Original Article

Underreporting of gestational, congenital and acquired syphilis among indigenous peoples in Mato Grosso do Sul State, Brazil, 2011-2014*

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Abstract

Objective: to describe the distribution, incidence, and underreporting of syphilis among indigenous peoples from Mato Grosso do Sul, Brazil. **Methods**: descriptive study performed with secondary data of the Information System for Notifiable Diseases (Sinan) and of the Special Indigenous Sanitary District of Mato Grosso do Sul (DSEI-MS), from 2011 to 2014; the data from both sources were compared to identify underreporting. **Results**: the highest incidence rates of syphilis in pregnant women were observed in 2014 (41.1/1,000 live births) and of congenital syphilis, in 2013 (10.7/1,000 live births); the highest numbers of underreporting of cases were for syphilis in pregnant women on Sinan (45/79), of congenital syphilis at DSEI-MS (8/17) in 2014, and of acquired syphilis on Sinan in 2011 and 2013 (5/9 and 10/18, respectively). **Conclusion**: syphilis has a high incidence; underreporting hides the extent of the disease in indigenous peoples from Mato Grosso do Sul.

Keywords: Syphilis; Congenital Syphilis; Information Systems; Indigenous Population; Epidemiology, Descriptive.

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Introduction

Syphilis is still a serious Public Health issue, and it strikes approximately 12 million people worldwide, every year.[1] In Brazil, an increase in detection rate of syphilis in pregnant women has been observed since 2006, as we can see from the record of 7.4 cases/1,000 live births in 2013. In the Midwest region of the country, the detection rate of syphilis for that same year was of 8.7 cases/1,000 live births, and Mato Grosso do Sul was the state which presented the highest rate among that Federative Units: 16.7 cases/1,000 live births.[2]

The geographic location of Mato Grosso do Sul is an important factor regarding the transmission of syphilis in that state. The municipalities located on the border with Paraguay and Bolivia present the highest incidence rates of syphilis in pregnant women. The socioeconomic characteristics and the high transit of people in that region favor the spread of the disease.[3]

> *There are few scientific studies on sexually transmitted infections (STI) in indigenous populations in Brazil.*

The raise in the prevalence of syphilis in pregnant women increases the risk of occurrence of congenital syphilis, a fact observed from the monitoring of the incidence rates for congenital syphilis in Brazil. In 2004, 1.7 cases/1,000 live births were recorded in Brazil; and in 2013, this rate increased to 4.7 cases/1,000 live births.[2]

There are few scientific studies on sexually transmitted infections (STI) in indigenous populations in Brazil, which hampers the knowledge on the magnitude of the problem and broadens the invisibility and vulnerability situations of these populations towards these infections.[4,5] Moreover, we should also consider the inequalities on the coverage of prenatal care among indigenous women and the low education level, possibly related to geographical, cultural and social barriers; all these make the access to health services more difficult and, therefore, leads to higher prevalence of STI, especially of syphilis during pregnancy.[6]

With regard to syphilis among indigenous peoples, the few studies developed in Mato Grosso do Sul showed that the detection rates of this disease have increased in the 2000-2010 period, mainly in the south region of the state.[6-8] The increase in the number of cases may be attributed to the organization of the Technical Department on Sexual Health and Sexually Transmitted Infections in the Special Indigenous Sanitary District of Mato Grosso do Sul (DSEI-MS), which expanded its coverage and diagnose capacity throughout the last decade. Data from DSEI-MS and the Information System for Notifiable Diseases (Sinan) and some studies show that the STI, especially syphilis, are part of a serious Public Health issue among indigenous peoples in the south of Mato Grosso do Sul State.[6-8]

Although the understanding that the information systems in health are important tools for improving the public policies, there are still many barriers that hamper its adequate use.[9] In the case of indigenous peoples, the data obtained at the Primary Health Care have to go through a long way until they reach the national information systems, such as Sinan, because the assistance units and DSEI are not notifier units.

This study aimed to describe the distribution, incidence, and underreporting of syphilis among indigenous peoples from Mato Grosso do Sul State, Brazil.

Methods

A descriptive study on the occurrence of syphilis among the indigenous population from Mato Grosso do Sul was conducted for the period from 2011 to 2014.

Mato Grosso do Sul is the second Brazilian state in number of indigenous people, with 77,025 self-declared indigenous, and 61,158 of them living in native villages and camps (79.4%). Out of the eight indigenous ethnicities living in that state, the most populous are Guarani Ñhandeva, Guarani Kaiowá and Terena: together, they comprise 96% of the indigenous population of Mato Grosso do Sul.[10] DSEI-MS is the biggest in Brazil, considering the population under its responsibility for Primary Health Care in 14 assistance units, 75 native villages and 26 camps.[11]

The definitions of cases of congenital and acquired syphilis and syphilis in pregnant women adopted in the present study are those recommended by the Brazilian Ministry of Health.[12] Only the cases of syphilis reported in indigenous resident in native villages and camps, assisted by DSEI-MS were included; cases of indigenous living in urban areas were excluded from the study. Cases related to recurrence, duplicate records and return to treatment after dropout were also excluded.

Data were obtained from two secondary sources: Sinan and records from the Technical Department on Sexual Health and STI of DSEI-MS. The State Health Department of Mato Grosso do Sul provided data on notification of syphilis in pregnant women, congenital syphilis and acquired syphilis for the studied period, for all the municipalities of that state inhabited by indigenous peoples. Only the reports which presented the variable ethnicity/skin color filled in were provided. After that, all the information was gathered and organized using the application Microsoft® Office Excel® 2010, according to the following variables: year of occurrence, assistance unit and type of syphilis.

The distribution of cases, analysis of incidence and underreporting for each assistance unit was conducted by manual comparison between the cases recorded on Sinan and at DSEI-MS. This stage was performed by the Technical Department on Sexual Health and STI of DSEI-MS, who have access to full data of each individual – including name, birth date and place of residence.

The reported cases, for each one of the analyzed diseases, were classified into three categories: (i) recorded only at DSEI-MS; (ii) recorded only on Sinan; and (iii) recorded on both information systems: DSEI-MS and Sinan. Thus, it was possible to identify the number of underreported cases in each information system and create a spreadsheet with the total cases of syphilis that occurred from 2011 to 2014, in each assistance unit.

The detection rates or incidence of acquired syfilis were calculated for each year of the study, considering the ratio between the number of new cases of syphilis and the number of people living in a certain geographic area (assistance unit) multiplied by 100 thousand (rate per 100 thousand inhabitants). For syphilis in pregnant women and congenital syphilis, the detection rates were calculated through the ratio between the total number of cases reported per year and assistance unit and the total number of live births, in the same period and place, multiplied by 1,000 (rate per one thousand live births).

The incidence rates were calculated per year, for all the indigenous population of Mato Grosso do Sul, and, later, for each assistance unit, having as reference the period from 2011 to 2014. The calculation of this indicator was performed separately, for each data source: DSEI-MS and Sinan. In the first analysis, the objective was to compare the rates calculated for each data source. For the analysis per assistance unit, we attempted to assess the distribution of the disease in the territory covered by DSEI-MS, besides identifying the assistance unit with higher incidence and underreporting for each type of syphilis, per year.

Aiming to observe the magnitude of the impact of underreporting on the calculation of rates, we estimated the ratio between incidence rates for each data source and the rates obtained for the total of cases, according to each type of syphilis. It is important to highlight that the total of cases corresponded to the total of cases reported on DSEI-MS and Sinan.

The study was approved by the Ethics in Research Committee with human beings from the Federal University of Mato Grosso do Sul and by the National Committee of Ethics in Research – Report No. 1.453.383/2016, dated March 17th 2016 –, according to the Resolution of the National Health Council (CNS) No. 466, dated December 12th 2012.

Results

From 2011 to 2014, DSEI-MS and Sinan in Mato Grosso do Sul registred 316 cases of syphilis in pregnant women, 69 cases of congenital syphilis and 64 cases of acquired syphilis, totalizing 449 cases of all types of syphilis in indigenous people. A total of 11 cases related to recurrence, duplicate records and return to treatment after dropout were not included, which corresponded to 2.3% of the total cases of acquired and congenital syphilis, and syphilis in pregnant women.

Underreporting of syphilis in pregnant women on Sinan was higher than those observed at DSEI-MS, for all analyzed years. In 2014, whilst four out of 79 cases of syphilis in pregnant women were not recorded at DSEI-MS, 45 out of 79 were not recorded on Sinan. The highest underreporting of congenital syphilis cases occurred at DSEI-MS: 8/17, in 2014. For acquired syphilis, there was high underreporting also on Sinan: 5/9 in 2011 and 10/18 in 2013 (Table 1).

The highest number of cases was reported in the assistance units located in the south of the state (Amambai, Iguatemi, Caarapó and Dourados). Among the cases reported on Sinan, we observed important underreporting for syphilis in pregnant women in the assistance units of Amambai (106/152), Dourados (15/29) and Antônio João (3/4). The underreporting of congenital syphilis on Sinan were higher in Amambai (16/27) and in Caarapó (2/5). At DSEI-MS, none of the six cases of congenital syphilis that occurred in the assistance unit of Dourados, from 2011

Table 1 – Distribution of cases of syphilis reported on the Special Indigenous Sanitary District of Mato Grosso do Sul (DSEI-MS), on the Information System for Notifiable Diseases (Sinan) and on both, and number of underreporting on DSEI-MS and Sinan, according to the type of syphilis and year of occurrence, Mato Grosso do Sul, 2011-2014

Disease (n)	Year	DSEI-MS	DSEI-MS and Sinan	Sinan	Underreporting on DSEI-MS	Underreporting on Sinan	Total reports
		n	n	n	n	n	n
Syphilis in pregnant women (n=316)	2011	30	47	12	12	30	89
	2012	38	22	16	16	38	76
	2013	32	24	16	16	32	72
	2014	45	30	4	4	45	79
Congenital syphilis (n=69)	2011	7	9	3	3	7	9
	2012	3	7	2	2	3	12
	2013	9	9	3	3	9	21
	2014	3	6	8	8	3	17
Acquired syphilis (n=64)	2011	5	1	3	3	5	9
	2012	6	8	8	8	6	22
	2013	10	3	5	5	10	18
	2014	6	2	7	7	6	15

to 2014, was registered. With regard to acquired syphilis, the most significant underreporting on Sinan occurred in Amambai (15/20), Dourados (1/1) and Sidrolândia (4/6). At DSEI-MS, the assistance units of Aquidauana (3/5) and Paranhos (5/5) stood out due to the number of underreporting for acquired syphilis (Table 2).

The total incidence annual rates, calculated from all cases recorded on both data sources, for each type of syphilis, oscillated from year to year, without showing any increase or reduction throughout the analyzed period. The highest incidence rate of syphilis in pregnant women was observed in 2014 (41.1/1,000 live births), and the highest rate of congenital syphilis, in 2013 (10.7/1,000 live births) (Table 3).

The magnitude of the differences between the total incidence rates and the rates calculated for each data source varied according to the year and type of syphilis. In 2014, the total rate represented 2.3 times the rate of syphilis in pregnant women, calculated on Sinan, 1.9 times the rate of congenital syphilis from DSEI-MS and, in 2011 and 2013, 2.3 times the rates of acquired syphilis according to Sinan data (Table 3).

From 2011 to 2014, the assistance units of Amambai and Iguatemi reported the highest incidences rates of syphilis in pregnant women (90.5/1,000 live births and 84.2/1,000 live births, respectively) and also the highest rates of congenital syphilis (16.1/1,000 live births and 24.9/1,000 live births, respectively). Comparing to the rates obtained on Sinan, the total incidence rate of syphilis in pregnant women was 3.3 times higher in the assistance unit of Amambai, 4.0 times in Antônio João, 2.1 times in Dourados and 2.0 times in Sidrolândia. With regard to congenital syphilis, the assistance unit of Amambai reported an incidence rate that represents 2.5 times the one calculated with underreporting data from Sinan (Table 4).

Discussion

The distribution of syphilis cases (in pregnant women, congenital and acquired) among indigenous living in Mato Grosso do Sul State, recorded on Sinan and DSEI-MS, was mainly located in the south of the state, especially in the assistance units of Amambai and Iguatemi, where two thirds of cases of syphilis in pregnant women and congenital syphilis were registered.

When Ferri and Gomes[7] assessed the prevalences of STI and AIDS in indigenous from Mato Grosso do Sul, using data from Sinan, covering the period from 2001 to 2005, they already pointed that a great part of STI reports in indigenous came from the south of the state, where Guarani and Kaiowá ethnicities live, mainly from villages close to urban areas.

Table 2 – Distribution of cases of syphilis reported on the Special Indigenous Sanitary District of Mato Grosso do Sul (DSEI-MS), on the Information System for Notifiable Diseases (Sinan) and on both, and number of underreporting on DSEI-MS and Sinan, according to the type of syphilis and assistance unit of record, Mato Grosso do Sul, 2011-2014

Disease (n)	Assistance unit	DSEI-MS	DSEI-MS and Sinan	Sinan	Underreporting on DSEI-MS	Underreporting on Sinan	Total reports
		n	n	n	n	n	n
Syphilis in pregnant women (n=316)	Amambai	106	32	14	14	106	152
	Antônio João	3	1	–	–	3	4
	Aquidauana	1	3	4	4	1	8
	Bodoquena	–	1	–	–	–	1
	Bonito	1	1	2	2	1	4
	Caarapó	7	10	2	2	7	19
	Dourados	15	12	2	2	15	29
	Iguatemi	5	42	7	7	5	54
	Miranda	–	2	1	1	–	3
	Paranhos	5	5	14	14	5	24
	Sidrolândia	1	1	–	–	1	2
	Tacuru	1	13	2	2	1	16
Congenital syphilis (n=69)	Amambai	16	7	4	4	16	27
	Antônio João	–	–	–	–	–	–
	Aquidauana	1	2	1	1	1	4
	Bodoquena	–	–	–	–	–	–
	Bonito	–	1	–	–	–	1
	Caarapó	2	2	1	1	2	5
	Dourados	–	–	6	6	-	6
	Iguatemi	3	12	1	1	3	16
	Miranda	–	–	–	–	–	–
	Paranhos	–	–	–	–	–	–
	Sidrolândia	–	–	3	3	–	3
	Tacuru	–	5	–	–	–	5
Acquired syphilis (n=64)	Amambai	15	1	4	4	15	20
	Antônio João	–	–	1	1	–	1
	Aquidauana	–	5	3	3	–	5
	Bodoquena	–	–	–	–	–	–
	Bonito	1	–	1	1	1	2
	Caarapó	3	5	–	–	3	8
	Dourados	1	–	–	–	1	1
	Iguatemi	3	4	6	6	3	13
	Miranda	–	–	–	–	–	–
	Paranhos	–	–	5	5	–	5
	Sidrolândia	4	–	2	2	4	6
	Tacuru	–	2	1	1	–	3

Table 3 – Annual syphilis incidence rate in the indigenous population assisted by the Special Indigenous Sanitary District of Mato Grosso do Sul (DSEI-MS), calculated from the records of DSEI-MS and of the Information System for Notifiable Diseases (Sinan), according to type of syphilis and year of occurrence, Mato Grosso do Sul, 2011-2014

Disease	Year	Incidence rate	Incidence rate	Incidence rate	Incidence ratio	Incidence ratio
		Total [a]	DSEI-MS	Sinan	Total/DSEI-MS	Total/Sinan
Syphilis in pregnant women[b]	2011	40.3	34.9	26.8	1.2	1.5
	2012	38.2	30.1	19.1	1.3	2.0
	2013	36.8	28.6	20.4	1.3	1.8
	2014	41.1	39.0	17.7	1.1	2.3
Congenital syphilis[b]	2011	8.6	7.3	5.4	1.2	1.6
	2012	6.0	5.0	4.5	1.2	1.3
	2013	10.7	9.2	6.1	1.2	1.8
	2014	8.8	4.7	7.3	1.9	1.2
Acquired syphilis[c]	2011	12.9	8.6	5.7	1.5	2.3
	2012	31.4	20.0	22.8	1.6	1.4
	2013	26.9	18.6	11.4	1.4	2.3
	2014	20.5	10.9	12.3	1.9	1.7

a) Total incidence calculated from the cases recorded in both record sources (DSEI-MS and Sinan)
b) Rates calculated for every 1,000 live births
c) Rates calculated for every 100,000 inhabitants

Similar results were found in another study on syphilis in pregnant women in the same state of Mato Grosso do Sul, using secondary data from the State Health Department regarding the period from 2003 to 2008. That study included the 78 municipalities from the state and identified that the highest frequencies of syphilis in pregnant women and congenital syphilis occurred in municipalities located in the country border and with high population density of indigenous.[3] In the study by Candido,[5] which assessed syphilis in pregnant women, specifically in border municipalities from Mato Grosso do Sul, from 2007 to 2010, 36.4% of cases of syphilis in pregnant women were among indigenous. The study developed by Santos,[8] in the municipality of Amambai, based on data from Sinan and from the IT Department of the Brazilian National Health System (Datasus) also regarding the 2007-2010 period, found high prevalence of syphilis in pregnant women when compared to the corresponding prevalence in the general population of that municipality.

The high occurrence of syphilis in indigenous from Mato Grosso do Sul may be related to countless factors determinant of their higher vulnerability, mainly when it comes to indigenous peoples from the south of the state, the Guarani and Kaiowá: both ethnicities are located in municipalities of the border between Brazil, Paraguay and Bolivia – a strip of land 150km from the border line between the countries. Specific characteristics from border regions, when there is a great flow of people and goods, favor the spread of pathogens. Moreover, the territory Guarani-Kaiwoá extends to areas located not only in Brazil, but also in Paraguay, and the intense mobility between the villages from both countries makes the monitoring of patients more difficult, mainly of indigenous women during pregnancy.[13]

The complex and adverse socioeconomic scenario of which the Guarani and Kaiowá are part also has important impact on the epidemiological vulnerability of these people regarding infectious diseases.[14,15] The contact process experienced by the indigenous peoples in Brazil, especially in Mato Grosso do Sul, was extremely devastating in terms of economic, social, environmental and cultural sustainability of those groups. In Mato Grosso do Sul, this process resulted in territory loss, demographic concentration and deep socioeconomic disruption of these peoples.[16]

The high incidence rates of syphilis in pregnant women and congenital syphilis found in this study show how serious syphilis is as a Public Health problem among indigenous peoples in Mato Grosso do Sul, besides being masked by

Table 4 – Syphilis incidence rates in the indigenous population assisted by the Special Indigenous Sanitary District of Mato Grosso do Sul (DSEI-MS), calculated from the records of DSEI-MS and of the Information System for Notifiable Diseases (Sinan), according to type of syphilis and assistance unit of record, Mato Grosso do Sul, 2011-2014

Disease	Assistance unit	Incidence rate	Incidence rate	Incidence rate	Incidence ratio	Incidence ratio
		Total [a]	DSEI-MS	Sinan	Total/DSEI-MS	Total/Sinan
Syphilis in pregnant women[b]	Amambai	90.5	82.2	27.4	1.1	3.3
	Antônio João	16.3	16.3	4.1	1.0	4.0
	Aquidauana	14.1	7.1	12.4	2.0	1.1
	Bodoquena	13.3	13.3	13.3	1.0	1.0
	Bonito	50.6	25.3	38.0	2.0	1.3
	Caarapó	28.4	25.4	17.9	1.1	1.6
	Dourados	15.9	14.8	7.7	1.1	2.1
	Iguatemi	84.2	73.3	76.4	1.2	1.1
	Miranda	4.0	2.7	4.0	1.5	1.0
	Paranhos	29.9	12.4	23.6	2.4	1.3
	Sidrolândia	4.9	4.9	2.5	1.0	2.0
	Tacuru	38.9	34.1	36.5	1.1	1.1
Congenital syphilis[b]	Amambai	16.1	13.7	6.6	1.2	2.5
	Antônio João	–	–	–	–	–
	Aquidauana	7.1	5.3	5.3	1.3	1.3
	Bodoquena	–	–	–	–	–
	Bonito	12.7	12.7	12.7	1.0	1.0
	Caarapó	7.5	6.0	4.5	1.3	1.7
	Dourados	3.3	–	3.3	–	1.0
	Iguatemi	24.9	23.4	20.3	1.1	1.2
	Miranda	–	–	–	–	–
	Paranhos	2.5	2.5	2.5	1.0	1.0
	Sidrolândia	7.4	–	7.4	–	1.0
	Tacuru	12.2	12.2	12.2	1.0	1.0
Acquired syphilis[c]	Amambai	161.3	129.0	40.3	1.3	4.0
	Antônio João	51.7	-	51.7	–	1.0
	Aquidauana	64.5	25.8	64.5	2.5	1.0
	Bodoquena	-	-	-	–	–
	Bonito	238.4	119.2	119.2	2.0	2.0
	Caarapó	126.8	126.8	79.3	1.0	1.6
	Dourados	7.5	7.5	-	1.0	–
	Iguatemi	274.6	147.8	211.2	1.9	1.3
	Miranda	-	-	-	–	–
	Paranhos	110.8	-	110.8	-	1.0
	Sidrolândia	175.0	116.7	58.3	1.5	3.0
	Tacuru	88.4	59.0	88.4	1.5	1.0

a) Total incidence calculated from the cases recorded in both record sources (DSEI-MS and Sinan)
b) Rates calculated for every 1,000 live births
c) Rates calculated for every 100,000 inhabitants

the high number of underreporting. The detection rates of syphilis in pregnant women represent five times the national rates and 2.5 times the state rates.[2] The high incidence of the disease among the indigenous population may be related to the epidemiological characteristics of syphilis, habits and practices culturally defined. The health care to indigenous pregnant women requires the development of qualification strategies directed to teams of health workers which take into consideration the cultural and geographical specificities of this population, consequences and difficulties of access of their pregnant women to health services.[7,17]

Congenital syphilis is preventable and is considered a sentinel event in prenatal care.[17-20] However, the disease control is still a complex issue, especially among indigenous peoples, and demands the development of strategies for monitoring the disease during pregnancy so the intervention occurs while the mother-to-child transmission can still be prevented.[21-23] In the case of indigenous peoples from Mato Grosso do Sul, the mother-to-child transmission of syphilis presented rates twice as big as those observed in the non-indigenous population of the state.[2]

DSEI-MS data (Technical Department on Women's Health) show that, on average, 80% of the partners of notified women were properly treated, according to the Brazilian Ministry of Health's Guidelines and Protocol for Comprehensive Care for individuals with STI, which recommends the partner to be treated at the same time as the pregnant woman and in up to 30 days after the childbirth.[12] Notwithstanding the high coverage of partners' treatment, these cases have not been reported as acquired syphilis, a fact that could be verified by the great difference observed in this study between the number of cases of syphilis in pregnant women and the number of cases of acquired syphilis.

Due to the epidemiological vulnerability of the indigenous peoples from Mato Grosso do Sul in relation to syphilis, presented in this study, the information systems must properly register the occurrence of cases. The availability of quality information, in a continuous and systematic way, is essential for monitoring and developing strategies of prevention and intervention of diseases and conditions.[9] The Sinan, created and developed in the 1990s, has as its main roles to collect and process the data on notifiable diseases and conditions in all the national territory. The system can be operated since the lowest administrative level and the information flow must go through the intermediary levels up to the central level, following the guidelines on decentralization recommended by the Brazilian National Health System – SUS.[24] Therefore, Sinan aims to provide information on municipal, state and federal level on Health management.[25]

Underreporting of cases in the national databases and flaws in when filling the files, especially in the item ethnicity/skin color, are among the main problems that affect the quality of Sinan data related to syphilis in indigenous.[8,9] This variable is self-declared by the patient and not filling this field in the notification file may influence on the performance of SUS and of the Subsystem of Indigenous Health, once it allows the identification of health needs from specific groups, enabling better health actions and the reduction of iniquity among the ethnic groups.[26,27]

This present study observed that, among the assistance units with higher absolute number of cases, underreporting on Sinan was significant for Amambai and Dourados, where half of the cases had not been reported. This underreporting has great impact in the calculation of the incidence rate. The total incidence rate calculated – considering all the cases of syphilis not recorded on Sinan – increased 3.3 and 2.1 times in the assistance units of Amambai and Dourados, respectively, hiding the real situation of syphilis in pregnant women assisted by these assistance units. In the assistance unit of Paranhos the total incidence rate of congenital syphilis is 2.4 times higher than the one observed in the records of DSEI-MS, which presented more than half of the cases underreported for this type of syphilis. Understanding the magnitude of underreporting of syphilis cases is important in order to establish effective strategies for solving problems related to the information flow in the assistance units and municipalities of the state.

The underreporting of syphilis is a recurrent problem in several countries and is one of the main factors that contribute to the persistence of syphilis as a Public Health issue in Latin America and the Caribbean.[28] In the case of Brazilian indigenous peoples, the underreporting of the disease may be associated to the incomplete filling of the notification files, especially regarding the variable ethnicity/skin color or place of residence, as well as the lack of information by the notifier units. The fact that the assistance units and/or DSEI-MS are not notifier units of Sinan increases the chances of underreporting

of diseases. Furthermore, some assistance units of DSEI-MS cover villages that occupy three different municipalities, making the information flow between assistance units and municipalities even more difficult.

In the case of DSEI-MS, the 43 multidisciplinary teams on indigenous health, who are responsible for the 14 assistance units need to be in contact with 31 municipalities, so the information on notifiable diseases and conditions reach the notifier units of the municipalities where the indigenous villages are located.[11] The lack of contact between the assistance units and the municipalities and the incorrect filling of the notification files are two factors that may influence the underreporting of syphilis among the indigenous peoples[29,30] – and also underreporting of other diseases.

Although the use of secondary data may be a limitation for the study, it allowed the researchers to understand the characteristics of syphilis distribution in the indigenous population of Mato Grosso do Sul and assess the occurrence of underreporting of cases in this population.

The results presented here showed that syphilis is a serious Public Health issue among the indigenous peoples of Mato Grosso do Sul, which is hidden by the high underreporting rates. Lastly, we recommend health managers to define strategies that can minimize the problem, including technical qualification of health teams who work in indigenous villages and municipalities of the state with high incidence of the disease and high underreporting, allied with the development of action of education in health and health promotion and prevention of STI. These actions may help strengthen epidemiological surveillance of syphilis and reduce the transmission of the disease among the indigenous population of Mato Grosso do Sul.

Authors' contributions

Tiago ZS, Picoli RP, Graeff SV, Cunha RV and Arantes R contributed to the conception and design of the study, analysis and interpretation of data, writing and relevant critical review of the manuscript's intellectual content. All the authors approved its final version and declared to be responsible for all aspects of the study, ensuring its accuracy and integrity.

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