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RESEARCH ARTICLE

Management of syphilis in pregnancy: Knowledge and practices of health care providers and barriers to the control of disease in Teresina, Brazil

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Summary

Aims: The aim of the study is to verify the knowledge and practices of health professionals working in prenatal care (PNC) related with syphilis during pregnancy and to identify the main barriers to the implementation of protocols for the control of this disease.

Methods: A cross-sectional study in Teresina, Brazil, from January to May 2015, was conducted with 366 physicians and nurses working in PNC, corresponding to 70% of eligible professionals. We evaluated 20 knowledge and practice criteria related to the diagnosis and treatment of syphilis during pregnancy with a 95% compliance standard. We performed descriptive analysis of the data and used χ^2 statistical test to verify differences according to professional category.

Results: Only 2 criteria, "knowledge about mother to child transmission according to gestational age" and "counselling on infection," reached 95% compliance. Knowledge of the epidemiological profile of congenital syphilis and the goal of elimination of congenital syphilis and knowledge about serological tests had scores below 50%, while practices related with posttest counselling, cure control, and treatment of partners reached 60%. We identified organisational barriers related to the late initiation of PNC, to the delayed return of syphilis test results, to the application of benzathine penicillin in primary care units and to the treatment of partners.

Conclusions: Strategies for early initiation of PNC, implementation of rapid tests for syphilis, ensuring treatment of pregnant women with penicillin, adequate partner treatment, and continued education of health professionals on clinical management and counselling in sexually transmitted diseases are necessary to eliminate congenital syphilis.

KEYWORDS

clinical protocols, Family Health Strategy, prenatal care, syphilis, vertical transmission of infectious disease

1 | INTRODUCTION

Congenital syphilis (CS) is the result of the haematogenous transplacental dissemination of *Treponema pallidum* from the infected, untreated, or inadequately treated pregnant woman to her foetus. It is estimated that 1.8 million pregnant women in the world are infected with syphilis and less than 10% are diagnosed and treated.[1,2] The highest number of infected pregnant women is in Asia (44.3%) and in Africa (39.3%), with the Americas presenting 7.8% of the world's cases.[3] In Brazil, the last study conducted by the Ministry of Health (MoH) in 2010-2012 estimated a prevalence of syphilis during pregnancy of 0.85%,[4] corresponding to approximately 26 000 pregnant women infected with syphilis per year. The study "Birth in Brazil," conducted in 2011-2012, estimated a prevalence of syphilis during pregnancy of 1.02%, with no significant differences according to region and maternal age, but with a higher prevalence among women of greater social vulnerability.[5]

Adverse perinatal events are more frequent in pregnant women with syphilis than in pregnant women without this infection.[6] It is estimated that worldwide, in 2008, half a million negative outcomes, represented by foetal losses, neonatal deaths, preterm newborns, or low birth weight, were associated with syphilis during gestation.[3] Congenital syphilis is still a significant preventable cause of perinatal morbidity and mortality even in developed countries.[7]

The mother to child transmission (MTCT) of syphilis can be avoided by the diagnosis and appropriate treatment of the pregnant woman. In 2014, the World Health Organization (WHO) set a global goal of eliminating CS, defined as the occurrence of up to 0.5 cases of CS per 1000 live births. To reach this goal, it recommends that more than 95% of pregnant women have at least one prenatal visit, that more than 95% should undergo syphilis testing, and that more than 95% of infected pregnant women are treated with at least one dose of benzathine penicillin.[8]

In Brazil, although prenatal coverage is practically universal,[9] the coverage of testing has not yet reached the goals recommended by the Pan American Health Organization[2] and the WHO.[8] Failures in the diagnosis and treatment of pregnant women and partners have been reported in national studies.[5,10-12] There is a growing incidence of CS in the country, reaching a rate of 6.5 per 1000 live births in 2015, with the highest number occurring in the Northeast and Southeast regions.[4]

Teresina is the capital of one of the states located in the Northeast region of Brazil. It has an estimated population of 844 245 inhabitants and has an extensive network of public health services with coverage of more than 90% by Family Health Strategy (FHS) teams. In Brazil, FHS teams are responsible for primary health care (PHC). Each FHS team is responsible for 4000 inhabitants of a defined area. Teams are composed of general practitioners, nurses, and community health workers, who promote health practices, and monitor and care for the people of the region.

In spite of the good health care coverage by the FHS, the incidence of CS in the municipality of Teresina has increased in recent years, reaching 15.3 cases per thousand live births in 2015,[13] a value 2.4 times higher than the national incidence and 30 times higher than the elimination goal proposed by the WHO. Of the reported cases in 2015, 22.5% of the pregnant women did not receive prenatal care (PNC), 52.1% received a diagnosis of syphilis at the time of admission to delivery or postpartum, 19.2% were not treated during pregnancy, and 77.5% of partners were not treated.[13] These data indicate failures in the implementation of the Brazilian MoH clinical protocols recommended to prevent MTCT of syphilis.

Evaluative studies of clinical protocol implementation indicate that several factors may hinder or prevent their adoption. These factors may be related to the characteristics of the clinical protocol, the health professional, the patient or the external environment,[14] and the existence of incentives and regulatory mechanisms.[15] One of the

proposed evaluation models[16] classifies the barriers to protocol implementation as (1) barriers related to knowledge, (2) barriers related to attitudes, and (3) barriers related to the practices of health professionals.

Previous studies conducted in Brazil[17,18] and in other countries[19-21] have used knowledge of health professionals and/or practice evaluation to verify barriers to syphilis control. Knowledge gaps have been identified,[17,19,20] as well as cultural aspects,[21] difficulties related to testing for sexually transmitted diseases,[17,20,21] and logistical problems related to the organisation of services.[17,19,21] Although these findings are important, they indicate barriers that may be specific to the context of these studies and not relevant to other contexts. The recognition of specific barriers, on the basis of the characteristics of the protocol and the failures observed in the implementation of care protocols, has been identified as an important step in identifying the strategies that need to be adopted.[16,22] Therefore, a study conducted in Teresina would be a case study of a municipality with good PHC coverage and unfavourable outcomes (high incidence of CS) and could provide important information for similar care contexts in Brazil and other countries.

This study aims to verify the knowledge and practices of the health care workers of the FHS teams in Teresina in the management of syphilis during pregnancy and to identify the main barriers reported by these professionals in the management of this disease. Since FHS PNC is provided by physicians and nurses, we will verify whether there are differences in knowledge, practices, and barriers reported according to these professional categories. The aim is to formulate and adopt specific strategies for the implementation of available clinical protocols.

2 | METHODS

A cross-sectional study, with a quantitative approach, was conducted with the population of physicians and nurses who work at the FHS teams in the city of Teresina.

The PHC in the city of Teresina is made up of 89 health care units and 258 FHS teams. We performed the study in the 89 health services, and the study population was composed of 516 health professionals (physicians and nurses) who worked in these teams.

We performed data collection from January 12 to May 29, 2015. The FHS health professionals were approached during their working hours by the researcher herself, presented with the research objectives, and asked to sign the consent form and to fill out the questionnaire. We adopted a structured and self-administered questionnaire that had been previously used in the country.[17] The questionnaires were not identified and were returned in a sealed envelope in order to maintain the professional's anonymity. We considered professionals who were not approached because they were on sick leave or not located in the health facility at the time as losses. Professionals who did not return the questionnaire after a maximum period of 15 days or returned an unfilled questionnaire were considered a refusal.

In order to evaluate the knowledge and practices of health professionals, we used the theoretical framework of normative evaluation[23] and the available clinical protocols of the Brazilian MoH as references.[24,25] We used 20 evaluation criteria: 13 related to knowledge (2 on clinical aspects of the disease, 4 on serological tests, 3 on treatment, and 4 on epidemiological surveillance) and 7 related to practices (3 relating to diagnosis and pretest and posttest counselling, 3 relating to the treatment of women and partners, and 1 relating to treatment counselling). For each criterion, we estimated the proportion of correct professionals' answers and its respective 95% CI according to the MoH protocol. Following WHO standards adopted for diagnostic and treatment goals for syphilis during pregnancy,[8] we considered compliance with protocol if the value of 95% was included in the interval estimate.

We conducted a descriptive analysis with (1) characterisation of the professionals, (2) characterisation of the health service's routines, (3) verification of professionals' knowledge regarding syphilis and recommended care protocols, (4) verification of the adoption of protocols in their care practice, and (5) description of the main barriers reported to the implementation of clinical protocols for syphilis control during pregnancy. We also conducted a bivariate analysis using the χ^2 statistical test with a significance level of 5% to verify whether the differences between

proportions in the professional's knowledge, practices, and barriers reported were related to the professional category. We used SPSS software (version 20) for data analysis.

This research project was approved by the Research Ethics Committee of the Municipal Health Foundation of Teresina and by the Research Ethics Committee of the National School of Public Health/Fiocruz (CAAE: 37305814.5.0000.5240).

3 | RESULTS

Of the 516 eligible professionals, 366 (70.9%) returned the completed questionnaire (Figure 1). The response rate of the physicians (62.4%) was lower than that of the nurses (79.1%), with 44% of the questionnaires being answered by physicians and 56% by nurses.

Age ranged from 22 to 73 years (mean of 43 y), with the highest concentration in the age group of 20 to 39 years. The professionals were predominantly female, and most had 10 years or more since graduation and 10 years or more of work in FHS teams. More than 80% of the professionals were postgraduates, and 50% in family health care. Significant differences were observed between the 2 professional categories, with a higher proportion of female nurses, of greater age, more time since graduation, more time working in FHS, and more postgraduate courses in family health care (Table 1).

Physicians and nurses reported good access to training and manuals on syphilis management during pregnancy, mostly in the last 5 years, with a complete reading of the manuals reported by 26.5% of the professionals. Agreement and adherence to protocols of the Brazilian MoH were reported by 78.4% of professionals. Nurses reported greater access to training and manuals, while physicians reported more complete manual reading and adherence to protocol (Table 1).

According to the professionals' reports, 55.7% of pregnant women started PNC with more than 12 gestational weeks, and 48.2% attended less than 7 visits during pregnancy. Almost all practitioners stated that the most common routine screening test for syphilis is the Venereal Disease Research Laboratory (VDRL), with 3.8% reporting the use of rapid tests for syphilis (RST). According to 35.2% of the professionals, benzathine penicillin is not used in the primary health service, and infected pregnant women are referred for treatment in other services. Approximately 72% of the professionals reported that the health service has mechanisms to approach the woman's partner, and 82% noted that treatment of the partner is prescribed by the PNC provider. Almost all (97.5%) of the professionals stated that cases of

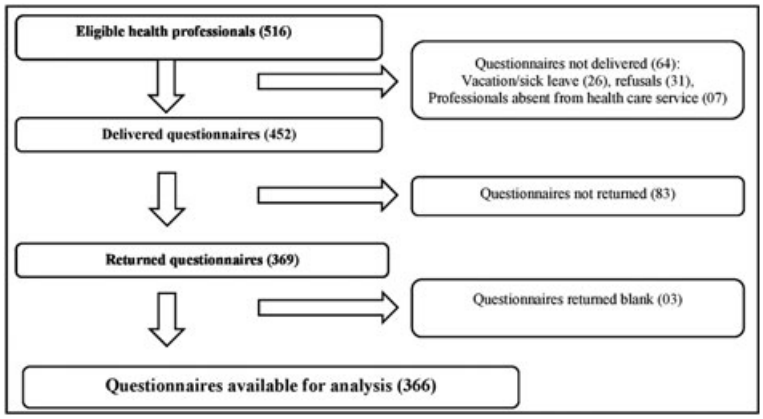

FIGURE 1 Flowchart of questionnaires, Teresina, Brazil, 2015

TABLE 1 Characteristics of Family Health Strategy teams according to professional category, Teresina, Brazil, 2015

Professional Characteristics	Total (N = 366)			Physicians (N = 161)			Nurses (N = 204)			*P* Value[a]
	n	%	95% CI	n	%	95% CI	n	%	95% CI	
Age (n = 365)										
20-39 y	174	47.7	42.6-53.0	89	55.3	47.2-63.0	85	41.7	34.9-48.8	.002
40-59 y	148	40.5	35.4-45.8	49	30.4	23.6-38.2	99	48.5	41.5-55.6	
60 y or more	43	11.8	8.7-15.6	23	14.3	9.4-20.9	20	9.8	6.2-14.9	
Sex (n = 364)										
Female	286	78.6	73.9-82.6	97	60.2	52.2-67.8	189	93.1	88.4-96.0	.000
Male	78	21.4	17.4-26.1	64	39.8	32.2-47.8	14	6.9	3.9-11.5	
Time since graduation (n = 365)										
<10 y	126	34.5	29.7-39.7	65	40.4	32.8-48.4	61	29.9	23.8-36.8	.037
≥10 y	239	65.5	60.3-70.3	96	59.6	51.6-67.2	143	70.1	63.2-76.2	
Working time at FHS (n = 365)										
<10 y	165	45.2	40.0-50.5	95	59.0	50.9-66.6	70	34.3	27.9-41.3	.000
≥10 y	200	54.8	49.5-60.1	66	41.0	33.4-49.0	134	65.7	58.7-72.1	
Postgraduates (n = 365)										
Yes	306	83.8	79.6-87.4	111	68.9	61.1-75.8	195	95.6	91.5-97.8	.000
No	59	16.1	12.6-20.4	50	31.1	24.1-38.9	9	4.4	2.2-8.5	
Type of postgraduate courses (n = 306)										
Family health care	153	50.0	44.4-55.6	44	39.6	30.6-49.4	109	55.9	48.6-63.0	.000
Others	153	50.0	44.4-55.6	67	60.4	50.6-69.4	86	44.1	37.1-51.4	
Training in syphilis management (n = 354)										
Yes	245	69.2	64.1-74.0	80	51.6	43.5-59.6	165	82.9	76.8-87.7	.000
No	109	30.8	26.1-36.0	75	48.4	40.3-56.5	34	17.1	12.3-23.2	
Time since last training (n = 228)										
<1 y	26	11.4	7.7-16.4	16	22.2	13.6-33.8	10	6.4	3.3-11.8	
1-5 y	136	59.7	53.0-66.0	33	45.8	34.2-58.0	103	66.0	58.0-73.3	.001
>5 y	66	28.9	23.2-35.4	23	31.9	21.7-44.1	43	27.6	20.8-35.4	
Access to technical manuals (n = 362)										
Yes	277	76.5	71.7-80.7	112	70.0	62.2-76.8	165	81.7	75.5-86.6	.009
No	85	23.5	19.3-28.2	48	30.0	23.1-37.8	37	18.3	13.4-24.5	
Time since last access (n = 254)										
<1 y	58	22.8	17.9-28.6	20	19.8	12.8-29.2	38	24.8	18.4-32.6	
1-5 y	140	55.1	48.8-61.3	58	57.4	47.2-67.1	82	53.6	45.4-61.6	.645
>5 y	56	22.1	17.2-27.7	23	22.8	15.3-32.4	33	21.6	15.5-29.1	
Reading of technical manuals (n = 275)										
No	8	2.9	1.3-5.9	3	2.7	0.7-8.3	5	3.0	1.1-7.3	.013
Yes, total	73	26.5	21.5-32.2	40	36.0	27.3-45.7	33	20.1	14.4-27.2	
Yes, partial	194	70.5	64.7-75.8	68	61.3	51.5-70.2	126	76.8	69.5-82.9	

(Continues)

TABLE 1 (Continued)

Professional Characteristics	Total (N = 366)			Physicians (N = 161)			Nurses (N = 204)			*P* Value[a]
	n	%	95% CI	n	%	95% CI	n	%	95% CI	
Agreement and adherence of clinical protocols (n = 365)										
Agree and adhere	286	78.4	73.7-82.4	135	83.9	77.0-89.0	151	74.0	67.3-79.8	.024
Others	79	21.6	17.6-26.3	26	16.1	11.0-22.9	53	26.0	20.2-32.7	

Abbreviation: FHS, Family Health Strategy.

[a]χ^2 test.

syphilis during pregnancy are routinely reported, in 88.7% of the cases by the PNC provider himself (data not shown in table).

The incidence of CS in Teresina was correctly noted by 10.7% of professionals, and 31.2% knew the epidemiological profile of CS in the municipality, which is characterised by high incidence of cases and severe forms of the disease. The goal of eliminating CS was correctly reported by a quarter of the professionals, and only 12.6% of professionals correctly cited all the criteria for defining CS cases, with a higher proportion of correctness among physicians (Table 2). The most frequent error in the case definition was the lack of knowledge about the treatment of the partner as one of the criteria used, among both physicians (31.7%) and nurses (30.9%) (data not shown in the table). Knowledge about the occurrence of MTCT of the disease at any time during pregnancy was high, with no significant differences according to the professional category, while 49.4% of the professionals had correct knowledge about MTCT of syphilis according to the maternal disease stage, with greater knowledge among physicians (Table 2).

More than 80% of the professionals correctly classified VDRL as nontreponemal test and fluorescent treponemal antibody absorption and *T pallidum* haemagglutination assay as treponemal tests, while only 46.3% classified the RST as a treponemal test. The correct answer for VDRL and fluorescent treponemal antibody absorption/*T pallidum* haemagglutination assay was significantly higher among physicians, and no differences were observed in relation to the rapid test. Correct knowledge regarding the relevant characteristics of the serological tests for the clinical management of pregnant women was 40.8% for the treponemal tests, and a higher rate was present among physicians (Table 3). The main errors included the following: the belief that these tests can (1) be used for cure control, (2) become "nonreagent" after adequate treatment, and (3) cross-react with other infections (data not shown in the table). The correctness ratio of the VDRL test was less than 5% when considering all its characteristics, without significant difference between the professional categories. The main error identified was the lack of knowledge that the test may become nonreagent after adequate treatment (73.9% doctors, 73% nurses).

The proportion of professionals who answered correctly about the treatment of syphilis during gestation according to the stages of the disease was high, and no significant differences were observed according to professional category (Table 2). Treatment was considered correct according to the MoH clinical protocols available at the time of the study, with a total dose of benzathine penicillin of 2 400 000 U for primary syphilis; 4 800 000 U for secondary or early latent syphilis; and 7 200 000 U for tertiary syphilis or late latent or of unknown duration.

More than 80% of the professionals reported correct practice for prenatal testing for syphilis, ordering tests in the first and third gestational trimesters, with a significantly higher proportion among nurses. The greatest error rate among physicians was due to excessive testing, with reports of testing in all gestational trimesters. Approximately half of practitioners reported the good practice of always offering testing during pretest counselling, with rates for posttest counselling reported by 62.3%. Differences observed between the doctors and nurses for the practice of counselling were not statistically significant (Table 2).

Almost 40% of the professionals reported inadequate practice for syphilis cure control during pregnancy, with requests for quarterly and nonmonthly exams. One-fifth of the professionals presented inadequate practice in terms

TABLE 2 Knowledge in the management of syphilis during pregnancy according to professional categories of Family Health Strategy teams, Teresina, Brazil, 2015

Knowledge criteria	Total (N = 366)			Physicians (N = 161)			Nurses (N = 204)			*P* Value[a]
	n	%	95% CI	n	%	95% CI	n	%	95% CI	
Health surveillance										
Congenital syphilis epidemiological profile (n = 365)										
Correct answer	114	31.2	26.5-36.3	48	29.8	23.0-37.6	138	32.4	60.7-73.9	.603
Wrong answer	251	68.8	63.7-73.4	113	70.2	62.4-77.0	66	67.6	26.1-39.3	
Incidence of congenital syphilis in Teresina (n = 365)										
Correct answer	39	10.7	7.8-14.4	13	8.1	4.5-13.7	26	12.7	8.6-18.3	.336
Wrong answer	59	16.2	12.6-20.4	28	17.4	12.0-24.3	31	15.2	10.7-21.0	
Not informed	267	73.2	68.2-77.5	120	74.5	66.9-80.9	147	72.1	65.3-78.0	
Congenital syphilis elimination goal (n = 365)										
Correct answer	96	26.3	21.9-31.2	40	24.8	18.5-32.4	56	27.5	21.6-34.2	.654
Wrong answer	68	18.6	14.8-23.1	28	17.4	12.0-24.3	40	19.6	14.5-25.9	
Not informed	201	55.1	49.8-60.2	93	57.8	49.7-65.4	108	52.9	45.8-59.9	
Congenital syphilis case definition (n = 365)[b]										
Correct answer	46	12.6	9.4-16.5	27	16.8	11.5-23.6	19	9.3	5.8-14.4	.033
Wrong answer	319	87.4	83.4-90.5	134	83.2	76.3-88.5	185	90.7	85.6-94.1	
Syphilis in pregnancy										
MTCT of syphilis according to gestational age (n = 365)										
Can occur at any gestational age	355	97.3	94.8-98.6	156	96.9	92.5-98.9	199	97.5	94.1-99.1	.704
Other/not informed	10	2.7	1.4-5.1	5	3.1	1.1-7.5	5	2.5	0.9-5.9	
MTCT of syphilis according to maternal disease stage (n = 340)										
Higher in primary and secondary syphilis	168	49.4	44.0-54.8	85	57.0	48.7-65.0	83	43.5	36.4-50.8	.009
Other/not informed	172	50.6	45.1-56.0	64	43.0	34.9-51.3	108	56.5	49.2-63.6	
Lab tests										
VDRL classification (n = 359)										
Nontreponemal	289	79.2	75.9-84.4	140	87.0	80.5-91.5	149	73.0	66.3-78.9	.001
Treponemal or not informed	76	20.8	17.1-25.8	21	13.0	8.4-19.5	55	27.0	21.1-33.7	

(Continues)

TABLE 2 (Continued)

Knowledge criteria	Total (N = 366)			Physicians (N = 161)			Nurses (N = 204)			*P* Value[a]
	n	%	95% CI	n	%	95% CI	n	%	95% CI	
FTA-Abs/TPHA classification (n = 354)										
Treponemal	294	80.5	78.6-86.7	139	86.3	79.8-91.0	155	76.0	69.4-81.5	.009
Nontreponemal or not informed	71	19.5	16.1-24.7	22	13.7	8.9-20.2	49	24.0	18.4-30.6	
RST classification (n = 346)										
Treponemal	169	46.3	43.5-54.2	79	49.1	41.1-57.0	90	44.1	37.2-51.2	.346
Nontreponemal or not informed	196	53.7	51.2-61.9	82	50.9	43.0-58.5	114	55.9	48.7-62.7	
VDRL characteristics (n = 365)[b]										
Correct answer	8	2.2	1.0-4.4	5	3.1	1.1-7.5	3	1.5	0.4-4.6	.289
Wrong answer	357	97.8	95.5-98.9	156	96.9	92.5-98.9	201	98.5	95.4-99.6	
Treponemal tests characteristics (n = 348)[b]										
Correct answer	142	40.8	35.6-46.2	76	48.7	40.7-56.8	66	34.4	27.8-41.6	.007
Wrong answer	206	59.2	53.8-64.4	80	51.3	43.2-59.3	126	65.6	58.4-72.2	
Treatment										
Primary syphilis (n = 365)										
Benzathine penicillin total dose 2 400 000 U	280	76.7	71.9-80.9	129	80.1	72.9-85.8	151	74.0	67.3-79.8	.171
Others	85	23.3	19.1-28.0	32	19.9	14.2-27.0	53	26.0	20.2-32.7	
Secondary or early latent syphilis (n = 365)										
Benzathine penicillin total dose 4 800 000 U	v269	73.7	68.8-78.1	120	74.5	66.9-80.9	149	73.0	66.3-78.9	.421
Others	96	26.3	21.9-31.2	41	25.5	19.1-33.0	55	27.0	21.1-33.7	
Tertiary syphilis, late latent or of unknown duration (n = 365)										
Benzathine penicillin total dose 7 200 000 U	319	87.4	83.4-90.5	145	90.1	84.1-94.0	174	85.3	79.5-89.7	.173
Others	46	12.6	9.5-16.5	16	9.9	5.9-15.9	30	14.7	10.3-20.5	

Abbreviations: FTA-Abs, fluorescent treponemal antibody absorption; MTCT, mother to child transmission; RST, rapid test for syphilis; TPHA, *Treponema pallidum* haemagglutination assay; VDRL, Venereal Disease Research Laboratory.

[a]χ^2 test.

[b]Questions with multiple possible answers.

TABLE 3 Practices in the management of syphilis during pregnancy according to professional categories of Family Health Strategy teams, Teresina, Brazil, 2015

	Total (N = 366)			Physicians (N = 161)			Nurses (N = 204)			
Practice criteria	n	%	95% CI	n	%	95% CI	n	%	95% CI	*P* Value[a]
Test ordering (N = 365)										
1st and 3rd gestational trimester	298	81.6	77.2-85.4	123	76.4	68.9-82.6	175	85.8	80.0-90.1	.021
Others	67	18.4	14.6-22.8	38	23.6	17.4-31.1	29	14.2	9.8-19.9	
Pretest counselling (N = 365)										
Yes	181	49.6	44.3-54.8	71	44.1	36.3-52.1	110	53.9	46.8-60.8	.062
No	184	50.4	45.2-55.6	90	55.9	47.9-63.6	94	46.1	39.1-53.2	
Posttest counselling (N = 365)										
Yes	229	62.7	57.5-67.7	104	64.6	56.6-71.8	125	61.3	54.2-67.9	.515
No	136	37.3	32.3-42.5	57	35.4	28.1-43.4	79	38.7	32.1-45.8	
Treatment counselling (N = 365)										
Yes	360	98.6	96.6-99.5	157	97.5	93.3-99.2	203	99.5	96.8-99.9	.104
No	5	1.4	0.5-3.3	4	2.5	0.8-6.6	1	0.5	0.0-3.1	
Cure control during pregnancy (N = 365)										
Monthly test ordering	223	61.1	55.9-66.1	103	64.0	56.0-71.3	120	58.8	51.7-65.6	.316
Others	142	38.9	33.9-44.1	58	36.0	28.7-44.0	84	41.2	34.4-48.3	
Partner management (N = 361)[b]										
Adequate	289	80.1	75.5-84.0	126	80.3	73.0-86.0	163	79.9	73.6-85.0	.934
Inadequate	72	19.9	16.0-24.5	31	19.7	14.0-27.0	41	20.1	14.9-26.4	
Partner treatment (N = 365)										
Adequate	222	60.8	55.6-65.8	105	65.2	57.3-72.4	117	57.4	50.2-64.2	.126
Inadequate	143	39.2	34.2-44.4	56	34.8	27.6-42.7	87	42.6	35.8-49.7	

[a]χ^2 test.

[b]Questions with multiple possible answers.

of partner treatment, ordering tests or prescribing treatments via the pregnant woman instead of calling the partner in for attendance at the health unit. About 40% of the professionals reported inadequate treatment of the partner, with treatment prescription only when the patient had a reactive serology. Almost 100% of the professionals reported that they always counselled the pregnant women with syphilis on the treatment of the disease. None of the treatment practices evaluated showed a statistically significant difference according to professional category (Table 3).

The most cited barriers to syphilis management during gestation were those related to clients, followed by organisational barriers and professional difficulties, without significant differences between physicians and nurses. The nonattendance of the partner to the service, late onset of PNC, and nonadherence of the pregnant woman to the testing or treatment were the most cited barriers related to the clients. Delays in the return of the syphilis test result, difficulty in accessing treponemal confirmatory exams, and difficulty in the application of benzathine penicillin in the health service were the most cited organisational barriers. Difficulties in approaching and treating the sexual partner of an infected pregnant woman was the main barrier related to professional performance (Table 4).

4 | DISCUSSION

The results of this study present the knowledge and practices of the population of professionals working in the FHS of Teresina, the capital of one of the Brazilian regions most affected by CS and with a good coverage of PHC. A high response rate of 70% was found, similar to that reported in another national study on the same topic.[17] The knowledge and practice criteria evaluated were based on recommendations of the Brazilian MoH, which are similar to international recommendations.[8] Therefore, the results may be relevant for other contexts.

However, the study has some limitations. There was a higher rate of nonresponse among physicians, which may have resulted in selection bias and limited comparisons among professional categories. The study instrument, a self-completed questionnaire, may have allowed participants to provide merely chance or intuitively correct answers. In addition, within the 15-day period used to complete the questionnaire, professionals may have consulted technical manuals and/or other sources. Therefore, the knowledge deficit found is probably underestimated. Likewise, the reported practices were not checked against the health unit's records, interviews with pregnant women, or direct observation. It is possible that adequate practices are overestimated if the professionals reported practices that they know to be recommended, even if they do not practice it. All these factors may have resulted in the underestimation of existing gaps.

Both physicians and nurses complied with only 2 of the 20 evaluated criteria. Only the criterion of knowledge "Mother to child transmission of syphilis according to gestational age" and the criterion of the practice "counselling the pregnant woman on the treatment of syphilis" reached the conformity standard of 95%.

Poor knowledge of the epidemiological profile of CS and of the goal of elimination of CS could affect the attitude of professionals in relation to the results reached using their practices. An attitude of disbelief regarding the results of a protocol may affect the motivation of the professionals to adopt it, constituting a barrier to its implementation.[16] Poor knowledge of the epidemiological profile of syphilis and CS was also observed in studies performed in São Paulo/Brazil[11] and in Burkina Faso.[20] The high adherence to syphilis in pregnancy case reporting found in this study, superior to that reported by other authors,[11,12,26-28] suggests little cooperation between health surveillance programmes and health care services in the city of Teresina, as the professionals showed insufficient knowledge of the epidemiological profile of CS. The return of epidemiological information to the health care providers is fundamental to the health surveillance process.

Insufficient knowledge about MTCT of syphilis according to the stage of maternal disease and the criteria for the definition of CS cases may lead to the poorer clinical management of the pregnant woman. The correct treatment of an infected pregnant woman depends on the identification of the stage of the maternal disease, with prescription of the appropriate dose of benzathine penicillin for each phase, and the time of initiation of the treatment, which should

TABLE 4 Barriers in the management of syphilis during pregnancy according to professional categories of Family Health Strategy teams, Teresina, Brazil, 2015

Barrier type[b]	Total (N = 366)			Physicians (N = 161)			Nurses (N = 204)			*P* Value[a]
	N	%	CI	N	%	CI	N	%	CI	
Clients barriers (n = 365)[b]	330	90.4	86.8-93.1	150	93.2	87.8-96.4	180	88.2	82.8-92.2	.112
Partners nonattendance	286	78.1	73.7-82.4	129	80.1	72.9-85.8	156	76.5	69.9-82.0	
Late onset of prenatal care	234	63.9	58.9-68.9	112	69.6	61.7-76.4	121	59.3	52.2-66.0	
Nonadherence to testing	88	24.0	19.9-28.9	40	24.8	18.5-32.4	47	23.0	17.6-29.5	
Nonadherence to treatment	79	21.6	17.6-26.3	36	22.4	16.3-29.7	42	20.6	15.4-26.9	
Organisational barriers (n = 365)[b]	279	76.4	71.7-80.6	122	75.8	68.3-82.0	157	77.0	70.4-80.4	.791
Delays in test results	205	56.0	50.9-61.3	92	57.1	49.1-64.8	112	54.9	47.8-61.8	
Difficulty in accessing treponemal tests	114	31.1	26.6-36.3	60	37.6	29.9-45.3	54	26.5	20.7-33.2	
Difficulty in application of benzathine penicillin in PHC services	110	30.1	25.5-35.2	47	29.2	22.4-36.9	63	30.9	24.7-37.8	
Lack of reference to STI treatment	40	10.9	8.0-14.7	13	8.1	4.5-13.7	27	13.2	9.0-18.8	
Professional barriers (n = 365)[b]	154	42.2	37.1-47.4	65	40.4	32.8-48.4	89	43.6	36.8-50.7	.532
Difficulties in approaching sex partner	126	34.4	29.7-39.7	55	34.2	27.0-42.1	71	34.8	28.4-41.8	
Difficulties in interpreting lab test results	33	9.0	6.4-12.6	4	2.5	0.8-6.6	29	14.2	9.9-19.9	
Lack of confidence in laboratory tests	15	4.1	24.0-68.3	9	5.6	2.7-10.7	6	2.9	1.2-6.6	
Nonagreement with clinical protocol	1	0.3	0.01-1.7	1	0.6	0.03-3.9	–	–	–	

Abbreviations: PHC, primary health care; STI, sexually transmitted infections.

[a]χ^2 test.

[b]Multiple possible answers.

be performed more than 30 days before delivery.[25] The nontreatment of the sexual partner was the least known CS case definition criterion.[24] It is possible that this lack of knowledge affected the practices of the professionals during the treatment of the partners, either by treating the partner via communication with the pregnant woman or by linking the treatment of the partner to the reactive serological result, limiting the control of sexual contacts if strategies to facilitate the serological diagnosis of the infection are not implemented. The nontreatment of the partner has been pointed out by several authors as one of the causes of the high incidence of CS in Brazil,[10,12,28,29] and it has also been reported in other countries as a failure to treat STIs.[30] The achievement of the CS elimination goal in Brazil depends on the reduction of syphilis in pregnancy prevalence and incidence.[31] Treatment of all sexual partners and syphilis control in the general population is therefore necessary.

Most pregnant women infected with syphilis are asymptomatic. Diagnosis through serological testing is the main form of identification of infected pregnant women seeking timely treatment. Professionals showed insufficient knowledge about serological tests, a result also reported in other national studies,[17,32] which may result in errors in the clinical management of the pregnant woman. Particularly worrying is the lack of knowledge regarding the rapid syphilis test, recommended by the WHO to improve access to syphilis diagnosis. There is evidence of the cost-effectiveness of these tests for the treatment of syphilis during pregnancy[33,34] and reports of high acceptance among professionals and users.[35,36] The Brazilian MoH established the implementation of RST in PNC in 2011,[37] which may explain the lower familiarity of professionals with these tests, given its more recent deployment. However, the shortcomings identified may result in the misinterpretation and misuse of this test, constituting a major barrier to the implementation of the use of RST in PNC.

In addition to insufficient knowledge regarding RST, the results of this study showed low use of this test in the Teresina FHS teams. Only 3.8% of the professionals reported using the RST to diagnose syphilis, a result similar to that found in a national study evaluating the quality of FHS PNC in Brazil, which observed the availability of RST and HIV rapid tests in only 1.6% of the evaluated teams.[38] These data indicate failures in the implementation of RST in the country and low availability of RST in primary care units.

Still in relation to the diagnosis, we observed both smaller and higher number of tests during PNC when compared with the routine recommended by the Brazilian MoH. Excessive testing is inconsistent with MoH recommendations and is not based on scientific evidence,[39] which implies unnecessary expenditure of resources. We also noted failures to conduct pretest and posttest counselling, resulting in lost opportunities to perform preventative measures. A lack of advice regarding syphilis has also been reported in studies in African countries.[40]

The 3 treatment knowledge criteria showed high adherence to the MoH protocols, although they did not reach 95% compliance. The lower proportion of correct results was observed in the primary and secondary stages/recent latency, resulting from the prescription of penicillin doses being above the recommended amount. This represents an increase in services costs and the submission of pregnant women to unnecessary suffering, as benzathine penicillin is a type of medicine that is injectable and painful. In 2015, the Brazilian protocol for the treatment of infected pregnant women[41] was modified, in line with international protocols, with a reduction in the total dose for pregnant women with secondary or recent latent syphilis from 4 800 000 U to 2 400 000 U. This change would result in greater levels of inadequate treatments due to overdoses in prescription, and widespread dissemination of the new recommendations is required.

From the professional practice criteria, in addition to the failures in treatment of partners, there was low compliance in the cure control of pregnant women with less opportunity to identify failures in the treatment of pregnant women. Inadequate control of the treatment of pregnant women has also been reported by Silva[18] and Campos[42] in studies in the state of Ceará/Brazil.

We identified several organisational barriers that may affect syphilis control in this study. The professionals reported late initiation of PNC and a low number of consultations in women attended by the FHS. The onset of PNC before the 12th gestational week is essential for the early diagnosis of the infection, in order to avoid cases of syphilis abortion and other adverse outcomes.[43] Failures in the early initiation of PNC in Brazil have already been reported in a national study performed in 2011-2012.[9] This has been associated with a higher incidence of CS.[12]

Lower adequacy of syphilis control measures in women with fewer PNC consultations was observed in a study conducted in the city of Rio de Janeiro[43] and was also associated with a higher incidence of CS in a study conducted in Belo Horizonte, MG.[12]

However, these results would not be expected in a city with high FHS coverage. It is the responsibility of the FHS team to identify pregnant women in their area and to link them to PNC, which must be shared by doctors and nurses.[44] However, we observed that some professionals refused to participate in the study because they do not provide PNC. Professionals also attributed the major barriers to syphilis control to clients, such as delayed PNC initiation, nonadherence to testing, and nonattendance of the pregnant woman or partner to the health care unit. This culpability of the users demonstrates the passive attitude of health professionals, inadmissible in the work context of the FHS, which advocates the principles of clientele assignment, bonding, sanitary accountability, and community actions.[44,45]

Other important barriers reported included the delay in returning test results and difficulty in accessing confirmatory treponemal exams. The delay in returning serological results delays the beginning of treatment of syphilis during pregnancy, which has a better result when performed at the 24th to 28th gestational weeks. However, these barriers could be mitigated with the use of RST, which allows the immediate diagnosis and treatment of infected pregnant women. In addition, since they are treponemal tests, RST can be used as confirmatory tests and thus clarify doubts regarding pregnant women with low titres in nontreponemal tests.

The nonapplication of benzathine penicillin, or time restrictions for its application, reported by professionals, also makes timely treatment of syphilis difficult, since it is the drug of choice for the treatment of pregnant women. The application of benzathine penicillin in PHC services is recommended by the Brazilian MoH,[24] but difficulties in its application have already been reported in the country.[46] Finally, the lack of referral services may make it difficult to handle more complex cases, for example, in the case of pregnant women allergic to penicillin. This shortage of referral services was also observed in a study performed in the city of Rio de Janeiro.[17]

Overcoming these barriers depends on the effective implementation of policies already defined in the country, such as the implementation of RST and the application of benzathine penicillin in PHC units; the organisation of the health care network in the municipality/state, which includes a definition of reference services; and better functioning of the FHS units. The control of syphilis during pregnancy depends exclusively on PNC. The FHS teams have the potential to diagnose and treat syphilis cases in their area, since they have prioritised access to families through community health workers or by actively searching in the community.[47] Therefore, better results for syphilis management would be expected in the FHS, something that has not been observed in national studies.[47,48] Lack of knowledge, poor practices, and barriers to treatment identified in this study may be making it difficult to control syphilis during pregnancy in the FHS of Teresina. It is also possible that this is occurring in other municipalities, where other similar failures and barriers were reported in studies conducted in other Brazilian regions.[17,49]

It is important to highlight that the large majority of the professionals agreed with the protocols of the MoH. Disagreement would be a barrier to noncompliance with clinical protocol.[16] It is probable that the errors in the reported practices, and in specific questions about exams and treatment, are related to the lack of knowledge and/or familiarity with existing protocols, coupled with organisational barriers to their implementation.

Adequate training is considered one way of overcoming barriers to control the elimination of MTCT of syphilis and HIV.[50] In this study, professionals reported good access to MoH training and manuals, although only partial reading of their contents, which may consequently have resulted in unfamiliarity with the protocols. Nurses presented more gaps in knowledge, although they had more access to training and manuals. However, these differences, more favourable to physicians, may be due to selection bias. The rate of nonresponse in this study was higher among physicians, and the greater knowledge scores could result from the refusal of professionals with less knowledge and/or inadequate practices to take part.

In a study performed in the city of Rio de Janeiro,[17] a link was established between greater knowledge of the epidemiological profile of CS and adequate practices with better access to training and manuals, but with discrete effects. These results are consistent with available evidence that shows that the passive transmission of information

is a strategy of continued education with little effect.[15] Training strategies that have been adopted should be reviewed, in light of knowledge gaps and inadequate care practices in professionals with access to training and technical manuals.[17,28]

5 | FINAL CONSIDERATIONS

The existence of PHC and PNC policies as well as specific clinical protocols for the management of syphilis during pregnancy in Brazil has not been sufficient to curb CS in Teresina and in the country. The results of this study showed gaps in the knowledge and practices of physicians and nurses of the FHS teams alongside organisational barriers for the adequate management of syphilis during pregnancy.

The identified failures and barriers make it difficult for the early diagnosis and timely treatment of pregnant women and their partners in preventing CS. The existence of such failures should support the development of specific strategies, including early initiation of PNC, implementation of RST, treatment of pregnant women with benzathine penicillin in primary care services, and greater integration between epidemiological surveillance and health care. Adaptations to continuous education for physicians and nurses may be needed to address specific knowledge gaps. Additional studies are needed to better evaluate FHS PNC in Teresina, which is one of the cities in the country with the highest FHS coverage.

CONFLICT OF INTEREST

The authors declare no conflict of interests.

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