

Syphilis in pregnancy and congenital syphilis in Amazonas State, Brazil: an evaluation using database linkage

Sífilis em gestantes e sífilis congênita no Estado do Amazonas, Brasil: uma abordagem por meio de relacionamento de bases de dados

Sífilis en mujeres embarazadas y sífilis congénita en el estado de Amazonas, Brasil: una aproximación a través de la relación en bases de datos

Claudia Marques de Oliveira Soeiro ^{1,2}

Angélica Espinosa Miranda ³

Valeria Saraceni ⁴

Marcelo Cordeiro dos Santos ⁵

Sinesio Talhari ⁶

Luiz Carlos de Lima Ferreira ⁶

Abstract

This study analyzes notification of syphilis in pregnancy and congenital syphilis in Amazonas State, Brazil, from 2007 to 2009 and verifies underreporting in databases in the National Information System on Diseases of Notification (SINAN) and the occurrence of perinatal deaths associated with congenital syphilis and not reported in the Mortality Information System (SIM). This was a cross-sectional study with probabilistic record linkage between the SINAN and SIM. There were 666 reports of syphilis in pregnant women, including 224 in 2007 (3.8/1,000), 244 (4.5/1,000) in 2008, and 198 (4.0/1,000) in 2009. The study found 486 cases of congenital syphilis, of which 153 in 2007 (2.1/1,000), 193 in 2008 (2.6/1,000), and 140 in 2009 (2.0/1,000). After linkage of the SINAN databases, 237 pregnant women (35.6%) had cases of congenital syphilis reported. The SIM recorded 4,905 perinatal deaths, of which 57.8% were stillbirths. Probabilistic record linkage between SIM and SINAN-Congenital Syphilis yielded 13 matched records. The use of SINAN and SIM may not reflect the total magnitude of syphilis, but provide the basis for monitoring and analyzing this health problem, with a view towards planning and management.

Syphilis; Congenital Syphilis; Pregnancy; Statistical Databases

Resumo

O estudo descreve o perfil das notificações de sífilis em gestantes e sífilis congênita no Estado do Amazonas, Brasil, entre 2007 e 2009, e verifica a subnotificação em bases de dados do Sistema Nacional de Agravos de Notificação (SINAN) e a ocorrência de óbitos perinatais associados à sífilis congênita não notificados no Sistema de Informação de Mortalidade (SIM). Estudo seccional com relacionamento entre SINAN e SIM. Ocorreram 666 notificações de sífilis em gestantes, sendo 224 em 2007 (taxa detecção de 3,8/1.000 nascidos vivos); 244 (4,5/1.000) em 2008 e 198 (4,0/1.000) em 2009. Encontraram-se 486 casos de sífilis congênita, sendo 153 (incidência: 2,1/1.000) em 2007, 193 (2,6/1.000) em 2008 e 140 (2,0/1.000) em 2009. Após o relacionamento das bases-SINAN, 237 (35,6%) gestantes tinham casos de sífilis congênita notificados. No SIM, constavam 4.905 óbitos perinatais, sendo 57,8% fetais. No relacionamento do SIM/SINAN-sífilis congênita foram encontrados 13 registros pareados. A utilização do SINAN e SIM podem não refletir a total magnitude da sífilis, mas formam base para o monitoramento e análise da situação de saúde, tendo em vista o planejamento e a gestão.

Sífilis; Sífilis Congênita; Gravidez; Bases de Dados Estatísticos

¹ Universidade do Estado do Amazonas, Manaus, Brasil.

² Fundação de Medicina Tropical Heitor Vieira Dourado, Manaus, Brasil.

³ Universidade Federal do Espírito Santo, Vitória, Brasil.

⁴ Secretaria Municipal de Saúde do Rio de Janeiro, Rio de Janeiro, Brasil.

⁵ Fundação de Vigilância em Saúde do Amazonas, Manaus, Brasil.

⁶ Universidade Federal do Amazonas, Manaus, Brasil.

Correspondência

C. M. O. Soeiro
Universidade do Estado do Amazonas.
Al. Espanha 62, Manaus, AM
69037-014, Brasil.
cmsoeiro@hotmail.com

Introduction

Syphilis in pregnancy, when untreated, results in a high proportion of stillbirths and early neonatal deaths¹. Maternal syphilis poses a threat to the fetus, given the high likelihood of vertical (mother-to-child) transmission of the disease, especially in the primary and secondary stages, increasing the risk of perinatal deaths². In Brazil, considering 3,059,402 deliveries per year and a 1.6% prevalence rate for syphilis in pregnancy, there were an estimated 48,950 cases of pregnant women with syphilis in 2004³. However, in 2005, the year after the above estimate, Brazil reported only 1,863 pregnant women with syphilis, increasing to 8,755 in 2009, but still far below the expected figure³. Congenital syphilis can be prevented by adequate diagnosis and treatment during pregnancy⁴. In Brazil, the conditions for such prevention are provided by the public healthcare system at the municipal level and can help eliminate the disease, since vertical transmission of syphilis can occur in up to 25% of cases of infected mothers^{5,6}.

Congenital syphilis has been subject to compulsory notification in Brazil since 1986⁷, with its own case definition, periodically revised⁸. Information on miscarriage, stillbirth, and live birth with congenital syphilis must be reported to the Information System on Diseases of Notification (SINAN)⁹. Syphilis in pregnancy has been subject to compulsory notification since 2005 according to the same principles as congenital syphilis¹⁰. Epidemiological surveillance of both diseases is essential for eliminating congenital syphilis, providing the necessary information for planning and intervention^{3,5,6}.

The Mortality Information System (SIM) was created in 1975 by the Brazilian Ministry of Health to gather regular mortality data in the country¹¹. The SIM can serve as an alternative source for measuring perinatal mortality (stillbirth plus early neonatal mortality) from congenital syphilis, particularly relevant when assessing the quality of prenatal care¹².

The lack of a mechanism to integrate the large health information systems in Brazil makes database linkage an important tool for integrating the various bases. Database linkage has been applied in public health for the last 50 years, since publication of the study by Newcombe et al.¹³. Recent decades have witnessed growing recognition of the importance of assessing the results of probabilistic or deterministic record linkage¹⁴.

The objectives of this study were to describe the epidemiological profile of reported cases of syphilis in pregnancy and congenital syphilis in Amazonas State from 2007 to 2009, verify under-

reporting of such cases in the SINAN databases, and verify perinatal deaths associated with congenital syphilis not recorded in the SIM using probabilistic record linkage.

Methodology

This was a descriptive cross-sectional study of cases of congenital syphilis and syphilis in pregnancy included in the SINAN (version SINAN-NET) from 2007 to 2009 in Amazonas State, Brazil. Data on stillbirths (fetal losses after the 22nd week of pregnancy or greater than 500 grams) and early neonatal deaths (up to 7 days of life) related to congenital syphilis, coded in the International Classification of Diseases, 10th Revision (ICD-10) as A50.0 to A50.9 were identified in SIM for 2007-2009 through a search for multiple causes of death, using Stata version 9 (Stata Corp., College Station, USA).

After selecting cases reported to SINAN, we conducted probabilistic linkage of the databases for syphilis in pregnancy and congenital syphilis and subsequently for the SINAN-Congenital Syphilis and SIM databases, using the variable "pregnant woman's name" in the SINAN-Syphilis in Pregnancy base and "mother's name" in the SINAN-Congenital Syphilis and SIM databases to identify cases, with ReLink (version 1)¹⁵ supported by Stata (version 9) to analyze cases present in the 3 databases.

In the SINAN-Congenital Syphilis database, recording of cases of miscarriage was preceded by the word "miscarriage by" before the name of the mother in the patient's name variable. This term was used to identify cases of miscarriage in the SINAN. The search in SIM identified one such case as stillbirth rather than miscarriage. For cases of stillbirths, we searched for the words "stillbirth of" or "fetal death of" before the mother's name in the SIM and SINAN-Congenital Syphilis databases in the patient name variable. The first blocking step was performed with "pregnant women's name - mother's name". Given the small number of cases, we then proceeded to a manual search. Mother's age, mother's municipality of residence, and temporal correspondence of cases were used in the manual revision of the probabilistic linkage.

After probabilistic linkage of the databases, a final base was constructed in which the variables related to the pregnant woman (or mother of the case of congenital syphilis) were year of diagnosis, age, race, schooling, prenatal care, timing of syphilis diagnosis, clinical classification of the maternal syphilis, and treatment of the pregnant woman and her partner. For cases of congeni-

tal syphilis, the study variables were sex, age at diagnosis of congenital syphilis, presence of symptoms at diagnosis of congenital syphilis in the child, long-bone x-rays, cerebrospinal fluid analysis, and final case classification.

We began with a descriptive analysis, including frequency distributions of categorical variables and measures of central tendency and dispersion for continuous variables. The detection rate for syphilis in pregnancy was calculated as the number of notifications of syphilis in pregnancy divided by the number of live births in the same year, and the incidence rate for congenital syphilis was calculated as the number of notifications divided by the live births in the same year, according to the Brazilian Ministry of Health's definitions for these indicators¹⁶.

Data were provided by the Amazonas State STD/AIDS Division and the Health Surveillance Foundation (FVS). The study was approved by the Ethics Research Committee of the Amazonas State University/Amazonas Foundation for Tropical Medicine, case n. 1993/2010.

Results

Cases of syphilis in pregnancy

As for reporting of syphilis in pregnancy to the SINAN database, there were 666 notifications during the period, 224 of which in 2007, or a detection rate of 3.8/1,000 live births, 244 (4.5/1,000 live births) in 2008, and 198 (4.0/1,000 live births) in 2009. Table 1 shows the pregnant women's demographic and clinical data. Most were brown/mixed-race (75.1%), less than 30 years old (80.6%), and had low schooling (66.2%). Sixty-four percent of notifications were for women residing in Manaus, the State capital. Staging of the disease showed 56.8% classified as primary syphilis, 82.9% with a reactive VDRL test at notification, and 58.7% treated with single-dose benzathine penicillin G, 2.4 million units.

Cases of congenital syphilis

A total of 486 cases of congenital syphilis were notified to SINAN from 2007 to 2009 in the Amazonas State, of which 153 cases were in 2007, or an incidence rate of 2.1/1,000 live births, 193 (2.6/1,000) in 2008, and 140 (2.0/1,000) in 2009. Seventy-eight per cent of notifications referred to mothers residing in the State capital. In 252 reports of congenital syphilis (51.9%), the diagnosis of maternal syphilis occurred late (at childbirth or post-miscarriage curettage), while 144 (29.6%) cases were diagnosed during prenatal care. Only

17% of the women were adequately treated. Less than one-fourth of the mothers' partners were treated (Table 2). Only 25 infants were reported as symptomatic at notification, 56.6% presented reactive peripheral blood VDRL, 20.6% underwent long-bone x-rays, and 6% cerebrospinal fluid analysis for syphilis (Table 2).

Deaths related to congenital syphilis

The SIM listed 4,905 perinatal deaths from 2007 to 2009 in Amazonas State, of which 57.8% were stillbirths. Of the total, only six presented congenital syphilis coded as A50 (ICD-10), five as the underlying causes and one as an associated cause. The proportion of stillbirths from congenital syphilis was 0.04%.

Probabilistic record linkage

After probabilistic record linkage between the databases for syphilis in pregnancy and congenital syphilis, 237 pregnant women (35.6%) were found with resulting cases of congenital syphilis notified during the period, of which 3 women were recorded twice, in different years, and were thus considered as 2 cases of diagnosis of syphilis in pregnancy, resulting in 2 cases of congenital syphilis in distinct periods (Figure 1).

Probabilistic linkage of the SIM and SINAN-Congenital Syphilis databases yielded 13 cases in which the mother's name was recorded on both the Death Certificate and the notification of congenital syphilis. Nine were stillbirths, none of these made any mention of congenital syphilis among the causes leading to death, and only two cases were notified in the SINAN-Congenital Syphilis database. Two cases of early neonatal deaths were in the SINAN database, one of which with congenital syphilis as the underlying cause and another as associated cause; a third early neonatal death was not notified, although congenital syphilis was listed as the underlying cause of death (Figure 2). Meanwhile, of the 20 cases listed as stillbirths in the SINAN-Congenital Syphilis database, only two were located in the SIM.

Estimated underreporting of syphilis in pregnancy and congenital syphilis

Approximately 60% of the women diagnosed with syphilis in pregnancy were treated with single-dose penicillin G, considered inadequate for controlling congenital syphilis. One could thus expect 25% of these mothers to transmit the disease, with an additional 100 cases of congenital syphilis during the period.

Table 1

Distribution of cases of syphilis in pregnancy in SINAN (Information System on Diseases of Notification) according to demographic and clinical variables. Amazonas State, Brazil, 2007-2009 (n = 666).

Variable	Cases	%
Age bracket (years)		
≤ 19	170	25,6
20-29	366	55,0
30-39	119	17,8
≥ 40	11	1,6
Race/Color		
White	87	13,1
Black	37	5,6
Asian	10	1,5
Brown/Mixed race	500	75,1
Indigenous	17	2,5
Missing	15	2,2
Schooling		
Illiterate	13	1,9
Primary	428	64,3
Secondary	122	18,4
Missing	103	15,4
Clinical classification		
Primary syphilis	378	56,8
Secondary syphilis	51	7,6
Latent syphilis	83	12,5
Tertiary syphilis	15	2,2
Missing	139	20,9
Nontreponemal test (VDRL)		
Reactive	552	82,9
Non-reactive	32	4,8
Not performed	58	8,7
Missing	24	3,6
Treponemal test		
Reactive	181	27,2
Non-reactive	34	5,1
Not performed	384	57,7
Missing	67	10,0
Treatment regimen		
Penicillin G benzathine 2.4 million units	391	58,7
Penicillin G benzathine 4.8 million units	77	11,6
Penicillin G benzathine 7.2 million units	97	14,6
Other regimen	17	2,5
Not performed	53	7,9
Missing	31	4,7

Source: Brazilian Ministry of Health, SINAN-Amazonas State, data subject to revision.

Meanwhile, some 50% of mothers of cases of congenital syphilis were not reported, which could have added 243 cases of syphilis in pregnancy during the period.

Discussion

The current study showed far fewer reported cases of pregnant women with syphilis than estimat-

Table 2

Distribution of cases of congenital syphilis notified to the SINAN (Information System on Diseases of Notification) according to infant and maternal variables. Amazonas State, Brazil, 2007-2009 (n = 486).

Variable	Cases	%
Prenatal care		
Yes	327	67.3
No	149	30.7
Missing	10	2.0
Adequate maternal treatment		
Yes	81	16.7
No	338	69.5
Missing	67	13.8
Treatment of partner		
Yes	117	24.1
No	326	67.1
Missing	43	8.8
Symptomatic at diagnosis		
Yes	25	5.1
No	101	20.8
Missing	360	73.1
Peripheral blood VDRL		
Reactive	275	56.6
Non-reactive	104	21.4
Not performed/Missing	107	22.0
Long-bone x-rays		
Yes	100	20.6
No	325	66.9
Missing	61	12.5
Cerebrospinal fluid analysis		
Yes	29	6.0
No	422	86.8
Missing	35	6.2
Final classification of case		
Early congenital syphilis	405	83.3
Late congenital syphilis	13	2.7
Miscarriage	7	1.4
Stillbirth	20	4.2
Discarded	41	8.4

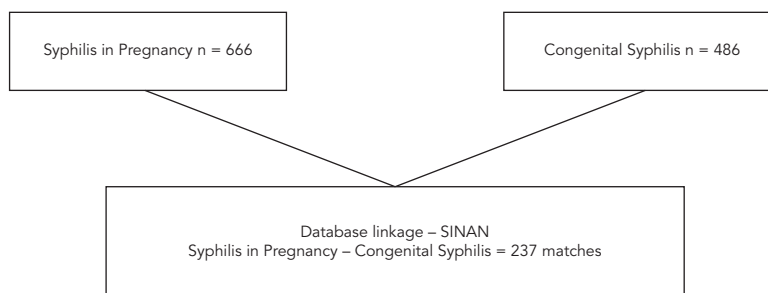
Source: Brazilian Ministry of Health, SINAN-Amazonas State, data subject to revision.

ed for the North of Brazil in 2004³, or some 1,200 pregnant women per year. Meanwhile, the study found an incidence rate of congenital syphilis ranging from 2.0 to 2.6 cases per 1,000 live births in the State of Amazonas, still above the target of elimination of the disease and indicating possible flaws in primary care¹⁷. In Brazil, congenital syphilis is still an important health problem, with rates around 2.0 per 1,000 live births in the study period¹⁶, thus highlighting the need for a high-priority policy for its control¹⁸.

The characteristics of the pregnant women reported with syphilis feature the high proportion of cases of primary syphilis (56.8%). The primary lesion (hard chancre) in women almost always presents with internal genital localization², and most cases of syphilis in pregnancy are diagnosed in the latent phase, without signs or symptoms, only through serological screening with the nontreponemal test (VDRL)¹⁹. Logically, one would not expect such a diagnostic percentage of chancre in women submitted to serological

Figure 1

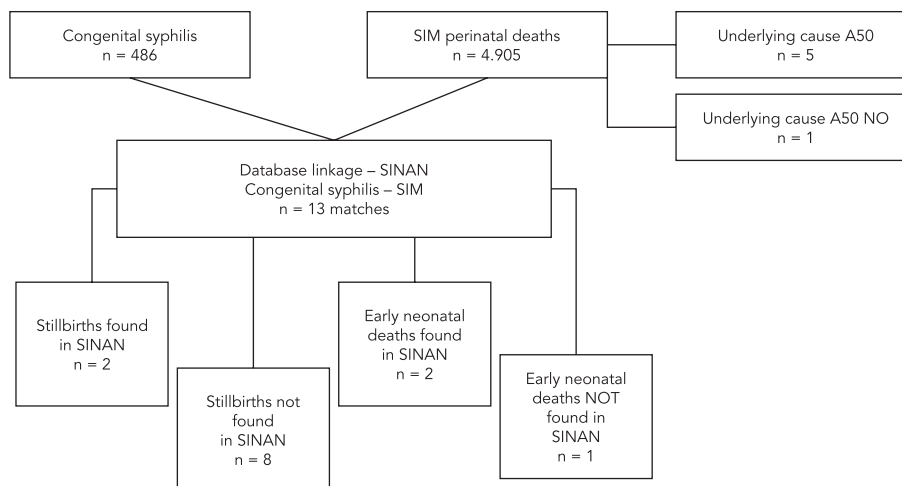
Result of probabilistic record linkage between the SINAN-Syphilis in Pregnancy and SINAN-Congenital Syphilis databases. Amazonas State, Brazil, 2007-2009.



SINAN: Information System on Diseases of Notification.

Figure 2

Result of linkage between the SINAN-Congenital Syphilis and MIS databases. Amazonas State, Brazil, 2007-2009.



SIM: Mortality Information System; SINAN: Information System on Diseases of Notification.

screening tests for diseases with risk of vertical transmission. In addition, since most of the women were probably treated inadequately, we were not able to assess treatment of the partners²⁰. When verifying the quality of the mother's treatment in the report of congenital syphilis, the failure becomes evident since only 16.7% of the women received adequate treatment, even

though 67.3% attended prenatal care. For the same years in Brazil as a whole, slightly more than 70% of mothers reported having attended prenatal care¹⁶.

As for cases of congenital syphilis reported in Amazonas State, 1.4% were classified as miscarriage due to syphilis and 4.2% as syphilitic stillbirth. In the year 2007, Brazil showed 1.7% as

miscarriage and 12.3% as stillbirth¹⁶. In a study in the city of Nova Iguaçu, Rio de Janeiro State, 11.7% of recorded stillbirths were related to maternal syphilis²¹. In the current study, only 5.1% of cases were symptomatic at birth, a very low proportion, which should lead to immediate case investigation based on the Brazilian national protocol^{5,22}. However, the data showed a low rate of long-bone x-rays (20.6%) and an even lower rate of cerebrospinal fluid analysis (6%) to assess involvement of the central nervous system.

Probabilistic record linkage of the databases found 237 women with syphilis in pregnancy whose newborns were also reported to the SINAN-Congenital Syphilis database during the same period. This corresponds to 35.6% of the pregnant women that were reported. One would not expect that all cases of syphilis in pregnancy would be followed by notification of congenital syphilis, since adequate treatment of the pregnant woman and partner should avoid the case¹⁸. Still, as discussed above, adequate treatment was only provided in a very low proportion of the pregnant women with syphilis, suggesting that there was underreporting of congenital syphilis, approximately 100 cases in the current study, as shown in another study in Rio de Janeiro²³. Meanwhile, not all the mothers had been reported in the SINAN-Syphilis in Pregnancy database.

Considering the detection rate for syphilis in pregnancy of approximately 2 per 1,000, the proportion of stillbirths due to syphilis was extremely low (0.04%). The World Health Organization considers a proportion of less than 2% tolerable²⁴. Of the 20 cases recorded as stillbirths in the SINAN-Congenital Syphilis database, only 2 were located in SIM. Many stillbirths are not claimed for burial by the families at the maternity hospitals and may not receive a Death Certificate. However, with the establishment of Committees for the Investigation of Infant and Fetal Mortality²⁵, all such cases should be investigated, and when necessary an "epidemiological" death certificate should be issued to permit burial.

In this study, probabilistic record linkage of different databases containing data on congenital syphilis was a useful tool for evaluating the quality of information contained in these large national systems. In general, probabilistic record linkage is important for monitoring target events^{26,27,28,29} or for upgrading information in different databases^{13,30}.

The use of secondary databases such as SINAN and SIM may not reflect the total magnitude of the respective diseases, given the need for adequate completion of notification forms and/or death certificates according to the prevailing national protocols and by responsible health professionals. Nevertheless, these health information systems can provide the basis for monitoring and analyzing the health situation in municipalities and states, with a view towards health planning and management.

Final remarks

Two issues are essential for a better understanding of the current study's findings and their extension to other locations. The first is adequate prenatal care provided in the municipalities and states, where diagnosis and treatment of syphilis in pregnancy can be the sentinel event for the quality of services, avoiding cases of congenital syphilis. The current study's findings corroborate this issue. The second issue is training for health professionals in epidemiological surveillance and for physicians in the completion of death certificates, in addition to the implementation of inquiries into stillbirths and infant deaths according to Ministry of Health criteria. With the development of more reliable information systems with broader coverage, the analysis of the health situation can contribute more robustly to the control of diseases such as syphilis.

Resumen

El estudio describe el perfil de las notificaciones de sífilis en mujeres embarazadas y sífilis congénita en la Amazonía entre 2007 y 2009, analizando el sub-registro en las bases de datos del Sistema Nacional de Enfermedades de Declaración Obligatoria (SINAN) y la ocurrencia de muertes perinatales, asociadas con sífilis congénita no declarada el Sistema de Información sobre la Mortalidad (SIM). Se trata de un estudio transversal de relación entre SINAN y SIM. Hubo 666 notificaciones de sífilis en mujeres embarazadas, y 224 en 2007 (tasa de detección de 3,8/1.000 nacidos vivos), 244 (4,5/1.000) en 2008 y 198 (4,0/1.000) en 2009. Así como 486 casos de sífilis congénita, 153 (incidencia: 2,1/1.000) en 2007, 193 (2,6/1.000) en 2008 y 140 (2,0/1.000) en 2009. Después de registrar la vinculación –SINAN, 237 (35,6%) mujeres habían reportado casos de sífilis congénita. Estaba presente en 4.905 de muertes perinatales, y en un 57,8% del feto. Se determinó la asociación de SIM/SINAN sífilis congénita –en 13 registros coincidentes. El uso de SIM SINAN puede no reflejar toda la magnitud de la sífilis, pero constituye la base para el seguimiento y análisis de la situación de salud, con vistas a la planificación y gestión.

Sífilis; Sífilis Congénita; Embarazo; Bases de Datos Estadísticos

Contributors

C. M. O. Soeiro, A. E. Miranda, V. Saraceni, S. Talhari, and L. C. L. Ferreira contributed to the article's elaboration, revision, and corrections. M. C. Santos collaborated in the article's elaboration and correction.

References

1. Goldenberg RL, Culhane JE, Johnson DC. Maternal infection and adverse fetal and neonatal outcomes. *Clin Perinatol* 2005; 32:523-59.
2. Sanchez PJ, Wendel GD. Syphilis in pregnancy. *Clin Perinatol* 1997; 24:71-90.
3. Departamento Nacional de DST, Aids e Hepatites Virais, Secretaria de Vigilância em Saúde, Ministério da Saúde. Dados epidemiológicos sífilis em gestantes. *Boletim Epidemiológico AIDS e DST* 2010; 1:34-6.
4. Schmid G. Economic and programmatic aspects of congenital syphilis prevention. *Bull World Health Organ* 2004; 82:402-9.
5. Secretaria de Assistência à Saúde/Secretaria de Vigilância em Saúde, Ministério da Saúde. Plano operacional – redução da transmissão vertical do HIV e da sífilis. Brasília: Ministério da Saúde; 2007.
6. Saraceni V, Leal MC. Avaliação da efetividade das campanhas para eliminação da sífilis congênita na redução da morbi-mortalidade perinatal. *Município do Rio de Janeiro, 1999-2000. Cad Saúde Pública* 2003; 19: 1341-9.
7. Brasil. Portaria nº 542 de 22 de dezembro de 1986. *Diário Oficial da República Federativa do Brasil* 1986; 24 dez.
8. Paz LC, Pereira GI, Matida LH, Saraceni V, Ramos Jr. AN. Vigilância epidemiológica da sífilis no Brasil: definição de casos, 2004. *Boletim Epidemiológico AIDS e DST* 2004; XVII:10-5.
9. Departamento de Vigilância Epidemiológica, Secretaria de Vigilância em Saúde, Ministério da Saúde. Sistema de Informação de Agravos de Notificação – SINAN: normas e rotinas. Brasília: Ministério da Saúde; 2007.

10. Ministério da Saúde. Portaria MS/SVS nº 33, de 15 de julho de 2005. Diário Oficial da República Federativa do Brasil 2005; 15 jul.
11. Ministério da Saúde. Manual de procedimentos do Sistema de Informações sobre Mortalidade. Brasília: Fundação Nacional de Saúde/Ministério da Saúde; 2001.
12. Saraceni V, Guimarães MHSE, Theme Filha MM, Leal MC. Mortalidade perinatal por sífilis congênita: indicador da qualidade da atenção à mulher e à criança. *Cad Saúde Pública* 2005; 21:1244-50.
13. Newcombe HB, Kennedy JM, Axford SJ, James AP. Automatic linkage of vital records. *Science* 1959; 130:954-9.
14. Silveira DP, Artmann E. Acurácia em métodos de relacionamento probabilístico de bases de dados em saúde: revisão sistemática. *Rev Saúde Pública* 2009; 43:875-82.
15. Camargo Jr. KR, Coeli CM. *Reclink*: aplicativo para o relacionamento de bases de dados, implementando o método *probabilistic record linkage*. *Cad Saúde Pública* 2000; 16:439-47.
16. Departamento Nacional de DST, Aids e Hepatites Virais, Secretaria de Vigilância em Saúde, Ministério da Saúde. Boletim Epidemiológico de Sífilis 2012; 1:3-8.
17. Secretaria de Políticas de Saúde, Ministério da Saúde. Sífilis congênita: diretrizes para o controle. Brasília: Ministério da Saúde; 2010.
18. Saraceni V, Miranda AE. Relação entre a cobertura da Estratégia Saúde da Família e o diagnóstico de sífilis na gestação e sífilis congênita. *Cad Saúde Pública* 2012; 28:490-6.
19. Krakauer Y, Pariente G, Sergienko R, Wiznitzer A, Sheiner E. Perinatal outcome in cases of latent syphilis during pregnancy. *Int J Gynaecol Obstet* 2012; 118:15-7.
20. Hildebrand VLPC. Sífilis congênita: fatores associados ao tratamento das gestantes e seus parceiros [Dissertação de Mestrado]. Rio de Janeiro: Escola Nacional de Saúde Pública Sergio Arouca; Fundação Oswaldo Cruz; 2010.
21. Nascimento MI, Cunha AA, Guimarães EV, Alvarez FS, Oliveira SR, Villas Bôas EL. Gestações complicadas por sífilis materna e óbito fetal. *Rev Bras Ginecol Obstet* 2012; 34:56-62.
22. Departamento de Atenção Básica, Secretaria de Atenção Básica, Ministério da Saúde. HIV/Aids, hepatites e outras DST. Brasília: Ministério da Saúde; 2006. (Cadernos de Atenção Básica, 18).
23. Saraceni V, Vellozo VRO, Leal MC, Hartz ZMA. Estudo da confiabilidade do SINAN a partir das campanhas para a eliminação da sífilis congênita no município do Rio de Janeiro. *Rev Bras Epidemiol* 2005; 8:419-24.
24. Blencowe H, Cousens S, Kamb M, Berman S, Lawn JE. Lives saved tool supplement detection and treatment of syphilis in pregnancy to reduce syphilis related stillbirths and neonatal mortality. *BMC Public Health* 2011; 11 Suppl 3:S9.
25. Secretaria de Vigilância em Saúde/Secretaria de Atenção à Saúde, Ministério da Saúde. Manual de vigilância do óbito infantil e fetal e do Comitê de Prevenção do Óbito Infantil e Fetal. Brasília: Ministério da Saúde; 2009.
26. Zingmond DS, Ye Z, Ettner SL, Liu H. Linking hospital discharge and death records accuracy and sources of bias. *J Clin Epidemiol* 2004; 57:21-9.
27. Coutinho ESE, Coeli CM. Acurácia da metodologia de relacionamento probabilístico de registros para identificação de óbitos em estudos de sobrevivência. *Cad Saúde Pública* 2006; 22:2249-52.
28. Rogot E, Sorlie P, Johnson NJ. Probabilistic methods in matching census samples to the National Death Index. *J Chronic Dis* 1986; 39:719-34.
29. van den Bragt PA, Schouten L, Gold-Bohm RA, Dorant E, Hunen PMH. Development of a record linkage protocol for use in the Dutch Cancer Registry for epidemiological research. *Int J Epidemiol* 1990; 19:553-8.
30. Coutinho RGM, Coeli CM, Faerstein E, Chor D. Sensibilidade do linkage probabilístico na identificação de nascimentos informados: Estudo Pró-Saúde. *Rev Saúde Pública* 2008; 42:1097-100.

Submitted on 24/Oct/2012

Final version resubmitted on 21/Jun/2013

Approved on 10/Oct/2013