

Prenatal and Congenital Syphilis in the US: Characterizing Screening and Treatment

Protocol

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Table of Contents

1	Abstract.....	4
2	Rationale and background	4
3	Research question and objectives.....	6
4	Research methods	7
4.1	Study design	7
4.2	Setting	7
4.2.1	Study population.....	7
4.3	Question 1: What proportion of pregnant individuals are tested for syphilis in pregnancy?	10
4.3.1	Study inclusion and exclusion criteria:.....	12
4.3.2	Variables	13
4.4	Question 2: What proportion of pregnant individuals diagnosed with syphilis are treated for syphilis in pregnancy, and when?	18
4.4.1	Study inclusion and exclusion criteria:.....	20
4.4.2	Variables	21
4.5	Question 3: Are infants born to mothers with syphilis diagnosis in pregnancy tested and treated in the first 30 days of life?	25
4.5.1	Study inclusion and exclusion criteria:.....	26
4.5.2	Variables	27
4.6	Data sources	30
4.6.1	Context and rationale for data sources	30
4.7	Data management	30
4.8	Quality control	30
5	Limitation of the methods.....	30
6	Protection of human subjects.....	31
7	References	32
1	Appendices	35
	Table A1. Codes to identify syphilis testing.....	35
	Table A2. Codes to identify syphilis diagnosis in pregnant individuals	36
	Table A3. Codes to identify primary, secondary, or early latent stage syphilis in pregnant individual	39

Table A4. Codes to identify late latent, tertiary, other, or unknown stage syphilis in the pregnant individual.....	40
Table A5. Codes to identify congenital syphilis diagnosis in infants.....	43
Table A6. Codes to identify HIV diagnosis.....	44
Table A7. Codes to identify chlamydia diagnosis.....	45
Table A8. Codes to identify gonorrhea diagnosis.....	46
Table A9. Codes to identify parental care visits.....	48
Table A10. Codes to identify benzathine G penicillin.....	51
Table A11. Codes to identify penicillin G procaine.....	51
Table A12. Codes to identify ceftriaxone.....	51
Table A13. Codes to identify doxycycline.....	51
Table A14. Codes to identify tetracycline.....	51
Table A15. Codes to identify azithromycin.....	51
Table A16. Codes to identify erythromycin.....	51
Table A17. Codes to identify amoxicillin.....	51
Table A18. Codes to identify penicillin desensitization.....	51

History of Modifications

Version	Date	Modification	Author
1.0	01/30/2024	Original Version	Sentinel Operations Center
2.0	04/04/2024	<ol style="list-style-type: none"> 1. Modify definition of enrollment requirement to assess pregnancies that enroll during pregnancy 2. Add categorization of states/territories by policies requiring syphilis testing in pregnancy 3. Modify definition of syphilis diagnosis 4. Add covariate for receipt of pregnancy-related care in first trimester 5. Correct mistake in the definition for treatment occurring close to delivery in Question 2. Treatment occurring close to delivery should be defined as only occurring in the 30 days prior to delivery. Previously, it was defined as only occurring less than 30 days prior to delivery (i.e., in the 29 days prior to delivery). 	Sentinel Operations Center

1 Abstract

Cases of congenital syphilis have been rising in the US since 2011. Lack of adequate testing and treatment during pregnancy, often due to a lack of timely prenatal care, are the most commonly cited reasons for fetal transmission during pregnancy. In this study, we will assess syphilis screening and treatment during pregnancy and initial follow-up of infants (30 days after delivery) using nationwide data from publicly and privately insured pregnant individuals and their infants in the US. This analysis will be completed using the Sentinel System Distributed Data Network and Sentinel System analysis tools.

2 Rationale and background

Congenital syphilis is caused by transmission of syphilis from the pregnant individual to the fetus during pregnancy due to untreated or inadequately treated maternal syphilis. Syphilis during pregnancy may result in serious health outcomes including miscarriage, stillbirth, neonatal death, preterm birth, and low birth weight.¹ The risk of the fetus acquiring congenital syphilis depends on the stage of syphilis in pregnancy and ranges from 10-50% without treatment.¹ However, congenital syphilis is preventable if the pregnant individual is appropriately diagnosed and treated in pregnancy; treatment with benzathine penicillin G is close to 100% effective in preventing congenital syphilis if dosed and timed appropriately.^{1,2} From 2018 national case surveillance data, the most common reason observed for inability to prevent syphilis transmission in pregnancy was lack of adequate maternal treatment in pregnancy (31% of cases), followed by a lack of timely prenatal care and syphilis testing (28%).³ Therefore, identifying maternal syphilis cases early in pregnancy (ideally at the first prenatal care visit in first trimester) and screening patients at a high-risk for new infection during pregnancy is essential for ensuring adequate treatment and decreasing the risk of mother to child transmission.

Cases of congenital syphilis have been rising in the US since 2011.^{1,4} In an effort to prevent congenital syphilis, universal testing for syphilis in pregnancy is strongly recommended by the CDC and other national and international medical associations.^{1,5,6} As of 2021, 44 US states mandate syphilis testing at or soon after the first prenatal visit, 16 also require third trimester or delivery testing for all pregnancies, and 4 require third trimester or testing at the time of delivery only for high-risk pregnancies.^{7,8} Despite these mandates, there is evidence that prenatal testing is not meeting expectations.⁹⁻¹² Adequacy of prenatal care and syphilis testing varies by region and race/ethnicity, which contributes to disparities in congenital syphilis cases.³ Additionally, the majority of maternal and congenital syphilis cases occur in the Medicaid-insured population.^{13,14}

The only recommended treatment for syphilis in pregnancy is benzathine penicillin G.¹ Alternative antibiotics have been tested in non-pregnant populations but currently do not have any evidence to support their use in pregnancy.^{1,15,16} Pregnant individuals receiving antibiotic treatment other than benzathine penicillin G are considered to be inadequately treated. Among congenital syphilis cases in the US from 2008-2014, <1% were born to a mother treated with an alternative antibiotic.⁴ There is a lack of published data on the use of alternative antibiotics for syphilis in pregnancy.

Diagnosis of congenital syphilis is difficult as the majority of infants are asymptomatic at birth. Testing the infant at birth alone cannot identify congenital syphilis since the infant will have

transfer of maternal antibodies. Algorithms for determining the risk of congenital syphilis in newborns rely on infant serology with a comparison to maternal serology at delivery, maternal treatment in pregnancy (adequate, inadequate, or none), timing of maternal treatment (started before or after 30 days prior to delivery), newborn signs and symptoms, and placental pathologic evaluation.¹ Early treatment in asymptomatic infants lowers risk of later manifestation of symptoms;¹⁷ therefore, infants judged to be highly probable and possible cases are typically treated with penicillin at birth.¹⁸ There is a lack of data available to understand how infants are tested and treated for congenital syphilis at birth.

Recent studies have used administrative data to assess syphilis testing rates in pregnancy in select states and regions in the US. Between 2017-2021 in southern US states, first trimester testing rates were 41-64%; third trimester testing was performed in less than 50% of the pregnancies.^{10,11} Testing was also found to be low at delivery for stillbirth, occurring in less than 10% of stillbirth cases among both publicly and privately insured pregnant individuals in 2012-2013.¹⁹ However, there is a lack of more recent data from across the US on syphilis testing rates. Little is known about the uptake of repeat testing, which would occur at 28 weeks and delivery, as recommended for high-risk pregnant individuals.⁵ Trends in the use and timing of treatment during pregnancy and infant follow-up have not been examined in a large, population-based study. Administrative claims data are useful for understanding trends in testing and treatment of syphilis in pregnancy and in infants across the US. Therefore, the objective of this study is to understand whether syphilis testing guidelines during pregnancy are followed across the US using data from privately and publicly insured pregnant individuals and their infants. Additionally, this study will evaluate the patterns of syphilis therapy during pregnancy to assess compliance with treatment guidelines.

3 Research question and objectives

Table 1a: Primary research questions and objectives for Question 1

Question 1	What proportion of pregnant individuals are tested for syphilis in pregnancy?
Objective:	To estimate the proportion of pregnant individuals who are tested for syphilis in pregnancy (tested at any time, in each trimester, at end of pregnancy) and who have repeat testing in pregnancy (1 st and 2 nd trimesters; 3 rd trimester; end of pregnancy period). In addition, testing will be described by calendar year, state screening policies, age, race/ethnicity, receipt of first trimester prenatal care, receipt of first trimester pregnancy-related care, other sexually transmitted diseases (STD) in pregnancy, syphilis or other STDs prior to pregnancy, birth outcome, preterm birth, and private vs public insurance status. We will vary the length of maternal enrollment required prior to delivery to include individuals who enrolled after pregnancy start.
Population (mention key inclusion-exclusion criteria):	All pregnant patients aged 10-55 years at the end of pregnancy with a live birth, stillbirth, or spontaneous abortion with various enrollment requirements.
Outcome:	Syphilis testing identified using procedure codes.

Table 1b: Primary research questions and objectives for Question 2

Question 2	What proportion of syphilis-diagnosed pregnant individuals are treated for syphilis in pregnancy, and when?
Objective:	To estimate the proportion of syphilis-diagnosed pregnant individuals who are treated for syphilis in pregnancy with benzathine penicillin G and with alternative non-recommended treatments, the gestational timing of their treatment with benzathine penicillin G (before or after 30 days prior to end of pregnancy), and the time between syphilis testing and treatment initiation. The proportion of patients with evidence of penicillin desensitization will also be estimated. Stratification will be by calendar year, age, race/ethnicity, first trimester prenatal care, first trimester pregnancy-related care, other STDs in pregnancy, syphilis or other STDs prior to pregnancy, syphilis stage (primary/secondary/early latent vs late latent/tertiary/other/unknown), birth outcome, preterm birth, and private vs public insurance status.
Population (mention key inclusion-exclusion criteria):	All pregnant individuals aged 10-55 years at the end of pregnancy with a live birth, stillbirth, or spontaneous abortion and continuous enrollment from last menstrual period (LMP) through end of pregnancy. Syphilis-diagnosed patients will be identified by presence of a procedure code for syphilis testing and a diagnosis code for syphilis (that does not occur on the same date as a testing code) during pregnancy.
Outcome:	Antibiotic treatment for syphilis (benzathine penicillin G, and other non-recommended alternatives: procaine penicillin G, ceftriaxone, doxycycline, tetracycline, azithromycin, erythromycin, and amoxicillin), timing of benzathine penicillin G, and days between treatment with benzathine penicillin G and testing in pregnancy

Table 1c: Primary research questions and objectives for Question 3

Question 3	Are infants born to pregnant individuals with syphilis diagnosis in pregnancy tested and treated in the first 30 days of life?
Objective:	To estimate the proportion of infants who are tested for syphilis or treated with penicillin among those born to pregnant individuals with syphilis testing and diagnosis in pregnancy. Stratify by private vs public insurance status, other demographics, and pregnancy treatment parameters (treated with benzathine penicillin G, treated with alternative antibiotics, treated before or after 30 days prior to delivery).
Population (mention key inclusion-exclusion criteria):	Singleton live born infants linked to pregnant individuals aged 10-55 years at the time of delivery with a live birth. Pregnant individuals must have a syphilis testing code and diagnosis code during pregnancy. Infants must be enrolled at birth and for 30 days after birth.
Outcome:	Antibiotic treatment for syphilis in the newborn (aqueous crystalline penicillin), identified through procedure codes and medication dispensings. Syphilis testing identified through procedure codes.

4 Research methods

4.1 Study design

We will use a cohort study design to conduct this descriptive study. The cohort study design allows for identification of the population of pregnant individuals or infants of interest for further follow-up. All pregnancies and infants (where applicable) that meet enrollment criteria will be followed for the outcome variables.

4.2 Setting

4.2.1 Study population

Pregnancies will be identified at the end of pregnancy event; therefore, the index date (time 0) will be the end of pregnancy date. After identification of the pregnancy outcome, a washout period will be applied during which no other pregnancy outcome can occur (length of washout varies by pregnancy outcome). This allows inclusion of multiple pregnancies per individual without including overlapping pregnancy periods identified by coding errors. The estimated date of last menstrual period (LMP) will also be used as a time anchor for outcome and covariate definitions. The LMP will be estimated using a validated algorithm for assignment of gestational age at end of pregnancy using diagnosis codes indicative of weeks of gestation, pre-term or post term codes without gestational age information, prenatal screening tests, and codes indicating trimester of pregnancy or prenatal visits during pregnancy.²⁰ The estimated gestational age at end of pregnancy will be used to count back from the end of pregnancy date to estimate the LMP date. Trimester-specific dates can then be estimated from the LMP date, assuming the first trimester includes days 0 to 97, the second trimester includes days 98 to 195, and the third trimester includes days 196 through the pregnancy outcome date.

Infant records will be used for Question 3. Infants are linked to live birth deliveries by each data site using family subscriber ID and other information, including names and addresses, when linkage is not made by subscriber ID.

Table 2. Operational definition of time 0 (index date) and other primary time anchors

Study population name(s)	Time anchor	Number of entries	Type of entry	Washout window	Care setting	Code Type	Dx position	Incident with respect to...	Measurement characteristics/validation	Source of algorithm
Pregnant individuals	End of pregnancy date	Multiple pregnancies per individual are allowed	Incident	180 days	Inpatient	ICD-9 dx and px, ICD-10 dx and px, CPT	Any	Previous pregnancy outcome	Percent agreement with obstetric claims: Live births: 100% Stillbirths: 70.8% Spontaneous abortion: 100%	Moll et al. ²¹
Infants	Date of birth (delivery)	1	NA	NA	Inpatient deliveries	NA	NA	NA	No validation study	NA

4.3 Question 1: What proportion of pregnant individuals are tested for syphilis in pregnancy?

Table 3. Analysis specification, Question 1

Descriptive outcome:	Syphilis testing
Analytic software:	SAS 9.4
Populations:	<ol style="list-style-type: none"> 1. Pregnancies with continuous enrollment from LMP through end of pregnancy+7 days 2. Pregnancies with enrollment starting between LMP and LMP+97 and continuing through end of pregnancy+7 days 3. Pregnancies with enrollment starting between LMP+98 and LMP+195 and continuing through end of pregnancy+7 days
Descriptive statistics:	<p>We will estimate the following parameters in each population:</p> <ol style="list-style-type: none"> 1. Proportion of all pregnancies with <u>any</u> testing in pregnancy (excluding end of pregnancy date) 2. Proportion of all pregnancies with <u>any</u> testing in first trimester 3. Proportion of all pregnancies with <u>any</u> testing in second trimester 4. Proportion of all pregnancies with <u>any</u> testing in third trimester 5. Proportion of all pregnancies with <u>any</u> testing at end of pregnancy (+7 days) 6. Proportion of all pregnancies with <u>repeat testing</u>, defined as testing in first/second trimester and in third trimester (not including end of pregnancy date) 7. Proportion of all pregnancies with <u>repeat testing</u>, defined as testing in first/second trimester and in third trimester and at end of pregnancy date (+7 days) 8. Proportion of all pregnancies with <u>first time</u> testing by gestational week, from week 1-week 42 <p>The denominator for each assessment will be the total number of pregnancies identified according to enrollment criteria. For populations 2-3, the number of pregnancies continuously enrolled during certain parameter windows will be less than the total number of pregnancies identified (e.g., if continuous enrollment is required to start between LMP and LMP+97, pregnancies included will have varying lengths of observed enrollment in first trimester [LMP to LMP+97]).</p>
Missing data methods:	We will assume that if no clinical codes indicative of a condition or procedure are in the claims data, then the patient did not have the condition or procedure.
Subgroup analyses:	<p>Parameters 1-7 will be estimated within the following subgroups:</p> <ul style="list-style-type: none"> • End of pregnancy year • State groupings based on syphilis testing policies • Race • Hispanic • Age at end of pregnancy • 1st trimester prenatal care visit

	<ul style="list-style-type: none">• 1st trimester pregnancy-related care• STD/syphilis prior to pregnancy• Other STD in pregnancy• Birth outcome• Preterm birth• Insurance type (public or private)• Insurance type by end of pregnancy year
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4.3.1 Study inclusion and exclusion criteria:

Pregnancy outcomes including live birth, stillbirth, and spontaneous abortions will be included in the cohort. We will restrict to end of pregnancy events identified in inpatient settings. Pregnant individuals with eligible pregnancy outcomes will be required to have continuous medical and drug insurance enrollment for various periods, as specified in Table 4. The continuous eligibility window will extend to 7 days past the end of pregnancy date to capture events related to the end of pregnancy.

Table 4. Operational definitions of inclusion and exclusion criteria, Question 1

Criterion	Details	Assessment window	Care settings	Code type	Diagnosis position	Applied to study populations	Measurement characteristics/ validation	Source for algorithm
Pregnancies ended with a live birth, stillbirth, or spontaneous abortion		NA	Inpatient	ICD-9 dx and px, ICD-10 dx and px, CPT	Any	Pregnant individuals	Percent agreement with obstetric claims: Live births: 100% Stillbirths: 70.8% Spontaneous abortion: 100%	Moll et al. ²¹
Observable time, throughout pregnancy	Medical and drug coverage required for population 1	LMP to pregnancy end date+7	NA	NA	NA	Pregnant individuals	NA	NA
Observable time, from 2 nd trimester through end of pregnancy	Medical and drug coverage required for population 2	LMP+98 to pregnancy end date+7	NA	NA	NA	Pregnant individuals	NA	NA
Observable time, from 3 rd trimester through end of pregnancy	Medical and drug coverage required for population 3	LMP+196 to pregnancy end date+7	NA	NA	NA	Pregnant individuals	NA	NA
Age 10-55 yrs		At pregnancy end date	NA	NA	NA	Pregnant individuals	NA	NA

4.3.2 Variables

4.3.2.1 Descriptive outcomes

Table 5. Operational definitions of descriptive outcomes, Question 1

Outcome name	Details	Type of outcome	Assessment window	Washout window	Care settings	Code type	Diagnosis position	Applied to study populations	Outcome measurement characteristics/validation	Source
Maternal syphilis testing in pregnancy	Any testing code for syphilis in pregnancy at any time in pregnancy (not including the end of pregnancy date)	Binary	LMP to pregnancy end date-1	NA	Any	Procedure codes	Any	Pregnant individuals	No validation study	Code search and refs ¹⁰⁻¹²
Maternal syphilis testing in 1 st trimester	Any testing code for syphilis in pregnancy at any time in 1 st trimester	Binary	LMP to LMP+97	NA	Any	Procedure codes	Any	Pregnant individuals	No validation study	Code search and refs ¹⁰⁻¹²
Maternal syphilis testing in 2 nd trimester	Any testing code for syphilis in pregnancy at any time in 2 nd trimester	Binary	LMP+98 to LMP+195	NA	Any	Procedure codes	Any	Pregnant individuals	No validation study	Code search and refs ¹⁰⁻¹²
Maternal syphilis testing in 3 rd trimester	Any testing code for syphilis in pregnancy at any time in 3 rd trimester	Binary	LMP+196 to pregnancy end date-1	NA	Any	Procedure codes	Any	Pregnant individuals	No validation study	Code search and refs ¹⁰⁻¹²
Maternal syphilis testing at	Any testing code for syphilis in pregnancy at end of	Binary	End of pregnancy date to pregnancy end date+7	NA	Any	Procedure codes	Any	Pregnant individuals	No validation study	Code search and refs ¹⁰⁻¹²

Outcome name	Details	Type of outcome	Assessment window	Washout window	Care settings	Code type	Diagnosis position	Applied to study populations	Outcome measurement characteristics/validation	Source
end of pregnancy	pregnancy (+7 days)									
First maternal syphilis testing in pregnancy	First testing code for syphilis in pregnancy, stratified by gestational week	Categorical	LMP to pregnancy end date-1, stratified by gestational week	From LMP	Any	Procedure codes	Any	Pregnant individuals	No validation study	Code search and refs ¹⁰⁻¹²
Maternal syphilis testing, repeat testing	Any testing code for syphilis appearing in each of the following windows of pregnancy: 1 st or 2 nd trimester and 3 rd trimester	Binary	LMP to pregnancy end date-1	NA	Any	Procedure codes	Any	Pregnant individuals	No validation study	Code search and refs ¹⁰⁻¹²
Maternal syphilis testing, repeat testing	Any testing code for syphilis appearing in each of the following windows of pregnancy: 1 st or 2 nd trimester and 3 rd trimester and at end of pregnancy	Binary	LMP to pregnancy end date+7	NA	Any	Procedure codes	Any	Pregnant individuals	No validation study	Code search and refs ¹⁰⁻¹²

4.3.2.2 Covariates

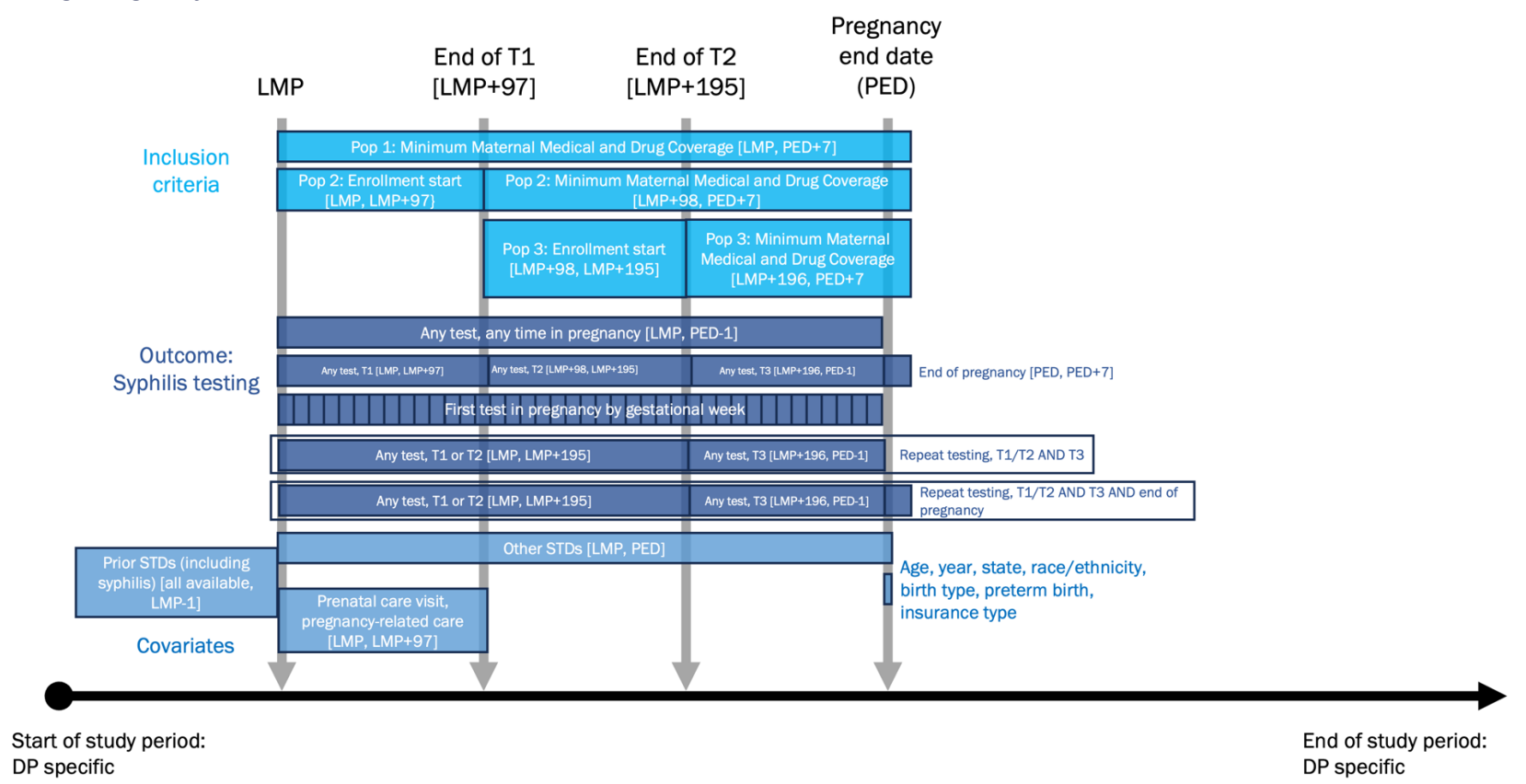
The following variables will be used to create subgroups for identification of the descriptive outcomes.

Table 6. Operational definitions of covariates, Question 1

Variable	Details	Type of variable	Assessment window	Care settings	Code type	Diagnosis position	Applied to study populations	Measurement characteristics/validation	Source for algorithm
Age	Age at end of pregnancy	Continuous	At pregnancy end date	NA	NA	NA	Pregnant individuals	NA	NA
Race	White, Black, Native Hawaiian or Pacific Islander, Native American or Alaska Native, Asian, Multiracial	Categorical	At pregnancy end date	NA	NA	NA	Pregnant individuals	No validation study	NA
Hispanic	Hispanic/Latino or non-Hispanic/Latino	Categorical	At pregnancy end date	NA	NA	NA	Pregnant individuals	No validation study	NA
Year	Year at end of pregnancy	Categorical	At pregnancy end date	NA	NA	NA	Pregnant individuals	NA	NA
State of birth requires syphilis screening in pregnancy	3 categories of US states and territories will be created: 1. Require syphilis screening in pregnancy 2. Do not require screening in pregnancy 3. Uncertain if screening is required	Categorical	At pregnancy end date	NA	NA	NA	Pregnant individuals	NA	Information on state policies from Warren et al., ⁷ Hollier et al., ²² and CDC ²³
State of birth requires repeat syphilis screening in pregnancy	3 categories of US states and territories will be created: 1. Require screening early AND late in pregnancy 2. Newly require screening early AND late in	Categorical	At pregnancy end date	NA	NA	NA	Pregnant individuals	NA	NA

Variable	Details	Type of variable	Assessment window	Care settings	Code type	Diagnosis position	Applied to study populations	Measurement characteristics/validation	Source for algorithm
	pregnancy during study period 3. Require screening in early pregnancy but not in late pregnancy								
Preterm birth	Gestational age at delivery <37 completed weeks	Categorical (preterm, term, postterm)	Within 7 days of the pregnancy end date	Any	ICD-9 and ICD-10 diagnosis	Any	Pregnant individuals	Sensitivity of term birth assignment: 98.3% Specificity of term birth assignment: 45.5%	Sentinel documentation and refs ^{20,24-26}
Other STDs in pregnancy	Diagnosis code for HIV, chlamydia, gonorrhea	Binary	LMP to pregnancy end date	Any	ICD-9 and ICD-10 diagnosis	Any	Pregnant individuals	Codes for chlamydia and gonorrhea have not been validated ²⁷	Code search and refs ¹¹
Prior STDs	Diagnosis code for syphilis, HIV, chlamydia, gonorrhea in all available history prior to pregnancy start	Binary	All available history to LMP	Any	ICD-9 and ICD-10 diagnosis	Any	Pregnant individuals	Codes for syphilis, chlamydia, and gonorrhea have not been validated ²⁷	Code search and refs ¹¹
1 st trimester prenatal care visit	Prenatal care visit occurring in the first trimester	Binary	LMP to LMP+97	Outpatient	ICD-9 and ICD-10 diagnosis	Any	Pregnant individuals	No validation study	Code search
1 st trimester pregnancy-related care	Visit in the first trimester with a code related to pregnancy	Binary	LMP to LMP+97	Outpatient	ICD-9 and ICD-10 diagnosis and procedure codes, CPT codes	Any	Pregnant individuals	No validation study	Code search

4.3.2.3 Design diagram for Question 1



4.4 Question 2: What proportion of pregnant individuals diagnosed with syphilis are treated for syphilis in pregnancy, and when?

Table 7. Analysis specification, Question 2

Descriptive outcome:	Syphilis treatment
Analytic software:	SAS 9.4
Populations:	<ol style="list-style-type: none"> 1. Pregnancies tested for syphilis and diagnosed with syphilis (any stage) during pregnancy, enrolled LMP through pregnancy end date+7 2. Pregnancies tested for syphilis, diagnosed with syphilis (any stage), enrolled LMP through pregnancy end date+7, and treated with benzathine penicillin G during pregnancy 3. Pregnancies tested for syphilis during pregnancy, diagnosed with syphilis (any stage) during pregnancy, enrolled LMP through end of pregnancy+7, and treated with benzathine penicillin G in the 30 days prior to pregnancy end date only
Descriptive statistics:	<p>We will estimate the following parameters in population 1:</p> <ol style="list-style-type: none"> 1. Proportion of all pregnancies with any treatment in pregnancy with the benzathine penicillin G 2. Proportion of all pregnancies with treatment with benzathine penicillin G in pregnancy before 30 days prior to pregnancy end date (LMP to pregnancy end date-31 days) 3. Proportion of all pregnancies with treatment with benzathine penicillin G in pregnancy on or after 30 days prior to end of pregnancy (pregnancy end date-30 days to pregnancy end date), and no prior benzathine penicillin G treatment prior to pregnancy end date-31 days 4. Proportion of all pregnancies with treatment in pregnancy with non-recommended alternative antibiotics (procaine penicillin G, ceftriaxone, doxycycline, tetracycline, azithromycin, erythromycin, and amoxicillin) and no use of benzathine penicillin G 5. Proportion of all pregnancies with penicillin desensitization procedure in pregnancy <p>We will estimate the following parameters in populations 2 and 3:</p> <ol style="list-style-type: none"> 6. The number of days between treatment start and the most recent prior date with a testing code.
Missing data methods:	We will assume that if no clinical codes indicative of a condition or procedure are in the claims data, then the patient did not have the condition or procedure.
Subgroup analyses	<p>Parameters 1-5 will be estimated within the following subgroups:</p> <ul style="list-style-type: none"> • End of pregnancy year • Race • Hispanic • Age at end of pregnancy • 1st trimester prenatal care visit • 1st trimester pregnancy-related care • STD/syphilis prior to pregnancy

	<ul style="list-style-type: none">• Other STD in pregnancy• Birth outcome• Preterm birth• Insurance type (public or private)• Insurance type by end of pregnancy year• Diagnosis of primary/secondary/early latent syphilis• Diagnosis of late latent/tertiary/other/unknown syphilis
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4.4.1 Study inclusion and exclusion criteria:

Pregnancy outcomes including live births, stillbirths, and spontaneous abortions will be included in the cohort. We will restrict to end of pregnancy events identified in inpatient settings. Pregnant individuals with eligible pregnancy outcomes will be required to have continuous medical and drug insurance enrollment from LMP through pregnancy end date+7 days. The continuous eligibility window will extend to 7 days past the pregnancy end date to capture events related to the end of pregnancy.

Table 8. Operational definitions of inclusion and exclusion criteria, Question 2

Criterion	Details	Assessment window	Care settings	Code type	Diagnosis position	Applied to study populations	Measurement characteristics/ validation	Source for algorithm
Pregnancies ended with a live birth, stillbirth, or spontaneous abortion		NA	Inpatient	ICD-9 dx and px, ICD-10 dx and px, CPT	Any	Pregnant individuals	Percent agreement with obstetric claims: Live births: 100% Stillbirths: 70.8% Spontaneous abortion: 100%	Moll et al. ²¹
Observable time, throughout pregnancy	Medical and drug coverage required	LMP to pregnancy end date+7	NA	NA	NA	Pregnant individuals	NA	NA
Age 10-55 yrs		At pregnancy end date	NA	NA	NA	Pregnant individuals	NA	NA
Syphilis testing in pregnancy	Any testing for syphilis in pregnancy	LMP to pregnancy end date+7	Any	CPT	NA	Pregnant individuals	No validation study	Code search and refs ¹⁰⁻¹²
Syphilis diagnosis in pregnancy	2 definitions will be implemented: 1. Diagnosis code for syphilis in pregnancy that does not occur on the same date as a syphilis testing code 2. 2+ diagnosis codes for syphilis	LMP to pregnancy end date+7	Any	ICD-9 dx, ICD-10 dx	Any	Pregnant individuals	No validation study	Code search

	in pregnancy that do not occur on the same date as a syphilis testing code								
Benzathine penicillin G in pregnancy	Benzathine penicillin G in record (additional inclusion criteria for population 2)	LMP to pregnancy end date+7	Any	Procedure codes, NDC codes	NA	Pregnant individuals	No validation study	Code search	
Benzathine penicillin G in ≤30 days prior to end of pregnancy only	Benzathine penicillin G in ≤30 days prior to end of pregnancy and no benzathine penicillin G at any other time in pregnancy (additional inclusion criteria for population 3)	Pregnancy end date-30 to pregnancy end date+7; washout LMP to pregnancy end date-31	Any	Procedure codes, NDC codes	NA	Pregnant individuals	No validation study	Code search	

4.4.2 Variables

4.4.2.1 Descriptive outcomes

Table 9. Operational definitions of descriptive outcomes, Question 2

Outcome name	Details	Type of outcome	Assessment window	Washout window	Care settings	Code type	Diagnosis position	Applied to study populations	Outcome measurement characteristics/ validation	Source
Benzathine penicillin G in pregnancy	Benzathine penicillin G in record during pregnancy	Binary	LMP to pregnancy end date+7	NA	Any	Procedure codes, NDC codes	NA	Pregnant individuals with syphilis testing code and syphilis diagnosis code (population 1)	No validation study	Code search
Benzathine penicillin G in pregnancy prior to 30 days	Benzathine penicillin G in record from LMP through 31 days prior to	Binary	LMP to pregnancy end date-31	LMP to pregnancy end date-31	Any	Procedure codes, NDC codes	NA	Pregnant individuals with syphilis testing code and syphilis	No validation study	Code search

Outcome name	Details	Type of outcome	Assessment window	Washout window	Care settings	Code type	Diagnosis position	Applied to study populations	Outcome measurement characteristics/ validation	Source
prior to end of pregnancy	pregnancy end date							diagnosis code (population 1)		
Benzathine penicillin G in ≤30 days prior to end of pregnancy only	Benzathine penicillin G in ≤30 days prior to end of pregnancy and no benzathine penicillin G at any other time in pregnancy	Binary	Pregnancy end date-30 to pregnancy end date+7	LMP to pregnancy end date-31	Any	Procedure codes, NDC codes	NA	Pregnant individuals with syphilis testing code and syphilis diagnosis code (population 1)	No validation study	Code search
Alternative antibiotics only in pregnancy	Procaine penicillin G, IV/IM ceftriaxone, oral doxycycline, oral tetracycline, oral azithromycin, oral erythromycin, or oral amoxicillin in record with a syphilis diagnosis code appearing within 30 days prior to the treatment start date; no benzathine penicillin G in pregnancy	Binary	LMP to pregnancy end date+7	Benzathine penicillin G: LMP to pregnancy end date+7	Any	Procedure codes, NDC codes	NA	Pregnant individuals with syphilis testing code and syphilis diagnosis code (population 1)	No validation study	Code search
Time between benzathine penicillin G treatment start and last test date	The number of days between the first date of benzathine penicillin G in pregnancy (defined above) and the most recent syphilis test (defined	Continuous	LMP to pregnancy end date+7	NA	Any	NA	NA	Pregnant individuals with syphilis testing code, syphilis diagnosis code, and benzathine penicillin G (population 2)	No validation study	Code search

Outcome name	Details	Type of outcome	Assessment window	Washout window	Care settings	Code type	Diagnosis position	Applied to study populations	Outcome measurement characteristics/ validation	Source
	above) in pregnancy									
Penicillin desensitization	Penicillin desensitization procedure codes	Binary	LMP to pregnancy end date+7	NA	Any	Procedure codes	NA	Pregnant individuals with syphilis testing code and syphilis diagnosis code (population 3)	No validation study	Code search

4.4.2.2 Covariates

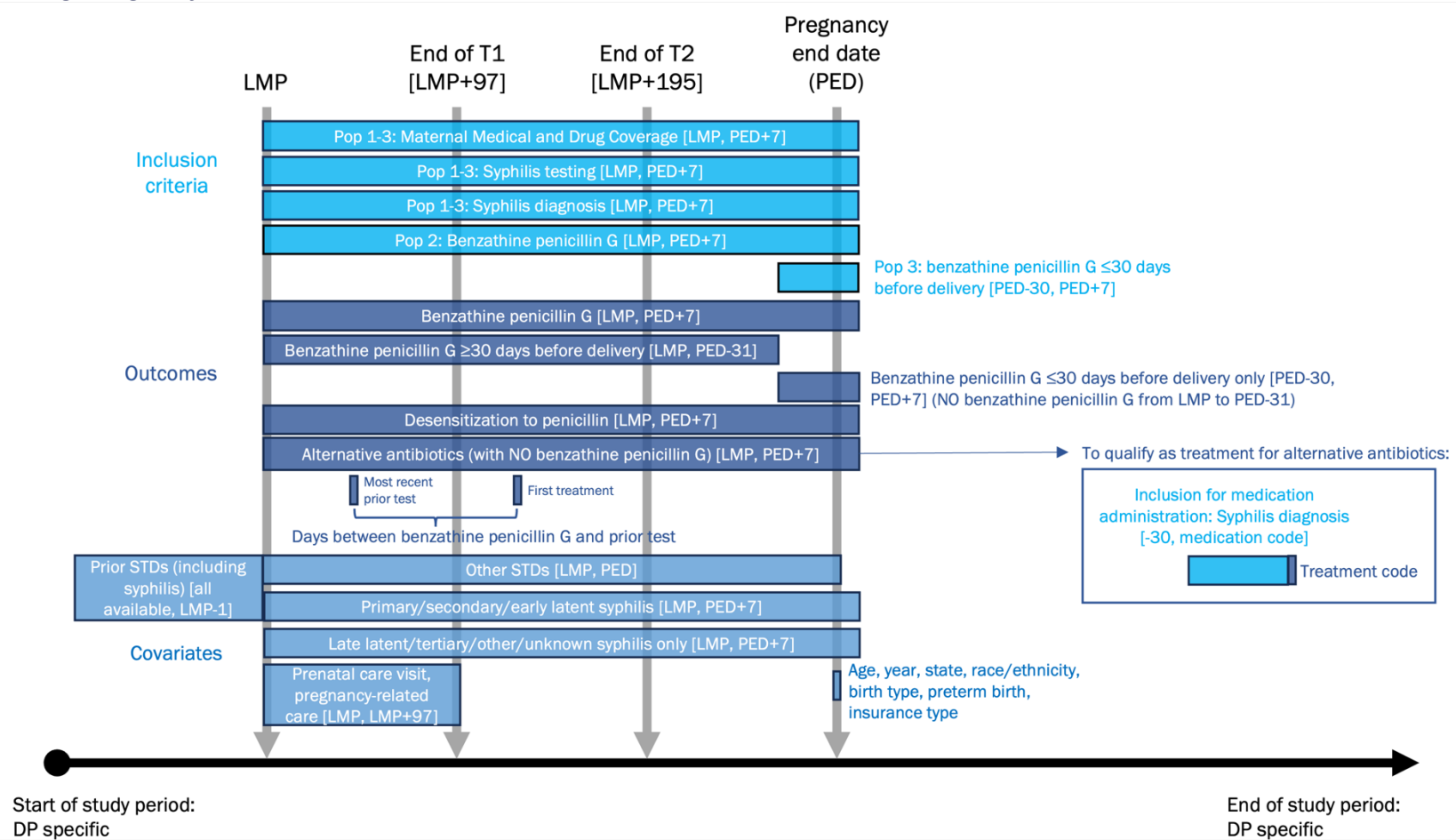
The following variables will be used to create subgroups for identification of the descriptive outcomes.

Table 10. Operational definitions of covariates, Question 2

Variable	Details	Type of variable	Assessment window	Care Settings	Code Type	Diagnosis Position	Applied to study populations	Measurement characteristics/ validation	Source for algorithm
Primary/secondary/early latent stage syphilis	Diagnosis code indicating primary/secondary/early latent syphilis in pregnancy	Binary	LMP to pregnancy end date+7	Any	ICD-9 and ICD-10	Any	Pregnant individuals	No validation study	Code search
Late latent/tertiary/other/unknown stage syphilis only	Diagnosis code indicating late latent/tertiary/other/unknown syphilis in pregnancy without any diagnosis code for primary/secondary/early latent syphilis in pregnancy	Binary	LMP to pregnancy end date+7	Any	ICD-9 and ICD-10	Any	Pregnant individuals	No validation study	Code search

Definitions for age, race, Hispanic, year, other STDs in pregnancy, prior STDs, 1st trimester prenatal care visit, and 1st trimester pregnancy-related care can be found in Table 6.

4.4.2.3 Design diagram for Question 2



4.5 Question 3: Are infants born to mothers with syphilis diagnosis in pregnancy tested and treated in the first 30 days of life?

Table 11. Analysis specification, Question 3

Descriptive outcome:	Congenital syphilis testing and treatment
Analytic software:	SAS 9.4
Population:	Infants born to pregnant individuals with a testing code for syphilis and a diagnosis code for syphilis (not occurring on the same day as a syphilis testing code) in pregnancy; two cohorts will be defined, with one requiring 1+ syphilis diagnosis code, and one requiring 2+ syphilis diagnosis codes; pregnant individuals will be required to be continuously enrolled for 90 days prior to delivery; infants will be required to be continuously enrolled from birth through 30 days of age
Descriptive statistics:	We will estimate the following parameters: <ol style="list-style-type: none"> 1. The proportion of infants tested for syphilis in the first 30 days of life 2. The proportion of infants treated for syphilis in the first 30 days of life
Missing data methods:	We will assume that if no clinical codes indicative of a condition or procedure are in the claims data, then the patient did not have the condition or procedure.
Subgroup analyses:	All parameters will be estimated within the following subgroups: <ul style="list-style-type: none"> • Insurance type (public or private) • Delivery year • Race • Hispanic • Preterm birth • Infants born to pregnant individuals who received benzathine penicillin G in pregnancy • Infants born to pregnant individuals who received treatment with non-recommended alternative antibiotics • Infants born to pregnant individuals who received benzathine penicillin G treatment ≤ 30 days prior to delivery

4.5.1 Study inclusion and exclusion criteria:

Infants linked to live birth deliveries will be included. Continuous medical and drug coverage from 90 days prior to delivery through 30 days after delivery will be required for the pregnant individuals.

Table 12. Operational definitions of inclusion and exclusion criteria, Question 3

Criterion	Details	Assessment window	Care settings	Code type	Diagnosis position	Applied to study populations	Measurement characteristics/validation	Source for algorithm
Pregnancies ended with a singleton live birth		NA	Inpatient	ICD-9 dx and px, ICD-10 dx and px, CPT	Any	Pregnant individuals	Live births: See Andrade et al ²⁸ for characteristics of live births.	Sentinel pregnancy algorithm ²⁹
Liveborn infants	Infants linked to delivery event	NA	NA	NA	NA	Infants	NA	NA
Observable time for pregnant individual	Medical and drug coverage required	90 days prior to delivery until 30 days after delivery	NA	NA	NA	Pregnant individuals	NA	NA
Observable infant time	Medical and drug coverage required	Delivery until 30 days after delivery	NA	NA	NA	Infants	NA	NA
Age 10-55 yrs		At delivery	NA	NA	NA	Pregnant individuals	NA	NA
Syphilis testing in pregnancy	Any testing for syphilis in pregnancy	LMP to delivery+7	Any	CPT	NA	Pregnant individuals	No validation study	Code search and refs ¹⁰⁻¹²
Syphilis diagnosis in pregnancy	2 definitions will be implemented: 1. Diagnosis code for syphilis in pregnancy that does not occur on the same date as a syphilis testing code 2. 2+ diagnosis codes for syphilis in pregnancy that do not occur on the same date as a syphilis testing code	LMP to delivery+7	Any	ICD-9 dx, ICD-10 dx	Any	Pregnant individuals	No validation study	Code search

4.5.2 Variables

4.5.2.1 Descriptive outcomes

Table 13. Operational definitions of descriptive outcomes, Question 3

Outcome name	Details	Type of outcome	Assessment window	Washout window	Care settings	Code type	Diagnosis position	Applied to study populations	Outcome measurement characteristics/ validation	Source
Infant congenital syphilis testing	Testing for congenital syphilis in first 30 days of life	Binary	Delivery date to delivery date+30	NA	Any	Procedure codes	Any	Liveborn infants	No validation study	Code search
Infant congenital syphilis treatment	Aqueous crystalline penicillin G code with congenital syphilis diagnosis code in first 30 days of life	Binary	Delivery date to delivery date+30	NA	Any	Procedure codes, NDC	NA	Liveborn infants	No validation study	Code search

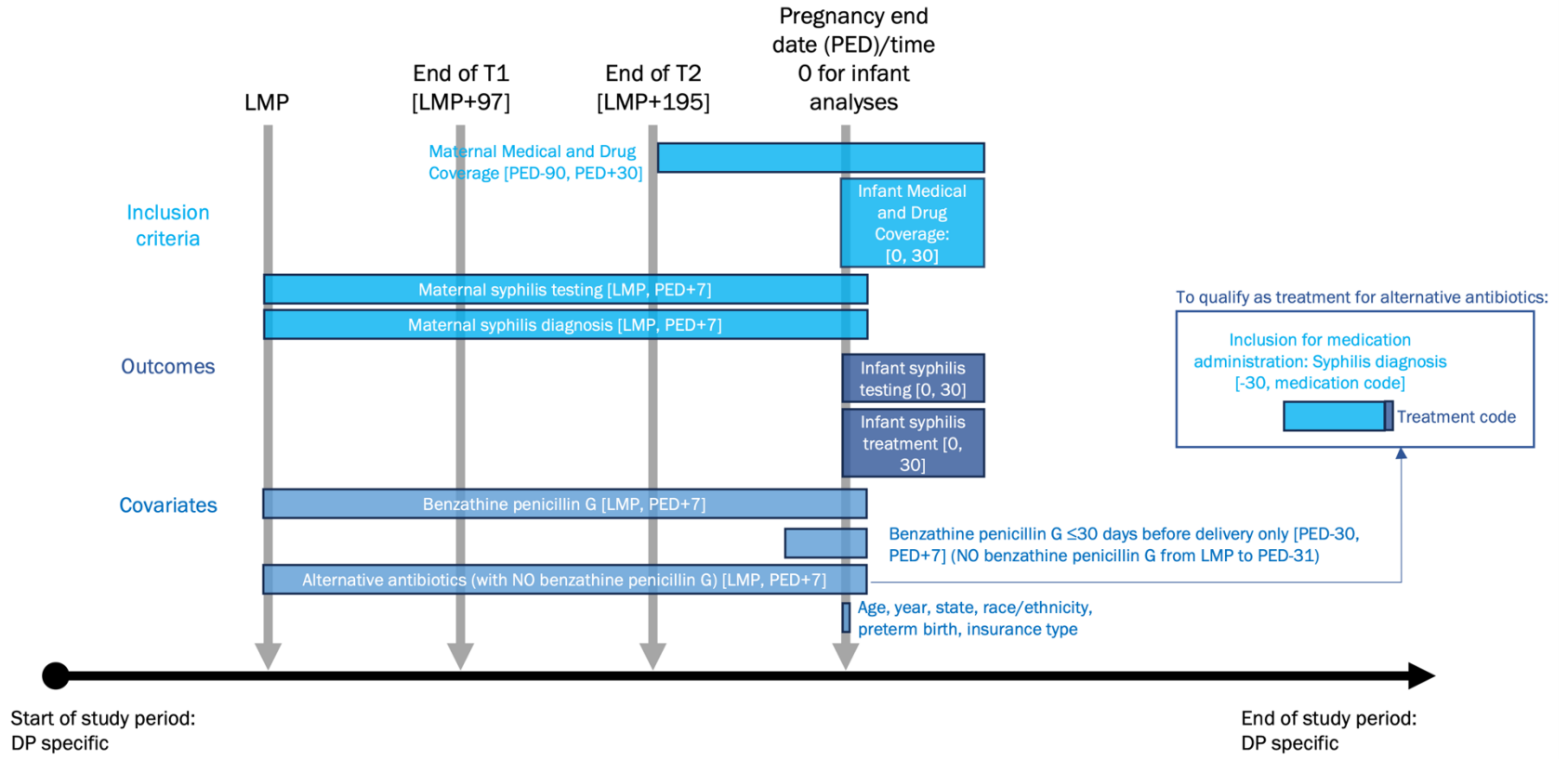
4.5.2.2 Covariates

The following variables will be used to create subgroups for identification of the descriptive outcomes.

Table 14. Operational definitions of covariates

Variable	Details	Type of variable	Assessment window	Care settings	Code type	Diagnosis position	Applied to study populations	Measurement characteristics/validation	Source for algorithm
Maternal treatment with benzathine penicillin G	Benzathine penicillin G in record during pregnancy	Binary	LMP to delivery date+7	Any	Procedure codes, NDC codes	NA	Pregnant individuals	No validation study	Code search
Maternal treatment with benzathine penicillin G, ≤30 days prior to delivery only	Benzathine penicillin G in ≤30 days prior to end of pregnancy and no benzathine penicillin G at any other time in pregnancy	Binary	Delivery date-30 to delivery date+7; washout LMP to delivery date-31	Any	Procedure codes, NDC codes		Pregnant individuals	No validation study	Code search
Maternal syphilis treatment with alternative antibiotics only	Procaine penicillin G, IV/IM ceftriaxone, oral doxycycline, oral tetracycline, oral azithromycin, oral erythromycin, or oral amoxicillin in record with a syphilis diagnosis code appearing within 30 days prior to the treatment start date; no benzathine penicillin G in pregnancy	Binary	LMP to delivery date+7	Any	Procedure codes, NDC codes		Pregnant individuals	No validation study	Code search
<i>Definitions for age, race, Hispanic, year, and can be found in Table 6.</i>									

4.5.2.3 Design diagram for Question 3



4.6 Data sources

4.6.1 Context and rationale for data sources

This study will be completed in the T-MSIS Analytic Files and the Sentinel System Distributed Database.

Table 15. Metadata about data sources and software

	Data 1	Data 2
Data source(s):	T-MSIS	Private insurance data partners
Study period:	2014-2020	2014-2020
Eligible cohort entry period:	2014-2020	2014-2020
Data version (or date of last update):		
Data sampling/extraction criteria:	NA	NA
Type(s) of data:	Administrative claims	Administrative claims
Data linkage:	Pregnancies were linked to infants within the dataset	Pregnancies were linked to infants within the dataset
Conversion to CDM:	Sentinel Common Data Model	Sentinel Common Data Model
Software for data management:	SAS version 9.4	SAS version 9.4

4.7 Data management

This project will be completed using the Sentinel System Distributed Database. Data are stored and accessed at each individual data partner site. Using the Sentinel System standardized analytic tools, each site will run the analysis package and return the summary results for aggregation.

4.8 Quality control

All analyses will be conducted using Sentinel System standardized analytic tools with ad-hoc programming implemented where needed. All code will undergo QC.

5 Limitation of the methods

1. We do not have results from syphilis testing; we only have record that the testing occurred. We will require a syphilis diagnosis code in addition to a testing code to approximate a population with a positive syphilis test in pregnancy. We may capture

false positive and unconfirmed cases by relying on diagnosis codes. This may result in an underestimate of the proportion treated (because not all pregnancies with a diagnosis code will be a true syphilis case).

2. We do not have information on maternal titer levels in pregnancy. Syphilis stage can be inferred from diagnosis codes; however, we do not know how accurate stage-specific codes will be, and many patients will have codes indicating “unknown” stage. However, all stages of syphilis should be treated in pregnancy per clinical guidelines. Analysis of maternal treatment by syphilis stage will be considered exploratory.
3. Given inconsistencies in how benzathine penicillin G treatment is recorded in claims (procedure codes, NDC codes for dispensings, or both), we are unable to reliably capture the number of doses or number of days between doses in pregnancy. These are important factors for whether treatment in pregnancy was adequate.
4. Infant testing and treatment are determined partially by adequacy of maternal treatment in pregnancy. We are not able to measure all factors that determine if treatment was adequate (see limitations above about maternal stage and treatment dose and duration). We can assess infant treatment and testing and stratify by measurable treatment parameters in pregnancy, including timing of treatment in pregnancy (before or after 30 days prior to delivery) and use of non-recommended antibiotics.

6 Protection of human subjects

This Sentinel System study is a public health surveillance activity conducted under the authority of the Food and Drug Administration and, accordingly, is not subject to Institutional Review Board oversight.³⁰

7 References

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1 Appendices

Table A1. Codes to identify syphilis testing

Code	Code type	Description
G0450	HCPCS	Screening for sexually transmitted infections, includes laboratory tests for chlamydia, gonorrhea, syphilis, and hepatitis B
0064U	CPT	Antibody, <i>Treponema pallidum</i> , total and rapid plasma reagin (RPR), immunoassay, qualitative
0065U	CPT	Syphilis test, non-treponemal antibody, immunoassay, qualitative (RPR)
0210U	CPT	Syphilis test, non-treponemal antibody, immunoassay, quantitative (RPR)
80055	CPT	Obstetric panel including: Blood count, complete (CBC), automated and automated differential WBC count (85025 or 85027 and 85004) OR Blood count, complete (CBC), automated (85027) and appropriate manual differential WBC count (85007 or 85009) Hepatitis B surface antigen (HBsAg) (87340) Antibody, rubella (86762) Syphilis test, non-treponemal antibody; qualitative (eg, VDRL, RPR, ART) (86592) Antibody screen, RBC, each serum technique (86850) Blood typing, ABO (86900) AND Blood typing, Rh (D) (86901)
80081	CPT	Obstetric panel (includes HIV testing) including: Blood count, complete (CBC), and automated differential WBC count (85025 or 85027 and 85004) OR Blood count, complete (CBC), automated (85027) and appropriate manual differential WBC count (85007 or 85009) Hepatitis B surface antigen (HBsAg) (87340) HIV-1 antigen(s), with HIV-1 and HIV-2 antibodies, single result (87389) Antibody, rubella (86762) Syphilis test, non-treponemal antibody; qualitative (eg, VDRL, RPR, ART) (86592) Antibody screen, RBC, each serum technique (86850) Blood typing, ABO (86900) AND Blood typing, Rh (D) (86901)
86592	CPT	Syphilis test, non-treponemal antibody; qualitative (eg, VDRL, RPR, ART)
86593	CPT	Syphilis test, non-treponemal antibody; quantitative
86780	CPT	Antibody; <i>Treponema pallidum</i>
86781	CPT	Antibody; <i>treponema pallidum</i>
87285	CPT	Infectious agent antigen detection by immunofluorescent technique; <i>Treponema pallidum</i>
3512F	CPT	Syphilis screening documented as performed (HIV)

Table A2. Codes to identify syphilis diagnosis in pregnant individuals

Code	Code type	Description
090.0	ICD-9 dx	Early congenital syphilis, symptomatic
090.1	ICD-9 dx	Early congenital syphilis, latent
090.2	ICD-9 dx	Early congenital syphilis, unspecified
090.3	ICD-9 dx	Syphilitic interstitial keratitis
090.40	ICD-9 dx	Unspecified juvenile neurosyphilis
090.41	ICD-9 dx	Congenital syphilitic encephalitis
090.42	ICD-9 dx	Congenital syphilitic meningitis
090.49	ICD-9 dx	Other juvenile neurosyphilis
090.5	ICD-9 dx	Other late congenital syphilis, symptomatic
090.6	ICD-9 dx	Late congenital syphilis, latent
090.7	ICD-9 dx	Late congenital syphilis, unspecified
090.9	ICD-9 dx	Congenital syphilis, unspecified
091.0	ICD-9 dx	Genital syphilis (primary)
091.1	ICD-9 dx	Primary anal syphilis
091.2	ICD-9 dx	Other primary syphilis
091.3	ICD-9 dx	Secondary syphilis of skin or mucous membranes
091.4	ICD-9 dx	Adenopathy due to secondary syphilis
091.50	ICD-9 dx	Syphilitic uveitis, unspecified
091.51	ICD-9 dx	Syphilitic chorioretinitis (secondary)
091.52	ICD-9 dx	Syphilitic iridocyclitis (secondary)
091.61	ICD-9 dx	Secondary syphilitic periostitis
091.62	ICD-9 dx	Secondary syphilitic hepatitis
091.69	ICD-9 dx	Secondary syphilis of other viscera
091.7	ICD-9 dx	Secondary syphilis, relapse
091.81	ICD-9 dx	Acute syphilitic meningitis (secondary)
091.82	ICD-9 dx	Syphilitic alopecia
091.89	ICD-9 dx	Other forms of secondary syphilis
091.9	ICD-9 dx	Unspecified secondary syphilis
092.0	ICD-9 dx	Early syphilis, latent, serological relapse after treatment
092.9	ICD-9 dx	Early syphilis, latent, unspecified
093.0	ICD-9 dx	Aneurysm of aorta, specified as syphilitic
093.1	ICD-9 dx	Syphilitic aortitis
093.20	ICD-9 dx	Syphilitic endocarditis of valve, unspecified
093.21	ICD-9 dx	Syphilitic endocarditis of mitral valve
093.22	ICD-9 dx	Syphilitic endocarditis of aortic valve
093.23	ICD-9 dx	Syphilitic endocarditis of tricuspid valve
093.24	ICD-9 dx	Syphilitic endocarditis of pulmonary valve
093.81	ICD-9 dx	Syphilitic pericarditis
093.82	ICD-9 dx	Syphilitic myocarditis
093.89	ICD-9 dx	Other specified cardiovascular syphilis
093.9	ICD-9 dx	Unspecified cardiovascular syphilis
094.0	ICD-9 dx	Tabes dorsalis
094.1	ICD-9 dx	General paresis
094.2	ICD-9 dx	Syphilitic meningitis
094.3	ICD-9 dx	Asymptomatic neurosyphilis
094.81	ICD-9 dx	Syphilitic encephalitis
094.82	ICD-9 dx	Syphilitic Parkinsonism
094.83	ICD-9 dx	Syphilitic disseminated retinochoroiditis
094.84	ICD-9 dx	Syphilitic optic atrophy
094.85	ICD-9 dx	Syphilitic retrobulbar neuritis
094.86	ICD-9 dx	Syphilitic acoustic neuritis
094.87	ICD-9 dx	Syphilitic ruptured cerebral aneurysm
094.89	ICD-9 dx	Other specified neurosyphilis
094.9	ICD-9 dx	Unspecified neurosyphilis
095.0	ICD-9 dx	Syphilitic episcleritis
095.1	ICD-9 dx	Syphilis of lung

Code	Code type	Description
095.2	ICD-9 dx	Syphilitic peritonitis
095.3	ICD-9 dx	Syphilis of liver
095.4	ICD-9 dx	Syphilis of kidney
095.5	ICD-9 dx	Syphilis of bone
095.6	ICD-9 dx	Syphilis of muscle
095.7	ICD-9 dx	Syphilis of synovium, tendon, and bursa
095.8	ICD-9 dx	Other specified forms of late symptomatic syphilis
095.9	ICD-9 dx	Unspecified late symptomatic syphilis
096	ICD-9 dx	Late syphilis, latent
097.0	ICD-9 dx	Unspecified late syphilis
097.1	ICD-9 dx	Unspecified latent syphilis
097.9	ICD-9 dx	Unspecified syphilis
647.00	ICD-9 dx	Maternal syphilis, complicating pregnancy, childbirth, or the puerperium, unspecified as to episode of care
647.01	ICD-9 dx	Maternal syphilis, complicating pregnancy, with delivery
647.02	ICD-9 dx	Maternal syphilis, complicating pregnancy, with delivery, with current postpartum complication
647.03	ICD-9 dx	Maternal syphilis, antepartum
647.04	ICD-9 dx	Maternal syphilis complicating pregnancy, childbirth, or the puerperium, postpartum condition or complication
A51	ICD-10 dx	Early syphilis
A52	ICD-10 dx	Late syphilis
A53	ICD-10 dx	Other and unspecified syphilis
A51.0	ICD-10 dx	Primary genital syphilis
A52.0	ICD-10 dx	Cardiovascular and cerebrovascular syphilis
A52.00	ICD-10 dx	Cardiovascular syphilis, unspecified
A53.0	ICD-10 dx	Latent syphilis, unspecified as early or late
A50.01	ICD-10 dx	Early congenital syphilitic ophthalmopathy
A52.01	ICD-10 dx	Syphilitic aneurysm of aorta
A50.02	ICD-10 dx	Early congenital syphilitic osteochondropathy
A52.02	ICD-10 dx	Syphilitic aortitis
A50.03	ICD-10 dx	Early congenital syphilitic pharyngitis
A52.03	ICD-10 dx	Syphilitic endocarditis
A50.04	ICD-10 dx	Early congenital syphilitic pneumonia
A52.04	ICD-10 dx	Syphilitic cerebral arteritis
A50.05	ICD-10 dx	Early congenital syphilitic rhinitis
A52.05	ICD-10 dx	Other cerebrovascular syphilis
A50.06	ICD-10 dx	Early cutaneous congenital syphilis
A52.06	ICD-10 dx	Other syphilitic heart involvement
A50.07	ICD-10 dx	Early mucocutaneous congenital syphilis
A50.08	ICD-10 dx	Early visceral congenital syphilis
A50.09	ICD-10 dx	Other early congenital syphilis, symptomatic
A52.09	ICD-10 dx	Other cardiovascular syphilis
A50.1	ICD-10 dx	Early congenital syphilis, latent
A51.1	ICD-10 dx	Primary anal syphilis
A52.1	ICD-10 dx	Symptomatic neurosyphilis
A52.10	ICD-10 dx	Symptomatic neurosyphilis, unspecified
O98.1	ICD-10 dx	Syphilis complicating pregnancy, childbirth, and the puerperium
A52.11	ICD-10 dx	Tabes dorsalis
O98.11	ICD-10 dx	Syphilis complicating pregnancy
O98.111	ICD-10 dx	Syphilis complicating pregnancy, first trimester
O98.112	ICD-10 dx	Syphilis complicating pregnancy, second trimester
O98.113	ICD-10 dx	Syphilis complicating pregnancy, third trimester
O98.119	ICD-10 dx	Syphilis complicating pregnancy, unspecified trimester
A52.12	ICD-10 dx	Other cerebrospinal syphilis
O98.12	ICD-10 dx	Syphilis complicating childbirth
A52.13	ICD-10 dx	Late syphilitic meningitis
O98.13	ICD-10 dx	Syphilis complicating the puerperium

Code	Code type	Description
A52.14	ICD-10 dx	Late syphilitic encephalitis
A52.15	ICD-10 dx	Late syphilitic neuropathy
A52.16	ICD-10 dx	Charcot's arthropathy (tabetic)
A52.17	ICD-10 dx	General paresis
A52.19	ICD-10 dx	Other symptomatic neurosyphilis
A50.2	ICD-10 dx	Early congenital syphilis, unspecified
A51.2	ICD-10 dx	Primary syphilis of other sites
A52.2	ICD-10 dx	Asymptomatic neurosyphilis
A50.30	ICD-10 dx	Late congenital syphilitic oculopathy, unspecified
A51.3	ICD-10 dx	Secondary syphilis of skin and mucous membranes
A52.3	ICD-10 dx	Neurosyphilis, unspecified
A50.31	ICD-10 dx	Late congenital syphilitic interstitial keratitis
A51.31	ICD-10 dx	Condyloma latum
A50.32	ICD-10 dx	Late congenital syphilitic chorioretinitis
A51.32	ICD-10 dx	Syphilitic alopecia
A50.39	ICD-10 dx	Other late congenital syphilitic oculopathy
A51.39	ICD-10 dx	Other secondary syphilis of skin
A50.40	ICD-10 dx	Late congenital neurosyphilis, unspecified
A51.4	ICD-10 dx	Other secondary syphilis
A50.41	ICD-10 dx	Late congenital syphilitic meningitis
A51.41	ICD-10 dx	Secondary syphilitic meningitis
A50.42	ICD-10 dx	Late congenital syphilitic encephalitis
A51.42	ICD-10 dx	Secondary syphilitic female pelvic disease
A50.43	ICD-10 dx	Late congenital syphilitic polyneuropathy
A51.43	ICD-10 dx	Secondary syphilitic oculopathy
A50.44	ICD-10 dx	Late congenital syphilitic optic nerve atrophy
A51.44	ICD-10 dx	Secondary syphilitic nephritis
A50.45	ICD-10 dx	Juvenile general paresis
A51.45	ICD-10 dx	Secondary syphilitic hepatitis
A51.46	ICD-10 dx	Secondary syphilitic osteopathy
A50.49	ICD-10 dx	Other late congenital neurosyphilis
A51.49	ICD-10 dx	Other secondary syphilitic conditions
A51.5	ICD-10 dx	Early syphilis, latent
A50.51	ICD-10 dx	Clutton's joints
A50.52	ICD-10 dx	Hutchinson's teeth
A50.53	ICD-10 dx	Hutchinson's triad
A50.54	ICD-10 dx	Late congenital cardiovascular syphilis
A50.55	ICD-10 dx	Late congenital syphilitic arthropathy
A50.56	ICD-10 dx	Late congenital syphilitic osteochondropathy
A50.57	ICD-10 dx	Syphilitic saddle nose
A50.59	ICD-10 dx	Other late congenital syphilis, symptomatic
A50.6	ICD-10 dx	Late congenital syphilis, latent
A50.7	ICD-10 dx	Late congenital syphilis, unspecified
A52.7	ICD-10 dx	Other symptomatic late syphilis
A52.72	ICD-10 dx	Syphilis of lung and bronchus
A52.73	ICD-10 dx	Symptomatic late syphilis of other respiratory organs
A52.74	ICD-10 dx	Syphilis of liver and other viscera
A52.75	ICD-10 dx	Syphilis of kidney and ureter
A52.76	ICD-10 dx	Other genitourinary symptomatic late syphilis
A52.77	ICD-10 dx	Syphilis of bone and joint
A52.78	ICD-10 dx	Syphilis of other musculoskeletal tissue
A52.79	ICD-10 dx	Other symptomatic late syphilis
A52.8	ICD-10 dx	Late syphilis, latent
A50.9	ICD-10 dx	Congenital syphilis, unspecified
A51.9	ICD-10 dx	Early syphilis, unspecified
A52.9	ICD-10 dx	Late syphilis, unspecified
A53.9	ICD-10 dx	Syphilis, unspecified

Table A3. Codes to identify primary, secondary, or early latent stage syphilis in pregnant individual

Code	Code type	Description
091.0	ICD-9 dx	Genital syphilis (primary)
091.1	ICD-9 dx	Primary anal syphilis
091.2	ICD-9 dx	Other primary syphilis
091.3	ICD-9 dx	Secondary syphilis of skin or mucous membranes
091.4	ICD-9 dx	Adenopathy due to secondary syphilis
091.50	ICD-9 dx	Syphilitic uveitis, unspecified
091.51	ICD-9 dx	Syphilitic chorioretinitis (secondary)
091.52	ICD-9 dx	Syphilitic iridocyclitis (secondary)
091.61	ICD-9 dx	Secondary syphilitic periostitis
091.62	ICD-9 dx	Secondary syphilitic hepatitis
091.69	ICD-9 dx	Secondary syphilis of other viscera
091.7	ICD-9 dx	Secondary syphilis, relapse
091.81	ICD-9 dx	Acute syphilitic meningitis (secondary)
091.82	ICD-9 dx	Syphilitic alopecia
091.89	ICD-9 dx	Other forms of secondary syphilis
091.9	ICD-9 dx	Unspecified secondary syphilis
092.0	ICD-9 dx	Early syphilis, latent, serological relapse after treatment
092.9	ICD-9 dx	Early syphilis, latent, unspecified
A51	ICD-10 dx	Early syphilis
A51.0	ICD-10 dx	Primary genital syphilis
A51.1	ICD-10 dx	Primary anal syphilis
A51.2	ICD-10 dx	Primary syphilis of other sites
A51.3	ICD-10 dx	Secondary syphilis of skin and mucous membranes
A51.31	ICD-10 dx	Condyloma latum
A51.32	ICD-10 dx	Syphilitic alopecia
A51.39	ICD-10 dx	Other secondary syphilis of skin
A51.4	ICD-10 dx	Other secondary syphilis
A51.41	ICD-10 dx	Secondary syphilitic meningitis
A51.42	ICD-10 dx	Secondary syphilitic female pelvic disease
A51.43	ICD-10 dx	Secondary syphilitic ophthalmopathy
A51.44	ICD-10 dx	Secondary syphilitic nephritis
A51.45	ICD-10 dx	Secondary syphilitic hepatitis
A51.46	ICD-10 dx	Secondary syphilitic osteopathy
A51.49	ICD-10 dx	Other secondary syphilitic conditions
A51.5	ICD-10 dx	Early syphilis, latent
A51.9	ICD-10 dx	Early syphilis, unspecified

Table A4. Codes to identify late latent, tertiary, other, or unknown stage syphilis in the pregnant individual

Code	Code type	Description
090.0	ICD-9 dx	Early congenital syphilis, symptomatic
090.1	ICD-9 dx	Early congenital syphilis, latent
090.2	ICD-9 dx	Early congenital syphilis, unspecified
090.3	ICD-9 dx	Syphilitic interstitial keratitis
090.40	ICD-9 dx	Unspecified juvenile neurosyphilis
090.41	ICD-9 dx	Congenital syphilitic encephalitis
090.42	ICD-9 dx	Congenital syphilitic meningitis
090.49	ICD-9 dx	Other juvenile neurosyphilis
090.5	ICD-9 dx	Other late congenital syphilis, symptomatic
090.6	ICD-9 dx	Late congenital syphilis, latent
090.7	ICD-9 dx	Late congenital syphilis, unspecified
090.9	ICD-9 dx	Congenital syphilis, unspecified
092.0	ICD-9 dx	Early syphilis, latent, serological relapse after treatment
092.9	ICD-9 dx	Early syphilis, latent, unspecified
093.0	ICD-9 dx	Aneurysm of aorta, specified as syphilitic
093.1	ICD-9 dx	Syphilitic aortitis
093.20	ICD-9 dx	Syphilitic endocarditis of valve, unspecified
093.21	ICD-9 dx	Syphilitic endocarditis of mitral valve
093.22	ICD-9 dx	Syphilitic endocarditis of aortic valve
093.23	ICD-9 dx	Syphilitic endocarditis of tricuspid valve
093.24	ICD-9 dx	Syphilitic endocarditis of pulmonary valve
093.81	ICD-9 dx	Syphilitic pericarditis
093.82	ICD-9 dx	Syphilitic myocarditis
093.89	ICD-9 dx	Other specified cardiovascular syphilis
093.9	ICD-9 dx	Unspecified cardiovascular syphilis
094.0	ICD-9 dx	Tabes dorsalis
094.1	ICD-9 dx	General paresis
094.2	ICD-9 dx	Syphilitic meningitis
094.3	ICD-9 dx	Asymptomatic neurosyphilis
094.81	ICD-9 dx	Syphilitic encephalitis
094.82	ICD-9 dx	Syphilitic Parkinsonism
094.83	ICD-9 dx	Syphilitic disseminated retinochoroiditis
094.84	ICD-9 dx	Syphilitic optic atrophy
094.85	ICD-9 dx	Syphilitic retrobulbar neuritis
094.86	ICD-9 dx	Syphilitic acoustic neuritis
094.87	ICD-9 dx	Syphilitic ruptured cerebral aneurysm
094.89	ICD-9 dx	Other specified neurosyphilis
094.9	ICD-9 dx	Unspecified neurosyphilis
095.0	ICD-9 dx	Syphilitic episcleritis
095.1	ICD-9 dx	Syphilis of lung
095.2	ICD-9 dx	Syphilitic peritonitis
095.3	ICD-9 dx	Syphilis of liver
095.4	ICD-9 dx	Syphilis of kidney
095.5	ICD-9 dx	Syphilis of bone
095.6	ICD-9 dx	Syphilis of muscle
095.7	ICD-9 dx	Syphilis of synovium, tendon, and bursa
095.8	ICD-9 dx	Other specified forms of late symptomatic syphilis
095.9	ICD-9 dx	Unspecified late symptomatic syphilis
096	ICD-9 dx	Late syphilis, latent
097.0	ICD-9 dx	Unspecified late syphilis
097.1	ICD-9 dx	Unspecified latent syphilis
097.9	ICD-9 dx	Unspecified syphilis
647.00	ICD-9 dx	Maternal syphilis, complicating pregnancy, childbirth, or the puerperium, unspecified as to episode of care
647.01	ICD-9 dx	Maternal syphilis, complicating pregnancy, with delivery

Code	Code type	Description
647.02	ICD-9 dx	Maternal syphilis, complicating pregnancy, with delivery, with current postpartum complication
647.03	ICD-9 dx	Maternal syphilis, antepartum
647.04	ICD-9 dx	Maternal syphilis complicating pregnancy, childbirth, or the puerperium, postpartum condition or complication
A52	ICD-10 dx	Late syphilis
A53	ICD-10 dx	Other and unspecified syphilis
A52.0	ICD-10 dx	Cardiovascular and cerebrovascular syphilis
A52.00	ICD-10 dx	Cardiovascular syphilis, unspecified
A53.0	ICD-10 dx	Latent syphilis, unspecified as early or late
A50.01	ICD-10 dx	Early congenital syphilitic oculopathy
A52.01	ICD-10 dx	Syphilitic aneurysm of aorta
A50.02	ICD-10 dx	Early congenital syphilitic osteochondropathy
A52.02	ICD-10 dx	Syphilitic aortitis
A50.03	ICD-10 dx	Early congenital syphilitic pharyngitis
A52.03	ICD-10 dx	Syphilitic endocarditis
A50.04	ICD-10 dx	Early congenital syphilitic pneumonia
A52.04	ICD-10 dx	Syphilitic cerebral arteritis
A50.05	ICD-10 dx	Early congenital syphilitic rhinitis
A52.05	ICD-10 dx	Other cerebrovascular syphilis
A50.06	ICD-10 dx	Early cutaneous congenital syphilis
A52.06	ICD-10 dx	Other syphilitic heart involvement
A50.07	ICD-10 dx	Early mucocutaneous congenital syphilis
A50.08	ICD-10 dx	Early visceral congenital syphilis
A50.09	ICD-10 dx	Other early congenital syphilis, symptomatic
A52.09	ICD-10 dx	Other cardiovascular syphilis
A50.1	ICD-10 dx	Early congenital syphilis, latent
A52.1	ICD-10 dx	Symptomatic neurosyphilis
A52.10	ICD-10 dx	Symptomatic neurosyphilis, unspecified
O98.1	ICD-10 dx	Syphilis complicating pregnancy, childbirth, and the puerperium
A52.11	ICD-10 dx	Tabes dorsalis
O98.11	ICD-10 dx	Syphilis complicating pregnancy
O98.111	ICD-10 dx	Syphilis complicating pregnancy, first trimester
O98.112	ICD-10 dx	Syphilis complicating pregnancy, second trimester
O98.113	ICD-10 dx	Syphilis complicating pregnancy, third trimester
O98.119	ICD-10 dx	Syphilis complicating pregnancy, unspecified trimester
A52.12	ICD-10 dx	Other cerebrospinal syphilis
O98.12	ICD-10 dx	Syphilis complicating childbirth
A52.13	ICD-10 dx	Late syphilitic meningitis
O98.13	ICD-10 dx	Syphilis complicating the puerperium
A52.14	ICD-10 dx	Late syphilitic encephalitis
A52.15	ICD-10 dx	Late syphilitic neuropathy
A52.16	ICD-10 dx	Charcot's arthropathy (tabetic)
A52.17	ICD-10 dx	General paresis
A52.19	ICD-10 dx	Other symptomatic neurosyphilis
A50.2	ICD-10 dx	Early congenital syphilis, unspecified
A52.2	ICD-10 dx	Asymptomatic neurosyphilis
A50.30	ICD-10 dx	Late congenital syphilitic oculopathy, unspecified
A52.3	ICD-10 dx	Neurosyphilis, unspecified
A50.31	ICD-10 dx	Late congenital syphilitic interstitial keratitis
A50.32	ICD-10 dx	Late congenital syphilitic chorioretinitis
A50.39	ICD-10 dx	Other late congenital syphilitic oculopathy
A50.40	ICD-10 dx	Late congenital neurosyphilis, unspecified
A50.41	ICD-10 dx	Late congenital syphilitic meningitis
A50.42	ICD-10 dx	Late congenital syphilitic encephalitis
A50.43	ICD-10 dx	Late congenital syphilitic polyneuropathy
A50.44	ICD-10 dx	Late congenital syphilitic optic nerve atrophy
A50.45	ICD-10 dx	Juvenile general paresis
A50.49	ICD-10 dx	Other late congenital neurosyphilis

Code	Code type	Description
A50.51	ICD-10 dx	Clutton's joints
A50.52	ICD-10 dx	Hutchinson's teeth
A50.53	ICD-10 dx	Hutchinson's triad
A50.54	ICD-10 dx	Late congenital cardiovascular syphilis
A50.55	ICD-10 dx	Late congenital syphilitic arthropathy
A50.56	ICD-10 dx	Late congenital syphilitic osteochondropathy
A50.57	ICD-10 dx	Syphilitic saddle nose
A50.59	ICD-10 dx	Other late congenital syphilis, symptomatic
A50.6	ICD-10 dx	Late congenital syphilis, latent
A50.7	ICD-10 dx	Late congenital syphilis, unspecified
A52.7	ICD-10 dx	Other symptomatic late syphilis
A52.72	ICD-10 dx	Syphilis of lung and bronchus
A52.73	ICD-10 dx	Symptomatic late syphilis of other respiratory organs
A52.74	ICD-10 dx	Syphilis of liver and other viscera
A52.75	ICD-10 dx	Syphilis of kidney and ureter
A52.76	ICD-10 dx	Other genitourinary symptomatic late syphilis
A52.77	ICD-10 dx	Syphilis of bone and joint
A52.78	ICD-10 dx	Syphilis of other musculoskeletal tissue
A52.79	ICD-10 dx	Other symptomatic late syphilis
A52.8	ICD-10 dx	Late syphilis, latent
A50.9	ICD-10 dx	Congenital syphilis, unspecified
A52.9	ICD-10 dx	Late syphilis, unspecified
A53.9	ICD-10 dx	Syphilis, unspecified

Table A5. Codes to identify congenital syphilis diagnosis in infants

Code	Code type	Description
090.0	ICD-9 dx	Early congenital syphilis, symptomatic
090.1	ICD-9 dx	Early congenital syphilis, latent
090.2	ICD-9 dx	Unspecified early congenital syphilis
090.3	ICD-9 dx	Syphilitic interstitial keratitis
090.40	ICD-9 dx	Juvenile neurosyphilis, unspecified
090.41	ICD-9 dx	Congenital syphilitic encephalitis
090.42	ICD-9 dx	Congenital syphilitic meningitis
090.49	ICD-9 dx	Other juvenile neurosyphilis
090.5	ICD-9 dx	Other late congenital syphilis, symptomatic
090.6	ICD-9 dx	Late congenital syphilis, latent
090.7	ICD-9 dx	Late congenital syphilis, unspecified
090.9	ICD-9 dx	Congenital syphilis, unspecified
A50	ICD-10 dx	Congenital syphilis
A50.0	ICD-10 dx	Early congenital syphilis, symptomatic
A50.01	ICD-10 dx	Early congenital syphilitic oculopathy
A50.02	ICD-10 dx	Early congenital syphilitic osteochondropathy
A50.03	ICD-10 dx	Early congenital syphilitic pharyngitis
A50.04	ICD-10 dx	Early congenital syphilitic pneumonia
A50.05	ICD-10 dx	Early congenital syphilitic rhinitis
A50.06	ICD-10 dx	Early cutaneous congenital syphilis
A50.07	ICD-10 dx	Early mucocutaneous congenital syphilis
A50.08	ICD-10 dx	Early visceral congenital syphilis
A50.09	ICD-10 dx	Other early congenital syphilis, symptomatic
A50.1	ICD-10 dx	Early congenital syphilis, latent
A50.2	ICD-10 dx	Early congenital syphilis, unspecified
A50.30	ICD-10 dx	Late congenital syphilitic oculopathy, unspecified
A50.31	ICD-10 dx	Late congenital syphilitic interstitial keratitis
A50.32	ICD-10 dx	Late congenital syphilitic chorioretinitis
A50.39	ICD-10 dx	Other late congenital syphilitic oculopathy
A50.4	ICD-10 dx	Late congenital neurosyphilis [juvenile neurosyphilis]
A50.40	ICD-10 dx	Late congenital neurosyphilis, unspecified
A50.41	ICD-10 dx	Late congenital syphilitic meningitis
A50.42	ICD-10 dx	Late congenital syphilitic encephalitis
A50.43	ICD-10 dx	Late congenital syphilitic polyneuropathy
A50.44	ICD-10 dx	Late congenital syphilitic optic nerve atrophy
A50.45	ICD-10 dx	Juvenile general paresis
A50.49	ICD-10 dx	Other late congenital neurosyphilis
A50.5	ICD-10 dx	Other late congenital syphilis, symptomatic
A50.51	ICD-10 dx	Clutton's joints
A50.52	ICD-10 dx	Hutchinson's teeth
A50.53	ICD-10 dx	Hutchinson's triad
A50.54	ICD-10 dx	Late congenital cardiovascular syphilis
A50.55	ICD-10 dx	Late congenital syphilitic arthropathy
A50.56	ICD-10 dx	Late congenital syphilitic osteochondropathy
A50.57	ICD-10 dx	Syphilitic saddle nose
A50.59	ICD-10 dx	Other late congenital syphilis, symptomatic
A50.6	ICD-10 dx	Late congenital syphilis, latent
A50.7	ICD-10 dx	Late congenital syphilis, unspecified
A50.9	ICD-10 dx	Congenital syphilis, unspecified

Table A6. Codes to identify HIV diagnosis

Code	Code type	Description
042	ICD-9 dx	Human immunodeficiency virus [HIV]
079.53	ICD-9 dx	Human immunodeficiency virus, type 2 (HIV 2), in conditions classified elsewhere and of unspecified site
V08	ICD-9 dx	Asymptomatic human immunodeficiency virus (HIV) infection status
B20	ICD-10 dx	Human immunodeficiency virus [HIV] disease
Z21	ICD-10 dx	Asymptomatic human immunodeficiency virus [HIV] infection status
B97.35	ICD-10 dx	Human immunodeficiency virus, type 2 [HIV 2] as the cause of diseases classified elsewhere
O98.7	ICD-10 dx	Human immunodeficiency virus [HIV] disease complicating pregnancy, childbirth, and the puerperium
O98.71	ICD-10 dx	Human immunodeficiency virus [HIV] disease complicating pregnancy
O98.711	ICD-10 dx	Human immunodeficiency virus [HIV] disease complicating pregnancy, first trimester
O98.712	ICD-10 dx	Human immunodeficiency virus [HIV] disease complicating pregnancy, second trimester
O98.713	ICD-10 dx	Human immunodeficiency virus [HIV] disease complicating pregnancy, third trimester
O98.719	ICD-10 dx	Human immunodeficiency virus [HIV] disease complicating pregnancy, unspecified trimester
O98.72	ICD-10 dx	Human immunodeficiency virus [HIV] disease complicating childbirth
O98.73	ICD-10 dx	Human immunodeficiency virus [HIV] disease complicating the puerperium

Table A7. Codes to identify chlamydia diagnosis

Code	Code type	Description
077.0	ICD-9 dx	Inclusion conjunctivitis
077.98	ICD-9 dx	Unspecified diseases of conjunctiva due to Chlamydiae
078.88	ICD-9 dx	Other specified diseases due to Chlamydiae
079.88	ICD-9 dx	Other specified chlamydial infection, in conditions classified elsewhere and of unspecified site
079.98	ICD-9 dx	Unspecified chlamydial infection, in conditions classified elsewhere and of unspecified site
099.1	ICD-9 dx	Lymphogranuloma venereum
099.50	ICD-9 dx	Chlamydia trachomatis infection of unspecified site
099.51	ICD-9 dx	Chlamydia trachomatis infection of pharynx
099.52	ICD-9 dx	Chlamydia trachomatis infection of anus and rectum
099.53	ICD-9 dx	Chlamydia trachomatis infection of lower genitourinary sites
099.54	ICD-9 dx	Chlamydia trachomatis infection of other genitourinary sites
099.55	ICD-9 dx	Chlamydia trachomatis infection of unspecified genitourinary site
099.56	ICD-9 dx	Chlamydia trachomatis infection of peritoneum
099.59	ICD-9 dx	Chlamydia trachomatis infection of other specified site
099.41	ICD-9 dx	Other nongonococcal urethritis, chlamydia trachomatis
A55	ICD-10 dx	Chlamydial lymphogranuloma (venereum)
A56	ICD-10 dx	Other sexually transmitted chlamydial diseases
A74	ICD-10 dx	Other diseases caused by chlamydiae
A56.0	ICD-10 dx	Chlamydial infection of lower genitourinary tract
A56.00	ICD-10 dx	Chlamydial infection of lower genitourinary tract, unspecified
A74.0	ICD-10 dx	Chlamydial conjunctivitis
A56.01	ICD-10 dx	Chlamydial cystitis and urethritis
A56.02	ICD-10 dx	Chlamydial vulvovaginitis
A56.09	ICD-10 dx	Other chlamydial infection of lower genitourinary tract
A56.1	ICD-10 dx	Chlamydial infection of pelviperitoneum and other genitourinary organs
A56.11	ICD-10 dx	Chlamydial female pelvic inflammatory disease
A56.19	ICD-10 dx	Other chlamydial genitourinary infection
A56.2	ICD-10 dx	Chlamydial infection of genitourinary tract, unspecified
A56.3	ICD-10 dx	Chlamydial infection of anus and rectum
A56.4	ICD-10 dx	Chlamydial infection of pharynx
A56.8	ICD-10 dx	Sexually transmitted chlamydial infection of other sites
A74.8	ICD-10 dx	Other chlamydial diseases
A74.81	ICD-10 dx	Chlamydial peritonitis
A74.89	ICD-10 dx	Other chlamydial diseases
A74.9	ICD-10 dx	Chlamydial infection, unspecified

Table A8. Codes to identify gonorrhea diagnosis

Code	Code type	Description
098.0	ICD-9 dx	Gonococcal infection (acute) of lower genitourinary tract
098.10	ICD-9 dx	Gonococcal infection (acute) of upper genitourinary tract, site unspecified
098.11	ICD-9 dx	Gonococcal cystitis (acute)
098.12	ICD-9 dx	Gonococcal prostatitis (acute)
098.13	ICD-9 dx	Gonococcal epididymo-orchitis (acute)
098.14	ICD-9 dx	Gonococcal seminal vesiculitis (acute)
098.15	ICD-9 dx	Gonococcal cervicitis (acute)
098.16	ICD-9 dx	Gonococcal endometritis (acute)
098.17	ICD-9 dx	Gonococcal salpingitis, specified as acute
098.19	ICD-9 dx	Other gonococcal infection (acute) of upper genitourinary tract
098.2	ICD-9 dx	Gonococcal infection, chronic, of lower genitourinary tract
098.30	ICD-9 dx	Chronic gonococcal infection of upper genitourinary tract, site unspecified
098.31	ICD-9 dx	Gonococcal cystitis, chronic
098.32	ICD-9 dx	Gonococcal prostatitis, chronic
098.33	ICD-9 dx	Gonococcal epididymo-orchitis, chronic
098.34	ICD-9 dx	Gonococcal seminal vesiculitis, chronic
098.35	ICD-9 dx	Gonococcal cervicitis, chronic
098.36	ICD-9 dx	Gonococcal endometritis, chronic
098.37	ICD-9 dx	Gonococcal salpingitis (chronic)
098.39	ICD-9 dx	Other chronic gonococcal infection of upper genitourinary tract
098.40	ICD-9 dx	Gonococcal conjunctivitis (neonatorum)
098.41	ICD-9 dx	Gonococcal iridocyclitis
098.42	ICD-9 dx	Gonococcal endophthalmitis
098.43	ICD-9 dx	Gonococcal keratitis
098.49	ICD-9 dx	Other gonococcal infection of eye
098.50	ICD-9 dx	Gonococcal arthritis
098.51	ICD-9 dx	Gonococcal synovitis and tenosynovitis
098.52	ICD-9 dx	Gonococcal bursitis
098.53	ICD-9 dx	Gonococcal spondylitis
098.59	ICD-9 dx	Other gonococcal infection of joint
098.6	ICD-9 dx	Gonococcal infection of pharynx
098.7	ICD-9 dx	Gonococcal infection of anus and rectum
098.81	ICD-9 dx	Gonococcal keratosis (blennorrhagica)
098.82	ICD-9 dx	Gonococcal meningitis
098.83	ICD-9 dx	Gonococcal pericarditis
098.84	ICD-9 dx	Gonococcal endocarditis
098.85	ICD-9 dx	Other gonococcal heart disease
098.86	ICD-9 dx	Gonococcal peritonitis
098.89	ICD-9 dx	Gonococcal infection of other specified sites
647.10	ICD-9 dx	Maternal gonorrhea complicating pregnancy, childbirth, or the puerperium, unspecified as to episode of care
647.11	ICD-9 dx	Maternal gonorrhea with delivery
647.12	ICD-9 dx	Maternal gonorrhea, with delivery, with current postpartum complication
647.13	ICD-9 dx	Maternal gonorrhea, antepartum
647.14	ICD-9 dx	Maternal gonorrhea complicating pregnancy, childbirth, or the puerperium, postpartum condition or complication
A54.00	ICD-10 dx	Gonococcal infection of lower genitourinary tract, unspecified
A54.01	ICD-10 dx	Gonococcal cystitis and urethritis, unspecified
A54.02	ICD-10 dx	Gonococcal vulvovaginitis, unspecified
A54.03	ICD-10 dx	Gonococcal cervicitis, unspecified
A54.09	ICD-10 dx	Other gonococcal infection of lower genitourinary tract
A54.1	ICD-10 dx	Gonococcal infection of lower genitourinary tract with periurethral and accessory gland abscess
O98.2	ICD-10 dx	Gonorrhea complicating pregnancy, childbirth and the puerperium
O98.21	ICD-10 dx	Gonorrhea complicating pregnancy
A54.21	ICD-10 dx	Gonococcal infection of kidney and ureter
O98.211	ICD-10 dx	Gonorrhea complicating pregnancy, first trimester

Code	Code type	Description
O98.212	ICD-10 dx	Gonorrhea complicating pregnancy, second trimester
O98.213	ICD-10 dx	Gonorrhea complicating pregnancy, third trimester
O98.219	ICD-10 dx	Gonorrhea complicating pregnancy, unspecified trimester
O98.22	ICD-10 dx	Gonorrhea complicating childbirth
A54.22	ICD-10 dx	Gonococcal prostatitis
O98.23	ICD-10 dx	Gonorrhea complicating the puerperium
A54.23	ICD-10 dx	Gonococcal infection of other male genital organs
A54.24	ICD-10 dx	Gonococcal female pelvic inflammatory disease
A54.29	ICD-10 dx	Other gonococcal genitourinary infections
A54.30	ICD-10 dx	Gonococcal infection of eye, unspecified
A54.31	ICD-10 dx	Gonococcal conjunctivitis
A54.32	ICD-10 dx	Gonococcal iridocyclitis
A54.33	ICD-10 dx	Gonococcal keratitis
A54.39	ICD-10 dx	Other gonococcal eye infection
A54.40	ICD-10 dx	Gonococcal infection of musculoskeletal system, unspecified
A54.41	ICD-10 dx	Gonococcal spondylopathy
A54.42	ICD-10 dx	Gonococcal arthritis
A54.43	ICD-10 dx	Gonococcal osteomyelitis
A54.49	ICD-10 dx	Gonococcal infection of other musculoskeletal tissue
A54.5	ICD-10 dx	Gonococcal pharyngitis
A54.6	ICD-10 dx	Gonococcal infection of anus and rectum
A54.81	ICD-10 dx	Gonococcal meningitis
A54.82	ICD-10 dx	Gonococcal brain abscess
A54.83	ICD-10 dx	Gonococcal heart infection
A54.84	ICD-10 dx	Gonococcal pneumonia
A54.85	ICD-10 dx	Gonococcal peritonitis
A54.86	ICD-10 dx	Gonococcal sepsis
A54.89	ICD-10 dx	Other gonococcal infections
A54.9	ICD-10 dx	Gonococcal infection, unspecified

Table A9. Codes to identify parental care visits

Code	Code type	Description
V22.0	ICD-9 dx	Supervision of normal first pregnancy
V22.1	ICD-9 dx	Supervision of other normal pregnancy
V22.2	ICD-9 dx	Pregnant state, incidental
V23.0	ICD-9 dx	Pregnancy with history of infertility
V23.1	ICD-9 dx	Pregnancy with history of trophoblastic disease
V23.2	ICD-9 dx	Pregnancy with history of abortion
V23.3	ICD-9 dx	Pregnancy with grand multiparity
V23.4	ICD-9 dx	Pregnancy with other poor obstetric history
V23.41	ICD-9 dx	Supervision of pregnancy with history of pre-term labor
V23.42	ICD-9 dx	Pregnancy with history of ectopic pregnancy
V23.49	ICD-9 dx	Supervision of pregnancy with other poor obstetric history
V23.5	ICD-9 dx	Pregnancy with other poor reproductive history
V23.7	ICD-9 dx	Insufficient prenatal care
V23.8	ICD-9 dx	Supervision of other high-risk pregnancy
V23.81	ICD-9 dx	Supervision of high-risk pregnancy of elderly primigravida
V23.82	ICD-9 dx	Supervision of high-risk pregnancy of elderly multigravida
V23.83	ICD-9 dx	Supervision of high-risk pregnancy of young primigravida
V23.84	ICD-9 dx	Supervision of high-risk pregnancy of young multigravida
V23.85	ICD-9 dx	Supervision of high risk pregnancy, pregnancy resulting from assisted reproductive technology
V23.86	ICD-9 dx	Supervision of high risk pregnancy, pregnancy with history of in utero procedure during previous pregnancy
V23.87	ICD-9 dx	Pregnancy with inconclusive fetal viability
V23.89	ICD-9 dx	Supervision of other high-risk pregnancy
V23.9	ICD-9 dx	Unspecified high-risk pregnancy
V28.0	ICD-9 dx	Screening for chromosomal anomalies by amniocentesis
V28.1	ICD-9 dx	Screening for raised alpha-fetoprotein levels in amniotic fluid
V28.2	ICD-9 dx	Other antenatal screening based on amniocentesis
V28.3	ICD-9 dx	Encounter for routine screening for malformation using ultrasonics
V28.4	ICD-9 dx	Antenatal screening for fetal growth retardation using ultrasonics
V28.5	ICD-9 dx	Antenatal screening for isoimmunization
V28.6	ICD-9 dx	Screening of Streptococcus B
V28.8	ICD-9 dx	Encounter for other specified antenatal screening
V28.81	ICD-9 dx	Encounter for fetal anatomic survey
V28.82	ICD-9 dx	Encounter for screening for risk of pre-term labor
V28.89	ICD-9 dx	Other specified antenatal screening
V28.9	ICD-9 dx	Unspecified antenatal screening
O09.0	ICD-10 dx	Supervision of pregnancy with history of infertility
O09.00	ICD-10 dx	Supervision of pregnancy with history of infertility, unspecified trimester
O09.01	ICD-10 dx	Supervision of pregnancy with history of infertility, first trimester
O09.02	ICD-10 dx	Supervision of pregnancy with history of infertility, second trimester
O09.03	ICD-10 dx	Supervision of pregnancy with history of infertility, third trimester
O09.1	ICD-10 dx	Supervision of pregnancy with history of ectopic pregnancy
O09.10	ICD-10 dx	Supervision of pregnancy with history of ectopic pregnancy, unspecified trimester
O09.11	ICD-10 dx	Supervision of pregnancy with history of ectopic pregnancy, first trimester
O09.12	ICD-10 dx	Supervision of pregnancy with history of ectopic pregnancy, second trimester
O09.13	ICD-10 dx	Supervision of pregnancy with history of ectopic pregnancy, third trimester
O09.2	ICD-10 dx	Supervision of pregnancy with other poor reproductive or obstetric history
O09.21	ICD-10 dx	Supervision of pregnancy with history of pre-term labor
O09.211	ICD-10 dx	Supervision of pregnancy with history of pre-term labor, first trimester
O09.212	ICD-10 dx	Supervision of pregnancy with history of pre-term labor, second trimester
O09.213	ICD-10 dx	Supervision of pregnancy with history of pre-term labor, third trimester
O09.219	ICD-10 dx	Supervision of pregnancy with history of pre-term labor, unspecified trimester
O09.29	ICD-10 dx	Supervision of pregnancy with other poor reproductive or obstetric history
O09.291	ICD-10 dx	Supervision of pregnancy with other poor reproductive or obstetric history, first trimester

Code	Code type	Description
O09.292	ICD-10 dx	Supervision of pregnancy with other poor reproductive or obstetric history, second trimester
O09.293	ICD-10 dx	Supervision of pregnancy with other poor reproductive or obstetric history, third trimester
O09.299	ICD-10 dx	Supervision of pregnancy with other poor reproductive or obstetric history, unspecified trimester
O09.3	ICD-10 dx	Supervision of pregnancy with insufficient antenatal care
O09.30	ICD-10 dx	Supervision of pregnancy with insufficient antenatal care, unspecified trimester
O09.31	ICD-10 dx	Supervision of pregnancy with insufficient antenatal care, first trimester
O09.32	ICD-10 dx	Supervision of pregnancy with insufficient antenatal care, second trimester
O09.33	ICD-10 dx	Supervision of pregnancy with insufficient antenatal care, third trimester
O09.4	ICD-10 dx	Supervision of pregnancy with grand multiparity
O09.40	ICD-10 dx	Supervision of pregnancy with grand multiparity, unspecified trimester
O09.41	ICD-10 dx	Supervision of pregnancy with grand multiparity, first trimester
O09.42	ICD-10 dx	Supervision of pregnancy with grand multiparity, second trimester
O09.43	ICD-10 dx	Supervision of pregnancy with grand multiparity, third trimester
O09.5	ICD-10 dx	Supervision of elderly primigravida and multigravida
O09.51	ICD-10 dx	Supervision of elderly primigravida
O09.511	ICD-10 dx	Supervision of elderly primigravida, first trimester
O09.512	ICD-10 dx	Supervision of elderly primigravida, second trimester
O09.513	ICD-10 dx	Supervision of elderly primigravida, third trimester
O09.519	ICD-10 dx	Supervision of elderly primigravida, unspecified trimester
O09.52	ICD-10 dx	Supervision of elderly multigravida
O09.521	ICD-10 dx	Supervision of elderly multigravida, first trimester
O09.522	ICD-10 dx	Supervision of elderly multigravida, second trimester
O09.523	ICD-10 dx	Supervision of elderly multigravida, third trimester
O09.529	ICD-10 dx	Supervision of elderly multigravida, unspecified trimester
O09.6	ICD-10 dx	Supervision of young primigravida and multigravida
O09.61	ICD-10 dx	Supervision of young primigravida
O09.611	ICD-10 dx	Supervision of young primigravida, first trimester
O09.612	ICD-10 dx	Supervision of young primigravida, second trimester
O09.613	ICD-10 dx	Supervision of young primigravida, third trimester
O09.619	ICD-10 dx	Supervision of young primigravida, unspecified trimester
O09.62	ICD-10 dx	Supervision of young multigravida
O09.621	ICD-10 dx	Supervision of young multigravida, first trimester
O09.622	ICD-10 dx	Supervision of young multigravida, second trimester
O09.623	ICD-10 dx	Supervision of young multigravida, third trimester
O09.629	ICD-10 dx	Supervision of young multigravida, unspecified trimester
O09.7	ICD-10 dx	Supervision of high risk pregnancy due to social problems
O09.70	ICD-10 dx	Supervision of high risk pregnancy due to social problems, unspecified trimester
O09.71	ICD-10 dx	Supervision of high risk pregnancy due to social problems, first trimester
O09.72	ICD-10 dx	Supervision of high risk pregnancy due to social problems, second trimester
O09.73	ICD-10 dx	Supervision of high risk pregnancy due to social problems, third trimester
O09.8	ICD-10 dx	Supervision of other high risk pregnancies
O09.81	ICD-10 dx	Supervision of pregnancy resulting from assisted reproductive technology
O09.811	ICD-10 dx	Supervision of pregnancy resulting from assisted reproductive technology, first trimester
O09.812	ICD-10 dx	Supervision of pregnancy resulting from assisted reproductive technology, second trimester
O09.813	ICD-10 dx	Supervision of pregnancy resulting from assisted reproductive technology, third trimester
O09.819	ICD-10 dx	Supervision of pregnancy resulting from assisted reproductive technology, unspecified trimester
O09.82	ICD-10 dx	Supervision of pregnancy with history of in utero procedure during previous pregnancy
O09.821	ICD-10 dx	Supervision of pregnancy with history of in utero procedure during previous pregnancy, first trimester
O09.822	ICD-10 dx	Supervision of pregnancy with history of in utero procedure during previous pregnancy, second trimester

Code	Code type	Description
O09.823	ICD-10 dx	Supervision of pregnancy with history of in utero procedure during previous pregnancy, third trimester
O09.829	ICD-10 dx	Supervision of pregnancy with history of in utero procedure during previous pregnancy, unspecified trimester
O09.89	ICD-10 dx	Supervision of other high risk pregnancies
O09.891	ICD-10 dx	Supervision of other high risk pregnancies, first trimester
O09.892	ICD-10 dx	Supervision of other high risk pregnancies, second trimester
O09.893	ICD-10 dx	Supervision of other high risk pregnancies, third trimester
O09.899	ICD-10 dx	Supervision of other high risk pregnancies, unspecified trimester
O09.9	ICD-10 dx	Supervision of high risk pregnancy, unspecified
O09.90	ICD-10 dx	Supervision of high risk pregnancy, unspecified, unspecified trimester
O09.91	ICD-10 dx	Supervision of high risk pregnancy, unspecified, first trimester
O09.92	ICD-10 dx	Supervision of high risk pregnancy, unspecified, second trimester
O09.93	ICD-10 dx	Supervision of high risk pregnancy, unspecified, third trimester
O09.A	ICD-10 dx	Supervision of pregnancy with history of molar pregnancy
O09.A0	ICD-10 dx	Supervision of pregnancy with history of molar pregnancy, unspecified trimester
O09.A1	ICD-10 dx	Supervision of pregnancy with history of molar pregnancy, first trimester
O09.A2	ICD-10 dx	Supervision of pregnancy with history of molar pregnancy, second trimester
O09.A3	ICD-10 dx	Supervision of pregnancy with history of molar pregnancy, third trimester
Z34.0	ICD-10 dx	Encounter for supervision of normal first pregnancy
Z34.00	ICD-10 dx	Encounter for supervision of normal first pregnancy, unspecified trimester
Z34.01	ICD-10 dx	Encounter for supervision of normal first pregnancy, first trimester
Z34.02	ICD-10 dx	Encounter for supervision of normal first pregnancy, second trimester
Z34.03	ICD-10 dx	Encounter for supervision of normal first pregnancy, third trimester
Z34.8	ICD-10 dx	Encounter for supervision of other normal pregnancy
Z34.80	ICD-10 dx	Encounter for supervision of other normal pregnancy, unspecified trimester
Z34.81	ICD-10 dx	Encounter for supervision of other normal pregnancy, first trimester
Z34.82	ICD-10 dx	Encounter for supervision of other normal pregnancy, second trimester
Z34.83	ICD-10 dx	Encounter for supervision of other normal pregnancy, third trimester
Z34.9	ICD-10 dx	Encounter for supervision of normal pregnancy, unspecified
Z34.90	ICD-10 dx	Encounter for supervision of normal pregnancy, unspecified, unspecified trimester
Z34.91	ICD-10 dx	Encounter for supervision of normal pregnancy, unspecified, first trimester
Z34.92	ICD-10 dx	Encounter for supervision of normal pregnancy, unspecified, second trimester
Z34.93	ICD-10 dx	Encounter for supervision of normal pregnancy, unspecified, third trimester
Z36.0	ICD-10 dx	Encounter for antenatal screening for chromosomal anomalies
Z36.1	ICD-10 dx	Encounter for antenatal screening for raised alphafetoprotein level
Z36.2	ICD-10 dx	Encounter for other antenatal screening follow-up
Z36.3	ICD-10 dx	Encounter for antenatal screening for malformations
Z36.4	ICD-10 dx	Encounter for antenatal screening for fetal growth retardation
Z36.5	ICD-10 dx	Encounter for antenatal screening for isoimmunization
Z36.8	ICD-10 dx	Encounter for other antenatal screening
Z36.81	ICD-10 dx	Encounter for antenatal screening for hydrops fetalis
Z36.82	ICD-10 dx	Encounter for antenatal screening for nuchal translucency
Z36.83	ICD-10 dx	Encounter for fetal screening for congenital cardiac abnormalities
Z36.84	ICD-10 dx	Encounter for antenatal screening for fetal lung maturity
Z36.85	ICD-10 dx	Encounter for antenatal screening for Streptococcus B
Z36.86	ICD-10 dx	Encounter for antenatal screening for cervical length
Z36.87	ICD-10 dx	Encounter for antenatal screening for uncertain dates
Z36.88	ICD-10 dx	Encounter for antenatal screening for fetal macrosomia
Z36.89	ICD-10 dx	Encounter for other specified antenatal screening
Z36.8A	ICD-10 dx	Encounter for antenatal screening for other genetic defects
Z36.9	ICD-10 dx	Encounter for antenatal screening, unspecified

Table A10. Codes to identify benzathine G penicillin

Code	Code type	Description
J0560	HCPCS	Injection, penicillin G benzathine, up to 600,000 units
J0561	HCPCS	Injection, penicillin G benzathine, 100,000 units
J0580	HCPCS	Injection, penicillin G benzathine, up to 2,400,000 units
Various	NDC	Generic names of penicillin G benzathine

Table A11. Codes to identify penicillin G procaine

Code	Code Type	Description
J0530	HCPCS	Injection, penicillin G benzathine and penicillin G procaine, up to 600,000 units
J0540	HCPCS	Injection, penicillin G benzathine and penicillin G procaine, up to 1,200,000 units
J0550	HCPCS	Injection, penicillin G benzathine and penicillin G procaine, up to 2,400,000 units
J0558	HCPCS	Injection, penicillin G benzathine and penicillin G procaine, 100,000 units
J0559	HCPCS	Injection, penicillin G benzathine and penicillin G procaine, 2500 units
Various	NDC	Generic names of penicillin G procaine

Table A12. Codes to identify ceftriaxone

Code	Code type	Description
J0696	HCPCS	Injection, ceftriaxone sodium, per 250 mg
Various	NDC	Generic names of ceftriaxone, ceftriaxone sodium

Table A13. Codes to identify doxycycline

Code	Code type	Description
Various	NDC	Generic names of doxycycline hyclate, doxycycline monohydrate, doxycycline calcium

Table A14. Codes to identify tetracycline

Code	Code type	Description
Various	NDC	Generic names of tetracycline HCl

Table A15. Codes to identify azithromycin

Code	Code type	Description
Various	NDC	Generic names of azithromycin

Table A16. Codes to identify erythromycin

Code	Code type	Description
Various	NDC	Generic names of erythromycin base, erythromycin ethylsuccinate, erythromycin stearate

Table A17. Codes to identify amoxicillin

Code	Code type	Description
Various	NDC	Generic names of amoxicillin, amoxicillin/potassium clavulanate

Table A18. Codes to identify penicillin desensitization

Code	Code type	Description
95180	CPT	Rapid desensitization procedure, each hour (eg, insulin, penicillin, equine serum)