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Vaginal Douching and Risk of Preterm Birth among African-American Women

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Abstract

Objective—To examine how vaginal douching may influence risk of preterm birth.

Study Design—We conducted a hybrid cohort study on risk factors for preterm birth. African-American women residing in Baltimore City, Maryland, were enrolled prenatally if they received prenatal care at one of four Johns Hopkins Medical Institution prenatal clinics or enrolled postpartum if they delivered at the Johns Hopkins Medical Institution with late, none, or intermittent prenatal care. Interview data were collected on 832 enrolled women delivering singletons between March 2001 and July 2004.

Results—The preterm birth rate was 16.4%. After adjusting for several potential confounders, those covariates associated with either vaginal douching or preterm birth in our sample, or identified as confounders in the literature on douching and/or preterm birth, vaginal douching 6 months prior to pregnancy and less than 3 times per month (prevalence ratio (PR): 0.63, 95% CI: 0.42-0.95) was associated with a reduced risk of preterm delivery while douching during pregnancy was associated with a trend toward increased risk of preterm birth (PR: 1.64, 95% CI: 0.97-2.76).

Conclusion—Vaginal douching effects on risk of preterm birth depend on the timing of the exposure. Douching in the 6 months prior to pregnancy, but not during pregnancy, appears to protect against preterm birth.

Keywords

preterm; vaginal douching; race/ethnicity; socioeconomic status

Introduction

Vaginal douching is a widespread practice among American women which may be hazardous to their health.¹ Although the overall prevalence has declined, more than half of all U.S. African American women report douching and rates for all women are inversely associated with education.² The greater likelihood of vaginal douching in minority and low socioeconomic

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status women² has led our research team and others to hypothesize that the differences in the prevalence of this exposure may contribute to persistent racial and socioeconomic disparities in birth outcomes. It is postulated that douching may promote infection by propelling bacteria into the cervix, uterus, and fallopian tubes. Douches may also disturb the normal balance of organisms in the vagina and alter the vaginal milieu, thereby promoting ascending infection with sexually transmitted organisms.

While a number of studies have linked douching to an increased risk of reproductive tract infections in non-pregnant women,^{1, 3-17} only three studies have published findings on the effects of douching on birth outcomes. Using cross-sectional data from the 1988 National Survey of Family Growth (NSFG), Fiscella and colleagues reported that women who reported currently douching two to three times per week were more likely to have a history of delivering a low birth weight infant, but that women who douched less often experienced no increase in risk.¹⁸ Fiscella later conducted a case-control study of preterm birth in Rochester, New York and found no association overall between preterm birth and douching in the six months before pregnancy.¹⁹ Finally, in a postpartum study conducted at Kaiser Permanente medical center sites in Atlanta, Georgia, douching during pregnancy was associated with an increased risk of preterm birth while douching in the six months prior to pregnancy was correlated with a small albeit statistically significant reduction in risk of preterm birth. Patterns with the frequency of exposure were not reported.²⁰

We recently collected detailed data on the practice of vaginal douching in a cohort study of preterm birth among low-income African-American women. Our study collected data on a wide range of risk factors hypothesized to relate to preterm birth and/or douching, thus enabling us to consider and adjust for important confounders of the associations. We report here on the relationship between vaginal douching in the periods before and during pregnancy with preterm birth.

Methods

Study Design and Sample

The study was reviewed and approved by institutional review boards. The sample eligibility was restricted to African-American women residing in Baltimore City (Maryland). We approached eligible women for enrollment if they were receiving prenatal care at one of three selected clinics or had delivered at the affiliated hospital with late, sporadic, or no prenatal care. Methods are described in more detail in an earlier publication.²¹ In brief, women were interviewed in person to collect information regarding vaginal douching, sociodemographic factors, psychosocial factors, and most health behaviors. Women enrolled prenatally were interviewed twice, the first interview, at 22 to 28 weeks gestation and the second interview, a short postpartum interview. Women enrolled postpartum with late or no prenatal care were interviewed only once, during the postpartum hospitalization, to measure factors from all three trimesters of pregnancy. We collected interview data on a total of 872 women (enrolling 485 prenatally and 387 postpartum) over a forty-one month period (March 2001 through July 2004) with a 68 percent response rate. Excluding multiple births (n=24) and losses to follow up (n=16), 832 participants were included in the analyses.

Measurement of Key Variables

We asked about history of douching, specifically, the age at which douching was initiated. For women who reported douching, we asked whether and how often they douched in two time periods: the six months prior to the pregnancy, and during the pregnancy. Detailed information about douching practices (e.g. placement of nozzle/tube) was collected with regard to the most

recent time period a woman reported douching. We also asked women about use of “sprays, towelettes, or wipes” and “powders on private areas after bathing.”

Sociodemographic and behavioral data were collected from interviews. To provide a more nuanced assessment of socioeconomic status within this sample of low income women, we used the Family Resource Scale (FRS).²² This scale measures the extent to which women have the time or money to meet needs; based on exploratory analyses as well as prior studies we had conducted in this population,²³ we examined subscales for essential and nonessential needs and for time and money separately. The medical record was abstracted to collect data on component measures of gestational age (e.g. LMP, ultrasound estimated date of confinement), parity, multiple gestation, initiation of prenatal care, and number of prenatal visits. Medications were also abstracted; none of the women in our study were documented to receive progesterone injection therapy, recently recommended for the prevention of preterm birth in women with a prior preterm birth. Preterm was defined as birth prior to 37 completed weeks of gestation. Gestational age based on last menstrual period (LMP) as reported on the medical record was systematically compared to other estimates of gestational age in a hierarchical fashion. In the case of inconsistency, the initial estimate by the provider based on early ultrasound was selected. When estimates were consistent, the estimate based on LMP from the medical record was used. Adequacy of prenatal care was determined by medical record review and computation of the Adequacy of Prenatal Care Utilization (APNCU) Index.²⁴

Analysis

Due to the very small number of women who douched during pregnancy (n=43), we were unable to refine the measure of douching in this time period and maintain stable estimates. For women douching in the 6 months prior to pregnancy, we considered the four preset response categories: less than once a month (18.4%, n=69) once or twice a month (71.9%, n=268), three or four times a month (7.5%; n=28); more than four times a month (2.1%; n=8). As very few women reported douching in the highest frequency categories, we collapsed these with the adjacent category. For the lowest two frequency categories, the effect estimates were similar when separately examined and we therefore collapsed these categories. We thus categorized women who douched in the six months prior to pregnancy into two groups: <3 times per month (less than once a month and once or twice a month), 3+ times per month (three or four times a month and more than four times a month). Covariates were explored as both continuous and categorical variables and in most cases were treated as dichotomous factors in the final models. Covariates were considered as potential confounders if they were associated with either vaginal douching or preterm birth in our sample, or had been identified as confounders in the literature on douching and/or preterm birth. These included, in addition to those included in our final model: psychosocial factors (pregnancy locus of control; stress during pregnancy; social support, depression, anxiety); health behaviors (alcohol use in pregnancy; drug use in pregnancy); additional measures of socioeconomic status (rent/mortgage, income, housing quality). We judged covariates to be confounders if the coefficient for the exposure changed more than 10 percent when the covariate was included alone or in combination with other covariates. As our preterm birth rate (~16 percent) does not meet the rare disease assumption of logistic regression, we used log-binomial regression to estimate the unadjusted and adjusted prevalence ratios for the association between vaginal douching practices and preterm birth.^{25, 26} We did not compute relative risk estimates as our study design does not ensure that the identified preterm birth cases are incident rather than prevalent. The prevalence ratio, sometimes more precisely referred to as the prevalence proportion ratio, is simply defined as the ratio of the prevalence of the outcome in the exposed group as compared to the unexposed group.²⁶ Missing values for variables representing lifetime number of partners and age at first intercourse were imputed using multiple imputation.^{27, 28} We multiply imputed missing values ten times, under the multiple imputation procedure in SAS, the model included variables

for lifetime number of partners and age at first intercourse as well as complete variables including participants age and weight. The data analyses for this paper were performed using SAS ® software (SAS Version 9.1 for Windows; SAS Institute Inc., Cary, NC).

Results

Douching prevalence according to period of exposure is shown in Figure 1. Nearly two-thirds of the sample reported ever douching with a substantial proportion continuing to douche in the six months just prior to pregnancy. Only a small fraction of women reported douching during the index pregnancy. The overall preterm birth rate was 16.4 percent (139/832). Table 1 describes the characteristics of the study cohort.

Table 2 provides the unadjusted and adjusted prevalence ratios for preterm birth using the log-binomial method. In a crude model of the effects of douching, women who reported douching less than three times per month in the six months before pregnancy were less likely to deliver preterm than women who reported never douching (prevalence ratio (PR), 95% confidence interval (CI): 0.66, 0.44-0.99) while women reporting douching during the pregnancy were at higher risk of delivering preterm than women who reported never douching (PR, 95% CI: 1.76, 1.03-3.01). There was neither a protective nor an adverse effect of douching more frequently than three times per month in the six months prior to pregnancy. Compared to women who did not douche, women who reported ever douching but not in the six months prior to delivery were no more or less likely to deliver preterm. Adjusting for several confounders (age, smoking in pregnancy, parity, prior preterm birth, adequacy of prenatal care, number of lifetime sexual partners, age at first intercourse, and the “inadequacy of resources to meet nonessential needs” subscale of the Family Resource Scale), women who reported douching less than three times per month in the six months before pregnancy were significantly and much less likely to deliver preterm than women who reported never douching (PR, 95% CI: 0.63, 0.42-0.95). Compared to women reporting never douching, women reporting douching during the pregnancy were at a higher risk of delivering preterm, albeit not statistically significant (PR, 95% CI: 1.64, 0.97-2.76).

We hypothesized that the apparently adverse influence of douching during pregnancy might be the result of reverse causality in that women may have douched in response to symptoms of infection, with the infection being the true culprit. Figure 2 illustrates the relationship between douching practices and women's reports of symptoms (i.e. itching/burning, discharge, odor) or reported diagnoses of infections. For all indicators, much higher frequencies are seen for women who douched during pregnancy. Hence, douching during pregnancy might be a response to infection rather than its cause. However, due to constraints of our study design and the lack of primary data on infection, causality cannot be determined or excluded.

We then explored whether there were specific characteristics of a woman's douching practice that might modify the effect of douching. While there was variability in how far women inserted the nozzle/tube into the vagina, those who did not insert at all were a small group and could not be analyzed. We saw no sizeable difference in the effect of douching between those who inserted the nozzle/tube all of the way into the vagina and those who inserted only partially. Stratifying on duration of flow was also uninformative. Again, however, while there was considerable variability, the distribution by flow duration was skewed with too few women in the more than five minutes duration category to properly study this group. With regard to type of douching solution, results were inconclusive with use of only vinegar and water preparations found to be as protective as exclusive use of other douches or use of both types of products.

The effect of using “sprays, towelettes, or wipes” and powders for feminine hygiene was also explored. There was no statistically significant association of preterm birth with using powders in the six months prior to pregnancy in either crude or adjusted (PR, 95% CI: 0.70, 0.45-1.08)

models. Similarly, there was no association of preterm birth with use of “sprays, towelettes or wipes” in the six months prior to pregnancy in either crude or adjusted (PR, 95% CI: 0.88, 0.63-1.24) models. While these feminine hygiene behaviors overlap a great deal with vaginal douching practice, not all women engage in all of the behaviors. The prevalence ratios for the association between douching less than three times per month in the six months prior to pregnancy with these behaviors were 2.5 for use of powder in that same time period and 2.4 for use of “sprays, towelettes, or wipes.” In a model for preterm birth including use of powder in the six months prior to pregnancy as well as the other identified confounders, there was essentially no change in the estimate of the prevalence ratio relating vaginal douching less than three times per month in the six months prior to pregnancy with preterm birth. The same was true for a model including “sprays, towelettes, and wipes” in the six months prior to pregnancy.

Discussion

We hypothesized that vaginal douching would increase the risk of preterm birth and thereby possibly explain a portion of the racial disparity in preterm birth as the rates of douching are much higher for black women. While we found that women who douched during pregnancy appeared to be at increased risk for preterm birth, albeit not quite statistically significant at $p < 0.05$ after adjustment, exactly the opposite was true of exposure to douching in the six months prior to pregnancy. While very few studies have been published on this topic and none in a cohort as disadvantaged as this one, our findings are in fact consistent with results of the study by Bruce et al who also reported a reduction in preterm birth risk for douching in the six months prior to pregnancy.²⁰ What then might be the mechanism by which douching in this preconceptional period reduces preterm birth risk? While it has been postulated that douching increases risk of infection, it is conceivable that the reverse might be the case. There is some support for this notion from a recent study demonstrating a reduction in risk of incident HIV infection associated with douching.²⁹

A major strength of our study was the collection of data on a wide range of risk factors hypothesized to relate to preterm birth and/or douching, thus enabling us to consider and adjust for important confounders of the associations. This was especially important as two of the predictors of douching in our sample, smoking and prenatal care, had opposite effects on preterm risk. The inclusion of these confounders in models of preterm birth is critical to understanding the independent effect of douching. While we found differences in crude preterm birth rates by douching exposure, the effects were stronger after adjustment for confounders. Furthermore, we note that two other feminine hygiene behaviors strongly correlated with douching (use of powders and “sprays, towelettes, and wipes”) were not associated with similar reductions in risk of preterm birth in our study.

An additional strength of our study was the detailed information collected on douching. Prior studies have not reported any variation in the effect of douching on outcomes compared by type of douching solution or technique (e.g. insertion point of the nozzle, duration of flow). While we collected these data, the distribution of the data was such that our analyses were not very informative. However, we recommend that future studies continue to more carefully assess douching practices given the evidence for heterogeneity. Understanding the variations in the practice may be critical to determining the mechanism by which douching increases or reduces risk.

Our study does indeed differ in some important ways from previous studies of vaginal douching in pregnancy. While our study enrolled only African-American low income women, past studies were much more heterogeneous and included a far smaller proportion of such women. While black women were well represented in the Bruce et al study²⁰ in Atlanta, Georgia (n=375, 46%), all of the women enrolled were covered by private medical insurance and three-

quarters of the sample had more than twelve years of education. The study by Fiscella conducted in Rochester, New York¹⁹ also included a sizable proportion of African-Americans, but even among the African-American women nearly 30 percent had more than twelve years of education. The National Survey of Family Growth study of vaginal douching and preterm birth¹⁸ included a nationally representative sample of women. All three of these study populations are in marked contrast to our sample in which one hundred percent of the subjects were African-American, none of the study subjects were privately insured, and only ten percent of the sample had more than twelve years of education.

As we had collected data on other feminine hygiene behaviors, we were also able to consider whether douching had unique effects or was simply one of a number of feminine hygiene behaviors associated with preterm birth risk. If all of these hygiene behaviors were associated with a reduction in risk, we might interpret the effect as less likely to relate to a biologic exposure of the agent and more likely to be related to an underlying psychosocial factor that leads women to engage in these feminine hygiene practices. However, vaginal douching in the six months prior to pregnancy was the only one of the behaviors strongly associated with a reduction in risk, suggesting that it is not a proxy for health behavior more generally.

While our finding of a protective effect appears robust, examination of the pathways to this reduction in risk is compromised by the lack of data on reproductive tract infections, particularly bacterial vaginosis (BV), as these are known to increase risk of preterm birth. While BV data were available for approximately half of our sample (prenatal enrollees), the sample size was insufficient to achieve convergence for our (fully adjusted) statistical models. Furthermore, we collected only a single second trimester assessment for women enrolled prenatally. As a result, we could not effectively examine the role of BV in the douching-preterm birth association. BV assessments in the first trimester and beyond will be needed to provide insight into the apparent protective effect of douching in the six months prior to pregnancy. Longitudinal studies of douching and preterm birth may illuminate these issues.

Conclusion

Vaginal douching is a health behavior commonly practiced by minority and less educated women. It is critical that we determine whether this practice is a safe one for women, during and prior to pregnancy. Our findings suggest that effects of this behavior depend on timing and frequency of the exposure, and that douching may act differently than has previously been hypothesized. Replication of our findings should lead to a reconsideration of the health effects of vaginal douching.

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References

1. Martino J, Vermund S. Vaginal douching: Evidence for risks or benefits to women's health. *Epidemiologic Reviews* 2002;24:109–124. [PubMed: 12762087]
2. Abma J, Chandra A, Mosher W, Peterson L, Piccinino L. Fertility, family planning, and women's health: New data from the 1995 National Survey of Family Growth. *Vital Health Statistics* 1997;23:100.

3. Scholes D, Stergachis A, Ichikawa L. Vaginal douching as a risk factor for cervical Chlamydia trachomatis infection. *Obstet Gynecol* 1998;91:993–997. [PubMed: 9611011]
4. Stergachis A, Scholes D, Heidrich FE, Sherer DM, Holmes KK, Stamm WE. Selective screening for Chlamydia trachomatis infection in a primary care population of women. *American Journal of Epidemiology* 1993;138:143–153. [PubMed: 8356957]
5. Beck-Sague C, Farshy C, Jackson T, et al. Detection of Chlamydia trachomatis cervical infection by urine tests among adolescents clinics. *J Adolesc Health* 1998;22:197–204. [PubMed: 9502006]
6. Peters S, Beck-Sague C, Farshy C, et al. Behaviors associated with Neisseria gonorrhoeae and Chlamydia trachomatis: cervical infection among young women attending adolescent clinics. *Clin Pediatr (Phila)* 2000;39:173–177. [PubMed: 10752012]
7. Rajamanoharan S, Low N, Jones S, et al. Bacterial vaginosis, ethnicity, and the use of genital cleaning agents: A case control study. *Sex Transm Dis* 1999;26:404–409. [PubMed: 10458635]
8. Holzman C, Leventhal J, Qiu H, Jones N, Wang J. BV Study Group. Factors linked to bacterial vaginosis in nonpregnant women. *American Journal of Public Health* 2001;91:1664–1670. [PubMed: 11574333]
9. Fonck K, Kaul R, Keli F, et al. Sexually transmitted infections and vaginal douching in a population of female sex workers. *Sex Transm Dis* 2001;77:271–275.
10. Royce R, French J, Savitz D, et al. Vaginal douching, bacterial vaginosis, and preterm birth (Abstract 574). *Am J Epidemiol* 2001;153:S161.
11. Hawes SE, Hillier SL, Benedetti J, et al. Hydrogen peroxide producing lactobacilli and acquisition of vaginal infections. *Journal of Infectious Diseases* 1996;174:1058–1063. [PubMed: 8896509]
12. Onderdonk AB, Delaney ML, Hinkson PL, DuBois AM. Quantitative and qualitative effects of douche preparations on vaginal microflora. *Obstet Gynecol* 1992;80:333–338. [PubMed: 1495688]
13. Scholes D, Daling JR, Stergachis A, Weiss NS, Wang SP, Grayston JT. Vaginal douching as a risk factor for acute pelvic inflammatory disease. *Obstet Gynecol* 1993;81:601–606. [PubMed: 8459976]
14. Zhang J, Thomas G, Leybovich E. Vaginal douching and adverse health effects: A meta-analysis. *American Journal of Public Health* 1997;87:1207–1211. [PubMed: 9240115]
15. Paisarntantiwong R, Brockmann S, Clarke L, et al. The relationship of vaginal trichomoniasis and pelvic inflammatory disease among women colonized with Chlamydia trachomatis. *Sex Transm Dis* 1995;22:344–347. [PubMed: 8578405]
16. Mueller B, Luz-Jimenez M, Daling J. Risk factors for tubal infertility. Influence of prior pelvic inflammatory disease. *Sex Transm Dis* 1992;19:28–34. [PubMed: 1561585]
17. Wolner-Hanssen P, Eschenbach D, Paavonen J, et al. Association between vaginal douching and acute pelvic inflammatory disease. *JAMA* 1990;263:1936–1941. [PubMed: 2313870]
18. Fiscella K, Franks P, Kendrick J, Bruce F. The risk of low birth weight associated with vaginal douching. *Obstetrics and Gynecology* 1998;92:913–917. [PubMed: 9840548]
19. Fiscella K, Franks P, Kendrick J, Meldrum M, Kieke B. Risk of preterm birth that is associated with vaginal douching. *Am J Obstet Gynecol* 2002;186:1345–1350. [PubMed: 12066120]
20. Bruce C, Kendrick J, Kieke B, Jagielski S, Joshi R, Tolsma D. Is vaginal douching associated with preterm delivery? *Epidemiology* 2002;13:328–333. [PubMed: 11964935]
21. Misra D, Trabert B, Atherly-Trim S. Variation and predictors of vaginal douching practices. *Women's Health Issues*. In press
22. Dunst CJ, Leet HE. Measuring the adequacy of resources in households with young children. *Child: Care, Health, and Development* 1987;13:111–125.
23. Misra D, O'Campo P, Strobino D. Testing a sociomedical model for preterm delivery. *Paediatric and Perinatal Epidemiology* 2001;15(2):110–122. [PubMed: 11383575]
24. Kotelchuck M. An evaluation of the Kessner Adequacy of Prenatal Care Index and a proposed Adequacy of Prenatal Care Utilization Index. *Am J Public Health* 1994;84:140–120.
25. Spiegelman D, Hertzmark E. Easy SAS calculations for risk or prevalence ratios or differences. *Am J Epidemiol* 2005;162:199–200. [PubMed: 15987728]
26. Skov T, Deddens J, Peterson M, Endahl L. Prevalence proportion ratios: estimation and hypothesis testing. *Int J Epidemiol* 1998;27:91–95. [PubMed: 9563700]
27. Rubin D. Multiple imputation after 18+ years. *JASA* 1996;91:473–489.
28. Schafer, J. Analysis of incomplete multivariate data. Chapman and Hall; New York: 1997.

29. Gresenguet G, Kreiss K, Chapko MK, Hillier SL, Weiss NS. HIV infection and vaginal douching in Central Africa. *AIDS* 1997;11:101–106. [PubMed: 9110082]

Figure 1.
Vaginal douching by exposure period.

Figure 2.
Vaginal symptoms by douching exposures.

Table 1

Descriptive Characteristics of the Study Sample

Descriptive Characteristics	Total Sample (N=832)
<i>Age: mean (std dev) range</i>	23.1 (5.6) 12-43
<i>Race-self report: Black or African American</i>	n (percent) 832 (100%)
<i>Ethnicity-self report:</i> Hispanic	10 (1.2%)
<i>Education:</i> ≤ 12 years of school, < 21 years old	309 (37.1%)
≤ 12 years of school, ≥ 21 years old	440 (52.9%)
> 12 years of school	83 (10.0%)
<i>Recruitment:</i> Prenatal	456 (54.8%)
Postpartum	376 (45.2%)
<i>Previous preterm delivery</i> At least 1 prior preterm deliveries	103 (12.4%)
No prior preterm deliveries	532 (63.9%)
Nulliparous	197 (23.7%)
<i>Age at first intercourse</i> ≤ 11 years old	23 (2.8%)
12-14 years old	298 (35.8%)
15-17 years old	367 (44.1%)
≤ 18	82 (9.9%)
<i>Lifetime number of partners</i> 1-3 men	231 (27.8%)
4-10 men	419 (50.4%)
≤ 11 men	75 (9.0%)
<i>Vaginal Douching:</i> Ever (but not 6 months prior or during pregnancy)	175 (21.0%)
During the 6 months before pregnancy (only)	318 (38.2%)
Less than 3 times per month	294 (35.3%)
3 or more times per month	24 (2.9%)
During pregnancy (also includes women who douched 6 months before and during pregnancy)	40 (4.8%)
<i>Feminine Spray, wash or towelettes to clean private areas:</i> During 6 months before pregnancy	284 (34.1%)
During pregnancy	113 (13.6%)
<i>Talcum, baby or deodorizing powder on private areas after bathing</i> During 6 months before pregnancy	158 (19.0%)
During pregnancy	105 (12.6%)
<i>Pregnancy Outcome</i> Term birth	693 (83.3%)
Preterm birth	139 (16.7%)

Table 2

Unadjusted and Adjusted Prevalence Ratios for Preterm Birth

Variable	Preterm n (%)	Unadjusted Prevalence Ratios (PR)		Adjusted Prevalence Ratios (PR)	
		PR	95% CI	PR	95% CI
<i>Vaginal Douching</i>					
Did not douche	50 (17.1)	1.00	Referent	1.00	Referent
Ever douching [†]	35 (20.0)	1.17	(0.79, 1.73)	1.05	(0.71, 1.54)
Douched 6 mos. prior to pregnancy					
Less than 3 times per month	33 (11.2)	0.66	(0.44, 0.99) [*]	0.63	(0.42, 0.95) [*]
3 times per month or more	5 (20.8)	1.22	(0.54, 2.77) [*]	1.24	(0.55, 2.79)
Douched during pregnancy [‡]	12 (30.0)	1.76	(1.03, 3.01)	1.64	(0.97, 2.76)
<i>Age</i>					
12-19 year olds	44 (18.1)	1.12	(0.81, 1.55)	1.34	(0.86, 2.08)
Over 19	95 (16.1)	1.00	Referent	1.00	Referent
<i>Family Resources Scale:</i>					
<i>Time for Nonessentials</i>					
Above median (higher unmet needs)	72 (19.1)	1.31	(0.97, 1.78)	1.36	(1.00, 1.85) [*]
Below median (lower unmet needs)	65 (14.5)	1.00	Referent	1.00	Referent
<i>Previous preterm delivery</i>					
At least 1 prior preterm deliveries	31 (30.1)	1.85	(1.20, 2.33) ^{**}	1.93	(1.10, 3.39) [*]
No prior preterm deliveries	76 (14.3)	0.88	(0.60, 1.29)	1.02	(0.64, 1.63)
Nulliparous	32 (16.2)	1.00	Referent	1.00	Referent
<i>Did you smoke during the 2nd trimester?</i>					
Yes	38 (24.2)	1.67	(1.20, 2.33) ^{**}	1.72	(1.23, 2.41) ^{**}
No	97 (14.5)	1.00	Referent	1.00	Referent
<i>Adequacy of Prenatal Care</i>					
Missing	33 (15.8)	0.88	(0.56, 1.37)	0.97	(0.62, 1.51)
Inadequate (little or no prenatal care)	47 (15.6)	0.87	(0.57, 1.30)	0.82	(0.55, 1.24)
Adequate	32 (18.0)	1.00	Referent	1.00	Referent
Adequate Plus	27 (18.9)	1.05	(0.66, 1.67)	1.10	(0.70, 1.74)
<i>Age at 1st intercourse</i>					
≤11 years old	5 (21.7)	1.74	(0.66, 4.58)	1.55	(0.56, 4.27)
12-14 years old	42 (14.1)	1.19	(0.62, 2.28)	1.06	(0.53, 2.14)
15-17 years old	72 (19.6)	1.57	(0.85, 2.90)	1.47	(0.77, 2.80)
18 or older	10 (12.2)	1.00	Referent	1.00	Referent
<i>Lifetime number of partners</i>					
1-3 men	31 (13.4)	1.00	Referent	1.00	Referent
4-10 men	81 (19.3)	1.40	(0.94, 2.09)	1.22	(0.79, 1.87)
11 or more	7 (9.3)	0.88	(0.44, 1.77)	0.68	(0.32, 1.43)

[†] Ever douching includes women who reported ever douching, but did not douche during pregnancy or 6 mos. prior to pregnancy

[‡] During pregnancy includes women who douched 6 months before and during pregnancy

^{*} p<0.05

^{**} p≤0.01

^{***} p≤0.001