Published in final edited form as:

Sex Transm Dis. 2018 September ; 45(9) : S23–S28. doi:10.1097/OLQ.0000000000000838.

Use of National Syphilis Surveillance Data to Develop a Congenital Syphilis Prevention Cascade and Estimate the Number of Potential Congenital Syphilis Cases Averted

Sarah Kidd, MD, MPH, Virginia B. Bowen, PhD, MHS, Elizabeth A. Torrone, PhD, MSPH, Gail Bolan, MD

Division of STD Prevention, Centers for Disease Control and Prevention, Atlanta, GA

Abstract

Background: Recent increases in reported congenital syphilis have led to an urgent need to identify interventions that will have the greatest impact on congenital syphilis prevention. We sought to create a congenital syphilis prevention cascade using national syphilis surveillance data to (1) estimate the proportion of potential congenital syphilis cases averted with current prevention efforts and (2) develop a classification framework to better describe why reported cases were not averted.

Methods: We reviewed national syphilis and congenital syphilis case report data from 2016, including pregnancy status of all reported female syphilis cases and data on prenatal care, testing, and treatment status of mothers of reported congenital syphilis cases to derive estimates of the proportion of pregnant women with syphilis who received prenatal care, syphilis testing, and adequate syphilis treatment at least 30 days before delivery, as well as the proportion of potential congenital syphilis cases averted.

Results: Among the 2508 pregnant women who were reported to have syphilis, an estimated 88.0% received prenatal care at least 30 days before delivery, 89.4% were tested for syphilis at least 30 days before delivery, and 76.9% received an adequate treatment regimen that began at least 30 days before delivery. Overall, an estimated 1928 (75.0%) potential congenital syphilis cases in the United States were successfully averted. Among states that reported at least 10 syphilis cases among pregnant women, the estimated proportion of potential congenital syphilis cases averted ranged from 55.0% to 92.3%.

Conclusions: Although the majority of potential congenital syphilis cases in the United States were averted in 2016, there was substantial geographic variation, and significant gaps in delivering timely prenatal care, syphilis testing, and adequate treatment to pregnant women with syphilis were identified. The congenital syphilis prevention cascade is a useful tool to quantify programmatic successes and identify where improvements are needed.

Congenital syphilis is caused by mother-to-child transmission of *Treponema pallidum* infection during pregnancy. Transmission can occur during any trimester of pregnancy and

Correspondence: Sarah Kidd, MD, MPH, 1600, Clifton Rd, NE, MS E-63, Atlanta, GA 30329-4027. hgk9@cdc.gov.

The findings and conclusions in this manuscript are those of the authors and do not necessarily represent views of the Centers for Disease Control and Prevention.

during any stage of syphilis.^{1–3} However, the risk of transmission is highest during early syphilis (primary, secondary, or early latent syphilis).¹ Untreated syphilis during pregnancy can result in adverse pregnancy outcomes, including miscarriage, stillbirth, or infant death, as well as prematurity and low birth weight.^{2–5} Live-born infants with syphilitic infection can develop clinical manifestations that involve multiple organ systems, including disorders of the liver, blood, skeletal system, eye, and central nervous system.^{2,3,6} Historical data demonstrate that untreated early syphilis in pregnant women, if acquired during the 4 years before delivery, can lead to fetal infection in up to 80% of cases and may result in stillbirth or infant death in up to 40% of cases.¹ Infected infants can also be asymptomatic at birth, but if not treated can develop clinical manifestations later in life.^{2,3,7,8}

Congenital syphilis is preventable. Treatment with the long-acting, injectable penicillin (ie, benzathine penicillin G) regimen that is appropriate for the mother's stage of syphilis can prevent stillbirths and fetal infection if initiated as early as possible during pregnancy and, if initiated at least 30 days before delivery, effectively prevents morbidity in live-born infants.^{9–11} For this reason, the Centers for Disease Control and Prevention (CDC), the American Academy of Pediatrics, and the American College of Obstetricians and Gynecologists all recommend universal syphilis screening for all pregnant women at the first prenatal visit.^{11,12} In addition, for women who are at high risk for syphilis or live in areas of high syphilis morbidity, these organizations recommend repeat screening early in the third trimester and again at delivery. Pregnant women who are found to be infected should receive prompt treatment with the benzathine penicillin G regimen that is appropriate for the stage of syphilis and should be followed closely for the duration of the pregnancy to ensure that there is an appropriate serologic response to treatment and no indication of treatment failure or reinfection.

Despite the availability of an effective intervention, the rate of reported congenital syphilis has increased substantially in the United States since 2012.¹³ During 2012 to 2016, the national congenital syphilis rate increased 86.9%, from 8.4 to 15.7 reported cases per 100,000 live births.¹³ In 2016, there were 628 congenital syphilis cases reported in the United States, including 41 reported syphilitic stillbirths, 4 reported infant deaths, and 254 neonates with reported clinical findings consistent with infection (CDC, unpublished data). Congenital syphilis rates tend to mirror primary and secondary (P&S) syphilis rates among women of reproductive age, and the national P&S syphilis rate among women of reproductive age increased 100.0% during 2012–2016, from 2.1 to 4.2 reported cases per 100,000 females aged 15 to 44 years (CDC, unpublished data).

The recent increases in reported congenital syphilis and female P&S syphilis have led to renewed focus on congenital syphilis prevention and an urgent need to identify clinical and programmatic interventions that would have the greatest impact on congenital syphilis prevention. A key step towards developing effective interventions is gaining a clear understanding of where current prevention efforts are succeeding and where they could be strengthened. The HIV care continuum has been a useful tool to visualize the proportion of persons living with HIV who have received clinical services necessary to achieve the goal of viral suppression (eg, diagnosed, engaged in care, prescribed antiretroviral therapy).¹⁴ A similar model has been developed to visualize and evaluate health department sexually

transmitted disease (STD) control activities, such as treatment verification and contact elicitation.¹⁵ A congenital syphilis prevention cascade could help visualize the essential services required to prevent congenital syphilis among pregnant women and could help identify opportunities for improvement along the prevention pathway. In addition, a congenital syphilis prevention cascade could also help quantify programmatic successes by describing the number of potential congenital syphilis cases averted each year.

We sought to create a congenital syphilis prevention cascade using data available in the national syphilis and congenital syphilis surveillance databases. With this cascade, we aimed to better estimate the national proportion and number of potential congenital syphilis cases averted with current prevention efforts in 2016 and to begin to develop a classification framework to better describe why reported cases of congenital syphilis were not averted.

MATERIALS AND METHODS

Data Sources

We extracted female syphilis and congenital syphilis case report data from the National Notifiable Diseases Surveillance System, the system through which CDC receives notifiable STD data from all 50 states and the District of Columbia. The syphilis case report data are received as deidentified, line-listed data that include demographic information, stage of syphilis (primary, secondary, early latent, and late or late latent cases), and other variables, such as pregnancy status, if ascertained. These data do not include data on prenatal care, treatment, or pregnancy outcomes. The congenital syphilis case report data are received as deidentified, line-listed data that include information about the mother's prenatal care, testing, and treatment during pregnancy, as well as clinical information about the neonate. Because syphilis and congenital syphilis case reports are deidentified before transmission to CDC, a pregnant female syphilis case in the syphilis database cannot be linked to a specific case of congenital syphilis in the congenital syphilis database. We examined the national syphilis case report data to obtain the number of reported cases of syphilis (any stage) in 2016 that were female and known to be pregnant. Because vertical transmission of *T. pallidum* can occur during any stage of maternal syphilis,^{1–3,11} all reported pregnant female cases with any stage of syphilis were included in the analysis. We examined the national congenital syphilis cases report data to obtain the number of reported congenital syphilis cases in 2016.

Definitions and Assumptions

To create the congenital syphilis prevention cascade, we estimated the proportion of pregnant women with syphilis who received prenatal care at least 30 days before delivery, the proportion that were tested for syphilis during pregnancy and at least 30 days before delivery, the proportion who received an adequate treatment regimen for their stage of syphilis that began at least 30 days before delivery, and the proportion of pregnant women with syphilis for whom a potential case of congenital syphilis was averted. The number of congenital syphilis cases *not* averted was assumed to be the number of reported congenital syphilis cases. Cases of congenital syphilis were defined according to the Council of State and Territorial Epidemiologists and CDC surveillance case definition, which includes (1)

infants with physical signs or laboratory findings that are characteristic of congenital syphilis, and also (2) any infants or stillbirths born to infected mothers who did not receive an adequate treatment regimen for their stage of syphilis that began at least 30 days before delivery.¹³ Among reported congenital syphilis cases, we assessed the number of mothers of cases who received any prenatal care, syphilis testing, and adequate syphilis treatment during pregnancy at least 30 days before delivery. Prenatal care at least 30 days before delivery was defined as any documentation in the congenital syphilis case report data of any prenatal care at least 30 days before delivery. Testing for syphilis at least 30 days before delivery was defined as any reported syphilis test with a date that occurred during pregnancy and at least 30 days before delivery. Adequate treatment was defined in accordance with the CDC STD Treatment Guidelines¹¹: reported receipt of a penicillin-based regimen that was appropriate for the mother's stage of syphilis that began at least 30 days before delivery. For the purposes of this analysis, mothers lacking pertinent documentation of any of the above services were considered not to have received that service.

Because pregnant female syphilis cases are not linked to cases of congenital syphilis in the national database, and because pregnancy outcomes are not included in the female syphilis case report data, the creation of a congenital syphilis cascade that included all reported pregnant female syphilis cases required multiple assumptions. For the purposes of this analysis, we assumed that all mothers of reported congenital syphilis cases were reported as pregnant cases of syphilis in the syphilis case report database. We also assumed that outcomes of pregnant women with reported syphilis were accurately reported, so that all infants that met the surveillance definition of congenital syphilis were reported as cases of congenital syphilis, and infants that did not meet the case definition were not reported. In addition, we assumed that 1 infant was born to each pregnant woman with syphilis, and that there were no miscarriages, terminations, or multiple gestations. Finally, because adequate maternal treatment at least 30 days before delivery is included in the congenital syphilis case definition, to populate the intermediate steps of the cascade, we assumed that if a potential congenital syphilis case was averted, then the mother received prenatal care, syphilis testing, and adequate treatment at least 30 days before delivery.

Calculations for the Cascade and Potential Congenital Syphilis Cases Averted

The proportion of pregnant women with syphilis who received each of the intermediate services in the cascade (ie, prenatal care, syphilis testing, and adequate syphilis treatment) was calculated by subtracting the number of reported congenital syphilis cases whose mother did not have documentation that they received that service from the total number of reported pregnant women with syphilis; this number was then divided by the total number of reported pregnant women with syphilis. The number of potential congenital syphilis cases averted was calculated by subtracting the number of reported congenital syphilis cases from the number of reported pregnant women with syphilis. This number was then divided by the total number of reported pregnant women with syphilis to calculate the proportion of potential congenital syphilis cases averted.

RESULTS

In 2016, there were 14,838 reported cases of syphilis (any stage) among women in the United States. Of these, 2508 (16.9%) were known to be pregnant, 9315 (62.8%) were not pregnant, and 3015 (20.3%) were reported with unknown or missing pregnancy status.

Congenital Syphilis Prevention Cascade and Estimate of Potential Cases Averted

Among the 2508 pregnant women with reported syphilis, an estimated 2208 (88.0%) received prenatal care at least 30 days before delivery, 2242 (89.4%) were tested for syphilis at least 30 days before delivery, and 1928 (76.9%) received a treatment regimen that was adequate for their stage of syphilis and was initiated at least 30 days before delivery (Fig. 1). Overall, an estimated 1928 (75.0%) potential congenital syphilis cases in the United States were successfully averted in 2016.

The estimated proportion of potential congenital syphilis cases averted varied by state (Fig. 2). In 2016, 47 states and the District of Columbia reported at least 1 case of syphilis in a pregnant woman (range, 1–492 cases), with 32 of those 47 states reporting at least 10 cases of syphilis among pregnant women. Among the 32 states that reported at least 10 cases of syphilis among pregnant women, the estimated proportion of potential congenital syphilis cases averted ranged from 55.0% to 92.3%.

Description of Missed Opportunities for Prevention Among Mothers of Reported Congenital Syphilis Cases

Nationwide, there were 628 reported cases of congenital syphilis in the United States in 2016 (Fig. 3, Table 1). Among the mothers of the reported cases of congenital syphilis, 328 (52.2%) had documentation that they received any prenatal care at least 30 days before delivery; 30 (4.8%) received prenatal care but the first visit occurred fewer than 30 days before delivery, 166 (26.4%) did not receive any prenatal care, and 104 (16.6%) had unknown prenatal care status.

Overall, 362 (57.6%) mothers of reported congenital syphilis cases were tested for syphilis during pregnancy and at least 30 days before delivery, including 277 mothers who received prenatal care at least 30 days before delivery and 85 mothers who did not (ie, 85 mothers who appeared to be tested for syphilis outside of the prenatal care system) (Fig. 3, Table 1). Among the 266 (42.4%) mothers of cases who were not tested for syphilis at least 30 days before delivery, most ($n = 215$; 80.8% of those not tested at least 30 days before delivery; 34.2% of all cases) also lacked any documented prenatal care at least 30 days before delivery. However, 51 of these mothers (19.2% of those not tested at least 30 days before delivery; 8.1% of all cases) had at least 1 prenatal care visit at least 30 days before delivery.

Upon review of treatment status, 48 (7.6%) mothers of reported congenital syphilis cases received a treatment regimen that was adequate for their stage of syphilis and was initiated at least 30 days before delivery, and 580 (92.4%) did not (Fig. 3, Table 1). The most common reason for not receiving adequate treatment that was initiated at least 30 days before delivery was lack of testing at least 30 days before delivery ($n = 266$; 45.9% of those not adequately treated; 42.4% of all cases). In contrast, 101 (17.4% of those not adequately treated; 16.1%

of all cases) were tested for syphilis at least 30 days before delivery, but had a negative test result at that time and subsequently seroconverted and had a positive test result later in pregnancy or at delivery. These mothers apparently acquired syphilitic infection during pregnancy, after the initial syphilis test. Eighty-eight mothers (15.2% of those not adequately treated; 14.0% of all cases) were tested for syphilis at least 30 days before delivery, had a positive test result, but did not receive treatment at least 30 days before delivery. Twenty-three mothers (4.0% of those not adequately treated; 3.7% of all cases) had a positive test result and initiated treatment for syphilis at least 30 days before delivery, but received an inadequate regimen.

Among the 48 reported congenital syphilis cases born to mothers who received an adequate treatment regimen that began at least 30 days before delivery, 11 were reported as congenital syphilis cases because their mothers had serologic evidence of treatment failure or reinfection, and 31 (including 7 who had mothers with serologic evidence of treatment failure or reinfection) were born with physical examination ($n = 1$), x-ray ($n = 8$), or cerebrospinal fluid ($n = 25$) findings that were consistent with the congenital syphilis surveillance case definition; 13 cases were reported with insufficient data to determine why they were cases.

DISCUSSION

We created a congenital syphilis prevention cascade using data available in the national syphilis and congenital syphilis surveillance databases. A conceptual congenital syphilis prevention cascade has been described previously,¹⁶ but, to our knowledge, the cascade presented here is the first report of a congenital syphilis prevention cascade that includes national data for the United States. This national cascade highlights that the majority (75.0%) of potential congenital syphilis cases in the United States were successfully averted in 2016. This estimate is comparable to Matthias et al's¹⁷ calculation that 78% of potential congenital syphilis cases were averted in Louisiana and Florida during 2013 to 2014. Each of these averted cases is the result of clinical and programmatic interventions that successfully identified and treated a pregnant woman with syphilis. Interestingly, there was substantial variation in the estimated proportion of potential cases averted by state. Among states that reported at least 10 syphilis cases among pregnant women, the estimated proportion of potential congenital syphilis cases averted ranged from 55.0% to 92.3%. This suggests that these data could be used to identify state and local programs that are doing well at preventing potential cases of congenital syphilis, and might point toward specific clinical and/or programmatic activities that are associated with a higher proportion of potential cases averted.

The cascade also indicates where congenital syphilis prevention efforts need to be strengthened. From the cascade, it is apparent that the largest gaps in prevention services are (1) at entry into early prenatal care, and (2) between early testing and timely, adequate treatment. Nationally, we estimated that 12.0% of pregnant women with syphilis did not receive prenatal care at least 30 days before delivery, and 12.5% of pregnant women with syphilis were tested for syphilis at least 30 days before delivery but did not receive an adequate treatment regimen that began at least 30 days before delivery. Data on the

underlying reasons for lack of early prenatal care are not available in the national case report surveillance data, and might vary by geographic area. However, data from the reported congenital syphilis cases indicate that the gap between testing and adequate treatment is multifactorial. The most common factors contributing to this gap were (1) failure to initiate timely treatment in pregnant women with a positive syphilis test and (2) newly acquired syphilitic infections among pregnant women who had tested negative for syphilis infection earlier in pregnancy. A less common, but not insignificant, reason for this gap was use of an inadequate maternal treatment regimen, which includes use of a nonrecommended treatment regimen (ie, non-penicillin regimen) or failure to complete the recommended treatment regimen. These data underscore the challenges and complexity of congenital syphilis prevention, as well as the importance of using local data to appropriately prioritize local programmatic interventions.

These data and this analysis have limitations. Owing to underascertainment and underreporting of syphilitic infections and pregnancy status, surveillance data likely underestimate the true number of syphilitic infections among pregnant women in the country. In addition, surveillance for congenital syphilis is particularly challenging because there is no widely available test that reliably distinguishes passive transfer of maternal antibodies from true syphilitic infection in asymptomatic infants. The current surveillance definition for congenital syphilis is designed to be sensitive, and so includes infants who were exposed to syphilitic infection but likely were not truly infected. However, it is also likely that some cases of congenital syphilis, particularly syphilitic stillbirths, are never diagnosed or reported.^{18,19} Underascertainment or under-reporting of syphilis cases among pregnant women would lead to an underestimate of the proportion of potential congenital syphilis cases averted. Conversely, underascertainment or underreporting of congenital syphilis cases or syphilitic stillbirths would lead to an overestimate of the proportion of potential congenital syphilis cases averted.

Even among the cases that are reported, analysis of surveillance data is limited by incomplete data on prenatal care, testing, and treatment among mothers of reported congenital syphilis cases. It is therefore possible that the surveillance data underestimate the number of mothers of congenital syphilis cases who truly received each of these services. In addition, the inability to link pregnant women with syphilis to specific congenital syphilis cases in the national data meant that it was necessary to make certain assumptions about pregnancy outcomes and completeness of reporting to create a full cascade. Depending on the completeness of reporting for pregnant women with syphilis relative to the completeness of reporting for congenital syphilis cases, these assumptions could overestimate or underestimate the proportion of pregnant women with syphilis who received prenatal care, syphilis testing, and adequate syphilis treatment during pregnancy, as well as the proportion of potential congenital syphilis cases averted.

Despite these limitations, these data and the use of a cascade to visualize these data are useful. At the national level, an estimated 75% of potential congenital syphilis cases were successfully averted in 2016, which means that an estimated 1928 potential cases were successfully averted through current clinical and programmatic efforts. Especially if used at a local level, the congenital syphilis prevention cascade can help quantify programmatic

successes and identify where improvements are needed. State and local health departments are able to link maternal and infant records, and likely have access to more detailed and complete epidemiologic and clinical data than are available at the national level. Therefore, jurisdictions with substantial congenital syphilis morbidity should be encouraged to create and examine their own cascades to visualize their pregnant female syphilis and congenital syphilis data, and to identify potential targets for programmatic intervention. Several jurisdictions have already started to examine their Strengthened surveillance for congenital syphilis and pregnant women with syphilis would improve data quality and optimize the utility of the cascade. For example, high morbidity jurisdictions could establish a syphilis pregnancy registry, as has been established for Zika virus infection²⁰ or hepatitis B infection,²¹ to better quantify pregnancy complications and outcomes related to syphilitic infection during pregnancy. State and local health departments should be encouraged to share these data with stakeholders, including colleagues in maternal and child health, policy makers, and communities, to build partnerships and address the complexities of congenital syphilis prevention. Finally, state and local health departments should be encouraged to use these congenital syphilis cascade data to help prioritize and allocate resources for congenital syphilis prevention.

REFERENCES

1. Ingraham NR Jr. The value of penicillin alone in the prevention and treatment of congenital syphilis. *Acta Derm Venereol Suppl (Stockh)* 1950; 31(Suppl. 24):60–87.
2. Sánchez PJ, Wendel GD. Syphilis in pregnancy. *Clin Perinatol* 1997; 24:71–90. [PubMed: 9099503]
3. Shafii T, Radolf JD, Sánchez PJ. Congenital syphilis In: Holmes KK, Sparling PF, Stamm WE, eds. *Sexually Transmitted Diseases*. 4th ed. New York, NY: McGraw-Hill, 2008:1577–1612.
4. Gomez GB, Kamb ML, Newman LM, et al. Untreated maternal syphilis and adverse outcomes of pregnancy: A systematic review and meta-analysis. *Bull World Health Organ* 2013; 91:217–226. [PubMed: 23476094]
5. Qin J, Yang T, Xiao S, et al. Reported estimates of adverse pregnancy outcomes among women with and without syphilis: A systematic review and meta-analysis. *PLoS One* 2014; 9:e102203. [PubMed: 25025232]
6. Kaufman RE, Jones OG, Blount JH, et al. Questionnaire survey of reported early congenital syphilis: Problems in diagnosis, prevention, and treatment. *Sex Transm Dis* 1977; 4:135–139. [PubMed: 594857]
7. Dorfman DH, Glaser JH. Congenital syphilis presenting in infants after the newborn period. *N Engl J Med* 1990; 323:1299–1302. [PubMed: 2215616]
8. Rawstron SA, Jenkins S, Blanchard S, et al. Maternal and congenital syphilis in Brooklyn, NY. Epidemiology, transmission, and diagnosis. *Am J Dis Child* 1993; 147:727–731. [PubMed: 8322741]
9. Alexander JM, Sheffield JS, Sanchez PJ, et al. Efficacy of treatment for syphilis in pregnancy. *Obstet Gynecol* 1999; 93:5–8. [PubMed: 9916946]
10. Wendel GD Jr, Sheffield JS, Hollier LM, et al. Treatment of syphilis in pregnancy and prevention of congenital syphilis. *Clin Infect Dis* 2002; 35(Suppl 2):S200–S209. [PubMed: 12353207]
11. Workowski KA, Bolan GA. Centers for Disease Control and Prevention. Sexually transmitted diseases treatment guidelines, 2015. *MMWR Recomm Rep* 2015; 64:1–137.
12. American Academy of Pediatrics, American College of Obstetricians and Gynecologists, and March of Dimes Birth Defects Foundation. Guidelines for Perinatal Care. 8th ed. Elk Grove Village, IL: American Academy of Pediatrics; Washington, DC: The American College of Obstetrics and Gynecology; 2017.

13. Centers for Disease Control and Prevention. Sexually Transmitted Disease Surveillance 2016. Atlanta: U.S. Department of Health and Human Services, 2017.
14. Bradley H, Hall HI, Wolitski RJ, et al. Vital signs: HIV diagnosis, care, and treatment among persons living with HIV—United States, 2011. *MMWR Morb Mortal Wkly Rep* 2014; 63:1113–1117. [PubMed: 25426654]
15. Murphy RD, Wohl AR, Ma Y, et al. Adaptation of the HIV care continuum as a method for evaluating syphilis and gonorrhea disease control activities in Los Angeles County. *Sex Transm Dis* 2015; 42: 686–690. [PubMed: 26562697]
16. Economic Schmid G. and programmatic aspects of congenital syphilis prevention. *Bull World Health Organ* 2004; 82:402–409. [PubMed: 15356931]
17. Matthias JM, Rahman MM, Newman DR, et al. Effectiveness of prenatal screening and treatment to prevent congenital syphilis, Louisiana and Florida, 2013–2014. *Sex Transm Dis* 2017; 44: 498–502.
18. Winscott M, Taylor MM, Kenney K. Identifying unreported and undiagnosed cases of congenital syphilis in Arizona using live birth and fetal death registries. *Sex Transm Dis* 2010; 37:244–247. [PubMed: 20023596]
19. Patel CG, Huppert JS, Tao G. Provider adherence to syphilis testing recommendations for women delivering a stillbirth. *Sex Transm Dis* 2017; 44:685–690; epub ahead of print. [PubMed: 28876321]
20. Centers for Disease Control and Prevention. US Zika pregnancy registry [CDC website]. 8 30, 2017 Available at: <https://www.cdc.gov/zika/reporting/registry.html>. Accessed September 17, 2017.
21. Schillie S, Walker T, Veselsky S, et al. Outcomes of infants born to women infected with hepatitis B. *Pediatrics* 2015; 135:e1141–e1147. [PubMed: 25896839]

Figure 1.

Estimated proportion of pregnant women with syphilis ($n = 2508$) who received congenital syphilis prevention services and estimated proportion of potential congenital syphilis cases prevented, United States, 2016.

Figure 2.

Estimated proportion of potential congenital syphilis cases averted by state, among states with at least 10 reported cases of syphilis (any stage) among pregnant women in 2016.

Figure 3.

Categorization of mothers of reported congenital syphilis cases (n = 628) by prenatal care, syphilis testing, and syphilis treatment status, United States, 2016. * “No” includes all cases that were reported without documentation that their mothers received prenatal care, testing for syphilis, or adequate treatment for syphilis 30 days before delivery, respectively, in the congenital syphilis case report data.

TABLE 1.

Description of Missed Opportunities for Prevention Among Mothers of Reported Congenital Syphilis Cases (n = 628), United States, 2016

	N	%
Prenatal care		
Received any prenatal care 30 d before delivery	328	52.2%
No documented prenatal care 30 d before delivery	300	47.8%
First prenatal care was <30 d before delivery	30	4.8%
No prenatal care	166	26.4%
Unknown prenatal care status	104	16.6%
Testing		
Tested for syphilis 30 d before delivery	362	57.6%
Not tested for syphilis 30 d before delivery	266	42.4%
Received any prenatal care 30 d before delivery	51	8.1%
No documented prenatal care 30 d before delivery	215	34.2%
Treatment		
Received adequate treatment for syphilis that began 30 d before delivery	48	7.6%
Did not receive adequate treatment for syphilis that began 30 d before delivery	580	92.4%
Not tested 30 d before delivery	266	42.4%
Negative test 30 d before delivery, seroconversion during pregnancy	101	16.1%
Positive test 30 d before delivery, but not treated 30 d before delivery	88	14.0%
Positive test and treated 30 d before delivery, but with inadequate regimen	23	3.7%
Other/unknown*	102	16.2%

* Includes 45 mothers who were tested 30 days before delivery, but had unknown or missing test result data; 34 mothers who had a positive syphilis test result 30 days before delivery, but had unknown or missing treatment status; and 23 mothers who had a positive test result and were treated 30 days before delivery, but had unknown or missing data on adequacy of regimen.