São Paulo. Secretaria de Estado da Saúde de São Paulo. Boletim epidemiológico, CRT-PE-DST/AIDS/CVE [Internet]. 2018 [Accessed on Sep 1, 2019]. 35(1). Available at: <http://www.saude.sp.gov.br/resources/crt/vig.epidemiologica/boletim-epidemiologico-crt/boletim-epidemiologico-2018.pdf>
- National Cancer Institute. Surveillance Research Program. Jointpoint trend analysis software. Version 4.7.0.0 [Internet]. National Cancer Institute; 2019 [Accessed on Oct 1, 2019]. Available at: <https://surveillance.cancer.gov/jointpoint/>
- Kim HJ, Fay MP, Feuer EJ, Midthune DN. Permutation tests for Joinpoint regression with applications to cancer rates. *Stat Med* 2000; 19(3): 335-51. [https://doi.org/10.1002/\(sici\)1097-0258\(20000215\)19:3%3C335::aid-sim336%3E3.0.co;2-z](https://doi.org/10.1002/(sici)1097-0258(20000215)19:3%3C335::aid-sim336%3E3.0.co;2-z)
- São Paulo. Centro de Referência e Treinamento DST/Aids-SP. Prevenção às IST/HIV/aids no Estado de São Paulo. BEPA especial - CRT DST/Aids - SP 30 anos. 2018; 15(175-6).
- São Paulo. Centro de Referência e Treinamento DST/Aids. Diretrizes de Implantação: Proposta para Ampliação da Implantação de Testes Rápidos no Estado de São Paulo [Internet]. São Paulo: Centro de Referência e Treinamento DST/Aids [Accessed on Sep 1, 2019]. Available at: <http://www.saude.sp.gov.br/centro-de-referencia-e-treinamento-dst-ids-sp/testes-rapidos/diretrizes-gerais-e-monitoramento/diretrizes-de-implantacao>
- World Health Organization. Report on global sexually transmitted infection surveillance 2015 [Internet]. Geneva: World Health Organization; 2016 [Accessed on Sep 1, 2019]. Available at: <https://apps.who.int/iris/bitstream/handle/10665/249553/9789241565301-eng.pdf;jsessionid=8ADD5572E92C5811620019A92A8C9604?sequence=1>
- European Centre for Disease Prevention and Control. Syphilis. In: European Centre for Disease Prevention and Control. Annual epidemiological report for 2016. Estocolmo: ECDC; 2018.
- Centers for Disease Control and Prevention. Sexually Transmitted Disease Surveillance 2017 [Internet]. Atlanta: U.S. Department of Health and Human Services; 2018 [Accessed on Sep 1, 2019]. Available at: <https://www.cdc.gov/std/stats17/default.htm>

21. World Health Organization. Sixty-fourth World Health Assembly WHA64.28. Youth and health risks [Internet]. World Health Organization; 2011 [Accessed on Mar 17, 2020]. Available at: https://www.who.int/hac/events/wha_a64_r28_en_youth_and_health_risks.pdf
22. Wendland EM, Horvath JDC, Kops NL, Bessel M, Caierão J, Hohenberger GF, et al. Sexual behavior across the transition to adulthood and sexually transmitted infections Findings from the national survey of human papillomavirus prevalence (POP-Brazil). *Medicine* 2018; 97(33): e11758. <https://doi.org/10.1097/MD.00000000000011758>
23. Da Motta LR, Sperhake RD, Adami AG, Kato SK, Vanni AC, Paganella MP, et al. Syphilis prevalence and risk factors among young men presenting to the Brazilian Army in 2016: Results from a national survey. *Medicine (Baltimore)* 2018; 97(47): e13309. <https://doi.org/10.1097/MD.00000000000013309>
24. Ribeiro D, Rezende EF, Pinto VM, Pereira GFM, Miranda AE. Prevalence of and risk factors for syphilis in Brazilian armed forces conscripts. *Sex Transm Infect* 2012; 88: 32-4. <https://doi.org/10.1136/sextrans-2011-050066>
25. Pinto VM, Basso CR, Barros CRS, Gutierrez EB. Factors associated with sexually transmitted infections: a population based survey in the city of São Paulo, Brazil. *Ciêns Saúde Coletiva* 2018; 23(7): 2423-32. <https://doi.org/10.1590/1413-81232018237.20602016>
26. Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. Departamento de DST, Aids e Hepatites Virais. Pesquisa de conhecimento, atitudes e práticas na população brasileira [Internet]. Brasília: Ministério da Saúde; 2016 [Accessed on Sep 1, 2019]. Disponível em: http://www.aids.gov.br/system/tdf/pub/2016/59392/pcap_2013.pdf?file=1&type=node&id=59392&force=1
27. Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. Programa Nacional de DST e Aids. Pesquisa de Conhecimento Atitudes e Práticas na População Brasileira de 15 a 54 anos [Internet]. Brasília: Ministério da Saúde; 2005 [Accessed on Sep 1, 2019]. Available at: http://bvsm.sau.gov.br/bvs/publicacoes/PCAP_2004.pdf
28. Domingues RMSM, Szwarcwald CL, Souza-Junior PRB, Leal MC. Prevalência de sífilis na gestação e testagem pré-natal: Estudo Nascer no Brasil. *Rev Saúde Pública* 2014; 48(5): 766-74. <http://dx.doi.org/10.1590/S0034-8910.2014048005114>

Received on: 11/11/2019

Revised on: 04/15/2020

Accepted on: 04/17/2020

Authors' contributions: Luppi CG contributed to the design of the study, data collection, analysis, writing of the article and a critical review of the intellectual content. Gomes SEC, Silva MA obtained data, performed analysis, and wrote and reviewed the article. Domingues CSB, Pinto VM, Tancredi MV, Tayra A, Silva RJC: contributed to the design, analysis, writing of the article and critical review of the intellectual content.

