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Sexually Transmitted Diseases Among Pregnant Women: 5 States, United States, 2009–2011

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Abstract

Introduction—Screening for specific sexually transmitted diseases (STDs) during pregnancy has been a longstanding public health recommendation. Prior studies have described associations between these infections and socioeconomic factors such as race/ethnicity and education.

Objectives—We evaluated the prevalence of STDs and the correlation socioeconomic factors have with the presence of these infections among pregnant women in the United States.

Methods—We conducted an analysis using self-reported data from 12,948 recently pregnant women from the Pregnancy Risk Assessment Monitoring System (PRAMS) in 5 states during 2009–2011. Responses to questions about curable STDs (chlamydia, gonorrhea, syphilis, trichomoniasis) diagnosed during pregnancy were utilized to calculate weighted STD prevalence estimates and 95% confidence intervals (CI). A logistic regression was also conducted to identify maternal socioeconomic characteristics significantly associated with STDs; results are displayed as adjusted prevalence ratios (aPR). The PRAMS protocol was approved at PRAMS participating sites and by CDC's Institutional Review Board.

Results—Overall, 3.3% (CI 2.9–3.7) reported ≥ 1 curable STD during her most recent pregnancy. The adjusted STD prevalence was higher among women with younger age (aPR, 2.4; CI 1.8–3.4), non-Hispanic black race/ethnicity (aPR, 3.3; CI 2.4–4.1), unmarried status (aPR, 2.1;

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Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflicts of interest. The authors are all employed by the Centers for Disease Control and Prevention (CDC). This research was made possible through CDC funding to state health departments to conduct the Pregnancy Risk Assessment Monitoring System under Funding Opportunity Announcement DP11-001.

CI 1.4–3.0), no college education (aPR, 1.4; CI 1.0–1.9), annual income < $25,000 (aPR, 2.0; CI 1.3–3.2), and no pre-pregnancy health insurance (aPR, 1.4; CI 1.1–1.8).

Conclusions for Practice—This is the largest study of prevalence of self-reported curable STDs among U.S. pregnant women. Differences in STD prevalence highlight the association between certain socioeconomic factors and the presence of STDs.

Keywords

Sexually transmitted diseases/sexually transmitted infections; Pregnant women; Socioeconomic factors; Pregnancy Risk Assessment Monitoring System (PRAMS)

Significance

Sexually transmitted diseases (STDs) are a substantial public health concern and prevalence in the general population continues to increase. Pregnant women are particularly vulnerable as STDs during pregnancy may result in devastating health consequences. However, little has been reported in the literature on the prevalence of these infections among pregnant women in the United States. As one of the few data sources focused on pregnant women and including information on STDs, the Pregnancy Risk Assessment Monitoring System (PRAMS) provides a unique opportunity to examine STD prevalence in this population.

Introduction

Curable sexually transmitted diseases (STDs), including chlamydia, gonorrhea, syphilis, and trichomoniasis, are among the most common infectious diseases in the United States, with chlamydia the most commonly reported notifiable disease in the nation (Centers for Disease Control and Prevention 2014a). According to the most current national estimates, approximately 1.29 million new chlamydial infections, 354,000 incident gonococcal infections, 680,000 new trichomonal infections, and 15,100 new syphilitic infections occurred among U.S. women in 2008 (Satterwhite et al. 2013). However, data regarding STD prevalence among U.S. pregnant women are limited, likely because of the scarcity of sources from which to obtain this information. For example, although chlamydia and gonorrhea are nationally notifiable conditions, pregnancy status may not be routinely reported. Additionally, some women might not be routinely screened for pregnancy when they present for STD screening and are not captured in STD sentinel surveillance systems. Other women may be appropriately screened during pregnancy but their provider may not report their diagnosis (Weinstock et al. 2004). Although a few studies have estimated STD prevalence among pregnant women in the United States, the majority of these studies are based on small groups (< 1400 women) or non-generalizable samples, (e.g., women attending STD clinics) (DiClemente et al. 2004; Johnson et al. 2011; Satterwhite et al. 2012; Sutton et al. 2007; Wheeler et al. 2012). Monitoring prevalence of STDs among pregnant women is needed because untreated STDs during pregnancy are associated with adverse outcomes (e.g., preterm delivery and low birth weight) that are major causes of infant morbidity and mortality (Andrews et al. 2000; Cotch et al. 1997; Edwards et al. 1978; Ricci et al. 1989). Finally, the direct cost of diagnosing and treating incident STDs in the United States are substantial and estimated to be $15.6 billion annually (Owusu-Edusei et al. 2013).

Although this estimate represents a considerable economic burden, it is a conservative one that does not include the costs associated with managing the adverse pregnancy outcomes associated with these infections (Owusu-Edusei et al. 2013).

Approximately 80–90% of chlamydial infections and 70–85% of trichomonal infections among women cause minimal or no symptoms (Centers for Disease Control and Prevention 2012; Peterman et al. 2009; Sutton et al. 2007). Many women with gonorrhea are also asymptomatic; rates of asymptomatic gonococcal infection among women have been cited between approximately 50–80% (Walker and Sweet 2011; Pariser 1976). Consequently, these conditions often remain undiagnosed among pregnant women unless they are screened. National guidelines for prenatal STD screening and treatment have been established to reduce the burden of these infections and prevent maternal and infant complications. The Centers for Disease Control and Prevention (CDC), the American Congress of Obstetricians and Gynecologists, and the U.S. Preventive Services Task Force all recommend that pregnant women be screened for syphilis at the first prenatal visit (Centers for Disease Control and Prevention 2015b; American Academy of Pediatrics and American College of Obstetricians and Gynecologists 2012; U.S. Preventive Services Task Force 2017). They also recommend additional age- and risk-based screening for other STDs (e.g., chlamydia and gonorrhea) during pregnancy (American Academy of Pediatrics and American College of Obstetricians and Gynecologists 2012; Centers for Disease Control and Prevention 2015b; Meyers et al. 2008). Although routine *Trichomonas vaginalis* screening is not formally recommended for pregnant women, except among women infected with human immunodeficiency virus (HIV), clinicians are advised to use their discretion in deciding whether to screen women who are not infected with HIV (Centers for Disease Control and Prevention 2015b).

Multiple factors have been associated with an increased risk for acquiring STDs among women, including young age, black race, poverty, interpersonal violence, and limited education (Centers for Disease Control and Prevention 1996, 2014b; Hogben and Leichliter 2008; Wheeler et al. 2012). However, published data are limited regarding the frequency of STDs and their association with these demographic and social factors among the U.S. pregnant population. We estimate the prevalence of self-reported curable STDs among pregnant women in the United States and describe the sociodemographic characteristics of women reporting these infections to identify characteristics that were associated with higher self-reported STD prevalence.

Methods

Data from the Pregnancy Risk Assessment Monitoring System (PRAMS) were used for this analysis. PRAMS is a U.S. population-based ongoing survey of maternal experiences and behaviors during pregnancy, conducted among women who have had a recent live birth. The survey includes questions regarding wide-ranging maternal experiences, including preconception and prenatal care, social support, and exposure to risk factors, among others. Details of the PRAMS sampling methodology have been published elsewhere, and information about the methodology is publically available (Centers for Disease Control and Prevention 2015a; Shulman et al. 2006). Briefly, the PRAMS sample of women is drawn

from the birth certificate files of 40 states and New York City, and each PRAMS site samples 1300–3400 women each year (Centers for Disease Control and Prevention 2015a). A standardized questionnaire is mailed to a representative sample of women 2–4 months after delivery, and initial nonresponders are contacted and interviewed by telephone. In addition to the core questions included on the surveys of every PRAMS site, each site is also able to customize its questionnaire by adding additional questions on such topics as STDs. The women's responses are then linked to extracted birth certificate data items for analysis (Centers for Disease Control and Prevention 2015a). Thus, PRAMS data includes demographic information collected from the state's vital records system, including age, race/ethnicity, marital status, educational attainment, annual income, insurance status before pregnancy, timing of initiation of prenatal care, and the women's experiences with intimate partner violence during pregnancy, among other factors (Centers for Disease Control and Prevention 2015a). PRAMS data are weighted at the state level to account for sampling stratum, nonresponses, and noncoverage, permitting population-based extrapolations. The PRAMS protocol was reviewed and approved at PRAMS participating sites and by CDC's Institutional Review Board.

We analyzed 2009–2011 PRAMS data from the five states that included questions on STDs diagnosed during pregnancy (Arkansas, Delaware, Mississippi, Missouri, and New York State) and that obtained a minimum overall response rate of 65%, per PRAMS policy for data usage. Curable STDs included chlamydia, gonorrhea, syphilis, and trichomoniasis. Women were coded as not having a curable STD diagnosed during pregnancy if they reported that either no STDs were diagnosed during their most recent pregnancy or if they reported an STD other than chlamydia, gonorrhea, syphilis, or trichomoniasis was diagnosed during their most recent pregnancy. Questions regarding HIV prevalence were only asked of participants in one of the five sites included in this analysis, which prohibited analysis of the impact of this variable on STD prevalence. Therefore, HIV prevalence in this study population was not assessed. To calculate the prevalence of curable STDs among the study population, we reviewed responses to STD-related questions, which varied in the five states. On the Arkansas PRAMS survey, the question was "During your most recent pregnancy, did a doctor, nurse, or other health care worker tell you that you had any of the following diseases or infections?" Respondents were asked to circle either Y (Yes) or N (No) for chlamydia, gonorrhea, syphilis, and trichomoniasis. On the PRAMS surveys for Delaware, Mississippi, Missouri, and New York State, women were asked to respond to the following question: "During your most recent pregnancy, did a doctor, nurse, or other health care worker tell you that you had a sexually transmitted disease (STD)," and respondents were asked to check either Y (Yes) or N (No). If a woman checked *Yes*, she was then asked a follow-up question: "What infection or disease were you told that you had?" She was then asked to check all that apply for chlamydia, gonorrhea, syphilis, trichomoniasis, or other. If *other* was checked, she was asked to write in an answer. We excluded participants who did not provide a response to these STD-related questions. In addition, we omitted participants with missing data on other variables of interest. The maternal sociodemographic variables explored included age (< 25, ≥ 25 years), race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, non-Hispanic other), marital status (unmarried, married), educational attainment (high school or less, some college), annual income (< $25,000, ≥ $25,000),

insurance status before pregnancy (no insurance, any insurance), timing of initiation of prenatal care (first trimester, after first trimester or no prenatal care), and intimate partner violence during the most recent pregnancy (yes, no). Because no statistically significant differences occurred in the prevalence of self-reported curable STDs among the non-Hispanic white, non-Hispanic other, and Hispanic groups, the race/ethnicity variable was collapsed into two categories—non-Hispanic black and other. The cut-off of $25,000 was chosen as the break-point for the annual income variable because it was the PRAMS annual income level closest to the federal poverty guidelines for a family of four during the study years of 2009–2011 (i.e., $22,050–$22,350).

We first estimated the weighted percentage of each maternal characteristic of interest and the weighed prevalence and 95% confidence interval (CI) of curable STDs among the study population. We then estimated unadjusted prevalence ratios and their corresponding 95% CI to investigate the association between self-reported curable STDs diagnosed during pregnancy and each maternal characteristic. To further explore these associations, we constructed a multivariable logistic regression model using a backward selection procedure with statistical significance set at 0.05. The Wald *F* test was used to select the best fit between models. Adjusted prevalence and prevalence ratio estimates were calculated by using predicted marginals from the logistic regression model (Bieler et al. 2010). The descriptive portion of the analysis was performed by using SAS® 9.3 (SAS Institute, Inc., Cary, NC, USA), and the multivariable logistic regression analysis was performed by using SAS-callable SUDAAN® 11 (RTI International, Research Triangle Park, NC, USA). Data were weighted to account for the complex survey design, nonresponse, and noncoverage.

Results

A total of 20,268 recently pregnant women with a live birth, were sampled by the five states that collected data regarding curable STDs diagnosed during pregnancy during 2009–2011, and 13,874 (68.5%) responded to the PRAMS questionnaire. Of women responding to the survey, 926 (6.7%) were excluded because they did not answer questions about STDs diagnosed during their most recent pregnancy or due to missing covariate data (maternal sociodemographic variables of interest), leaving 12,948 women in the study population. The excluded women were more likely to be < 25 years of age (49.6% vs. 34.0%, $p < 0.0001$), non-His-panic black (21.5% vs. 14.9%, $p = 0.0016$), Hispanic (24.6% vs. 8.5%, $p < 0.0001$), and unmarried (54.7% vs. 41.3%, $p < 0.0001$). Excluded women were also more likely to have no college education (76.9% vs. 42.7%, $p < 0.0001$), to report an annual income < $25,000 (77.8% vs. 47.1%, $p < 0.0001$), and to have no health insurance before pregnancy (34.1% vs. 24.1%, $p = 0.0002$) than women in the study population.

Overall, 66.0% of the study population were aged ≥ 25 years; 14.9% were non-Hispanic black; and 58.7% were married (Table 1). Regarding self-reported STDs, 3.3% (CI 2.9–3.7) of respondents reported having had a diagnosis of one or more curable STD during their last pregnancy (2.4% chlamydia; 1.0% trichomoniasis; 0.5% gonorrhea; and 0.2% syphilis) (Table 2). Among these women with curable STDs, 86.5% reported having received a diagnosis of only one STD; 8.5% reported two STDs; and 5.1% reported three or more STDs during their last pregnancy (*data not included in Table* 2). Although all of the maternal

sociodemographic variables of interest were statistically significant in the unadjusted analysis, two variables (timing of initiation of prenatal care and intimate partner violence during pregnancy) became non-significant in the multivariable analysis and were excluded from the final model. Therefore, the final model included age, race/ethnicity, marital status, education, annual income, and insurance status before pregnancy. After controlling for each of these maternal sociodemographic characteristics, the adjusted prevalence of self-reported curable STDs was higher among women < 25 years of age compared to older women (adjusted prevalence ratio [aPR], 2.4; CI 1.8–3.4), among non-Hispanic black women compared to women of other race/ethnicities (aPR, 3.3; CI 2.4–4.1), among unmarried women compared to married women (aPR, 2.1; CI 1.4–3.0), and among women with no college education compared with women with some college education (aPR, 1.4; 95% CI 1.0–1.9). The prevalence of self-reported curable STDs was also higher among women with an annual income < $25,000 compared to women with higher incomes (aPR, 2.0; CI 1.3–3.2) and among women with no health insurance before pregnancy compared to women with any insurance before pregnancy (aPR, 1.4; CI 1.1–1.8) (Table 3).

Discussion

To our knowledge, this analysis is the largest study of prevalence of self-reported curable STDs among U.S. pregnant women. Overall, 3.3% of the study population reported having received a diagnosis of one or more curable STDs during their most recent pregnancy. The prevalence of reported STDs during pregnancy in this analysis were similar to estimates of STD prevalence among women from other population-based surveys (Blatt et al. 2012; Gottlieb et al. 2008; Sutton et al. 2007; Torrone et al. 2013, 2014). Self-reported STDs were substantially more common among recently pregnant women with younger age, non-Hispanic black race/ethnicity, unmarried status, no college education, lack of health insurance before pregnancy and lower annual income. These results highlight the impact social determinants of health have on STD prevalence among pregnant women in the United States, a novel finding that is consistent with studies examining similar associations among the general population (Hogben and Leichliter 2008; Laumann and Youm 1999; Wheeler et al. 2012).

Our prevalence estimates are similar to findings from a previous study regarding gonorrhea and chlamydia positivity among pregnant women. Blatt et al. reported a 3.5% positivity rate for chlamydial infection and a 0.6% positivity rate for gonococcal infection among approximately 1.3 million pregnant women, by abstracting test result data for 2005–2008 from a large U.S. clinical laboratory (Blatt et al. 2012). However, our prevalence estimates were lower than what was noted in prior studies that used either clinician-verified diagnoses or data from settings serving higher-risk populations (e.g., STD clinics): chlamydia (2.2–13.8%), gonorrhea (1.2–7.1%), syphilis (1.2%), and trichomoniasis (8.9–14.9%) (DiClemente et al. 2004; Johnson et al. 2011; Johnson and Hellerstedt 2002; Sutton et al. 2007; Satterwhite et al. 2012; Wheeler et al. 2012). Nevertheless, the prevalence estimates quoted in nearly all of these types of studies were derived from convenience samples of pregnant women rather than the population of all pregnant women and might not represent true population prevalence.

Our findings are subject to several limitations. The most important limitation is that PRAMS is based on self-reported data. PRAMS does not access or collect clinical records; therefore, assessing screening, testing, or treatment for STDs was impossible, including whether all participants were screened for STDs in accordance with national recommendations for pregnant women. Reporting or recall bias might occur if some women were unaware of, misunderstood, or did not report their STD diagnoses out of reluctance to discuss this sensitive topic. This limitation might have resulted in prevalence underestimates. Conversely, women who were either symptomatic before their STD diagnoses or who had an adverse infant outcome might have been more likely to remember or report an STD during pregnancy than women receiving a diagnosis from a screening test or women with healthy newborns, which might bias our findings in the other direction. Although our results are based on self-reported data, prior studies have reported that women are able to correctly recall events that happened during pregnancy, even several years after the pregnancy (Githens et al. 1993; Liu et al. 2013b; Sou et al. 2006; Tomeo et al. 1999). Women are also willing to answer sensitive questions about such topics as STDs as noted in a previous study on maternal recall that reported 98% agreement between maternal recall and the medical record, when women were asked about STDs during their recent pregnancy (Githens et al. 1993). Although not directly related to STDs, prior studies on other topics have also shown that self-reported data can provide reliable estimates of population prevalence (Bays et al. 2007; Eke and Dye 2009; Soulakova et al. 2013).

These findings are not necessarily representative of the entire U.S. pregnant population. Although we present data from > 12,000 recently pregnant women, all participants were from five states, because these five were the only states that included STD questions on their PRAMS surveys during the study period. However, based on the 2011 U.S. census, these states were demographically similar to the United States overall on multiple parameters including the median age (38 years for the five states compared to 37.3 years for the United States), marital status (45.4% of females aged ≥ 15 were married compared to 46.6% for the United States), educational attainment (85.8% of females aged ≥ 25 were high school graduates versus 86.5% for the United States), median household income ($46,996 vs. $50,502 for the United States), poverty rate (12.8 vs. 11.7% for the United States), and lack of health insurance (13.9% of persons with no health insurance in the five states vs. 15.1% for the United States) (U.S. Census Bureau 2011). Also, PRAMS surveys women with a recent live birth only. Women with miscarriages or stillbirths are excluded, and prior studies have linked STDs to these adverse outcomes, also contributing to potential underestimates in our study (Baud et al. 2011; De Santis et al. 2012; Liu et al. 2013a). Although PRAMS collects self-reported data on HIV status during pregnancy, this question was asked of study participants at only one of the five states with STD-related questions on their survey. Consequently, we were unable to evaluate how HIV positivity might have affected the prevalence of curable STDs among this population, if at all. If we were able to evaluate HIV-positive women separately, we might have observed a higher prevalence of curable STDs among that group, similar to prior studies (Wasserheit 1992). Furthermore, as previously mentioned, 926 women were excluded from the analysis because either they did not answer questions about STDs diagnosed during their most recent pregnancy or had missing data for one of the maternal sociodemographic variables of interest. These women were statistically

different from the study population for several parameters: age, race/ethnicity, marital status, educational attainment, annual income, and insurance status. As indicated, prior studies have noted associations between some of these social determinants of health and the presence of STDs among the general population, and the excluded women might have been more likely to report these diagnoses during their most recent pregnancy (Centers for Disease Control and Prevention 1996, 2014b; Hogben and Leichliter 2008; Wheeler et al. 2012). Also, conclusions drawn from this analysis are limited to the specific sociodemographic factors we assessed that might contribute to STD prevalence. We did not analyze other factors that can also influence STD prevalence (e.g., substance abuse or participation in high-risk sexual networks) (Healthy People 2020 2017). Finally, because this is a cross-sectional analysis, we are unable to infer causality regarding the associations we have identified.

Despite these limitations, our study expands knowledge of the frequency and demographic distribution of curable STDs among U.S. pregnant women, by using one of the few available data sources specific to this population. We report prevalence data on four common STDs among a population for whom surveillance has been limited and few other data are available in the literature. We also highlight a concern with substantial clinical, public health, and economic consequences and for which interventions are readily available, including screening, diagnostic testing, and effective treatments. Also, because PRAMS allows us to evaluate all pregnant women with a recent live birth, despite our sampling limitation, our prevalence estimates might be closer to the true prevalence of these four STDs, when compared with prior studies. Still, further research is warranted to address the limitations previously discussed. Specifically, to establish more accurate estimates, studies evaluating STD prevalence are needed that are inclusive of all pregnant women, regardless of the outcome of the pregnancy or perceived risk for infection. In addition, including pregnancy status on STD case reports from providers and laboratories might help facilitate more reliable estimates. Studies are also needed that evaluate screening and treatment of STDs among women during the course of prenatal care. These types of analyses can improve STD prevalence estimates among pregnant women and potentially create opportunities to further assess interactions between STDs and adverse pregnancy outcomes. Additionally, data from more states would strengthen representativeness. Because STDs continue to be a cause of morbidity among pregnant women and infants, practitioners should follow national screening recommendations for STDs during pregnancy.

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Table 1

Maternal characteristics of women responding to STD[a] questions in PRAMS—5 states[b], United States, 2009–2011

Maternal characteristic	No. (Weighted %)
Total N	**12,948**
Age (years)	
<25	4766 (34.0)
≥25	8182 (66.0)
Race/ethnicity	
Non-Hispanic black	2696 (14.9)
Other	10,252 (85.1)
Marital status	
Married	7366 (58.7)
Unmarried	5582 (41.3)
Education	
High school or less	6084 (42.7)
Some college	6864 (57.3)
Annual income	
< $25,000	6675 (47.1)
≥$25,000	6273 (52.9)
Insurance status before pregnancy	
Any insurance	9574 (75.9)
No insurance	3374 (24.1)
Initiation of prenatal care	
1st trimester	11,136 (89.0)
After 1st trimester/no prenatal care	1605 (11.0)
Missing	207
Intimate partner violence	
Yes	507 (3.3)
No	12,394 (96.7)
Missing	47

PRAMS Pregnancy Risk Assessment Monitoring System, *STD* sexually transmitted disease

[a] Includes: chlamydia, gonorrhea, syphilis, trichomoniasis

[b] Arkansas, Delaware, Missouri, Mississippi, and New York (not including New York City)

Table 2

Self-reported STD diagnoses during pregnancy among women responding to STD questions in PRAMS—5 states[a], United States, 2009–2011 (N = 12,948)

Criterion	No.	Weighted %	95% CI
No curable STDs[b]	12,362	96.7	96.3–97.1
Any curable STD[c]	586	3.3	2.9–3.7
Chlamydia	382	2.4	2.0–2.7
Trichomoniasis	214	1.0	0.8–1.2
Gonorrhea	84	0.5	0.3–0.6
Syphilis	49	0.2	0.1–0.3

CI confidence interval, *PRAMS* Pregnancy Risk Assessment Monitoring System, *STD* sexually transmitted disease

[a] Arkansas, Delaware, Missouri, Mississippi, and New York (not including New York City)

[b] Includes women who reported no STDs and women who only reported genital herpes or genital warts

[c] Includes chlamydia, gonorrhea, syphilis, trichomoniasis

Table 3

Estimated prevalences and prevalence ratios of self-reported curable STDs[a] during pregnancy, by maternal characteristic, PRAMS—5 states[b], United States, 2009–2011

	Unadjusted prevalence of self-reported curable STDs[a] N = 12,948 Unweighted % (95% CI)	PR (95% CI)	Adjusted[f] prevalence of self-reported curable STDs[a] N = 12,948 Unweighted % (95% CI)	aPR[f] (95% CI)
Age (years)				
<25	7.1 (6.1–8.2)	5.2 (3.9–6.9)	4.6 (3.9–5.5)	2.4 (1.8–3.4)
≥25	1.4 (1.1–1.7)	Ref.	1.9 (1.5–2.5)	Ref.
Race/ethnicity				
Non-Hispanic black	10.5 (8.8–12.5)	5.1 (4.0–6.5)	7.1 (5.8–8.5)	3.3 (2.4–4.1)
Other	2.1 (1.7–2.5)	Ref.	2.3 (1.9–2.7)	Ref.
Marital status				
Unmarried	6.6 (5.7–7.6)	6.8 (4.9–9.4)	4.0 (3.4–4.6)	2.1 (1.4–3.0)
Married	1.0 (0.7–1.3)	Ref.	1.9 (1.4–2.6)	Ref.
Education				
High school or less	5.6 (4.8–6.4)	3.4 (2.6–4.6)	3.7 (3.2–4.3)	1.4 (1.0–1.9)
Some college	1.6 (1.3–2.1)	Ref.	2.7 (2.1–3.4)	Ref.
Annual income				
< $25,000	6.1 (5.4–7.0)	7.4 (5.1–10.8)	3.8 (3.3–4.4)	2.0 (1.3–3.2)
≥ $25,000	0.8 (0.6–1.2)	Ref.	1.9 (1.3–2.9)	Ref.
Insurance status before pregnancy				
No insurance	5.7 (4.7–7.0)	2.3 (1.7–2.9)	4.1 (3.4–5.1)	1.4 (1.1–1.8)
Any insurance	2.5 (2.2–3.0)	Ref.	2.9 (2.5–3.4)	Ref.
Initiation of prenatal care[c,d]				
1st trimester	3.0 (2.6–3.4)	Ref.		
After 1st trimester/no PNC	5.5 (4.1–7.4)	1.8 (1.3–2.5)		
Intimate partner violence[e,d]				
Yes	8.2 (5.5–12.1)	2.6 (1.7–3.9)		
No	3.1 (2.8–3.6)	Ref.		

PR prevalence ratio, *aPR* adjusted prevalence ratio, *CI* confidence interval, *PRAMS* Pregnancy Risk Assessment Monitoring System, *STD* sexually transmitted disease, *PNC* prenatal care

[a] Includes: chlamydia, gonorrhea, syphilis, trichomoniasis

[b] Arkansas, Delaware, Missouri, Mississippi, and New York (not including New York City)

[c] Excluded 207 women with missing values for the variable “Initiation of prenatal care”

[d] Initiation of prenatal care and Intimate partner violence were not statistically significant in the adjusted analysis and were excluded from the final model

[e] Excluded 47 women with missing values for the variable “Intimate partner violence”

[f] Adjusted for the following variables: age, race/ethnicity, marital status, education, annual income, insurance status