Factors Linked to Bacterial Vaginosis in Nonpregnant Women

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Bacterial vaginosis, in the past referred to as nonspecific vaginitis, is a condition of vaginal flora imbalance, in which the typically plentiful H_2O_2-producing *Lactobacillus* are scarce and other bacteria, such as *Gardnerella vaginalis*, *Mycoplasma hominis*, *Ureaplasma urealyticum*, and anaerobes (e.g., *Prevotella, Mobiluncus, Bacteroides*), are overly abundant.[1,2] Historically, the motivation for treating bacterial vaginosis was to eliminate symptoms in women troubled by the unpleasant odor and discharge that often accompany the condition.

More recent studies, however, have noted that bacterial vaginosis–related organisms are associated with inflammatory processes in the upper genital tract and in fetal membranes and amniotic fluid during pregnancy.[3,4] Bacterial vaginosis has been linked to a series of adverse health outcomes, including posthysterectomy cuff cellulitis,[5] postsurgical endometritis,[6] endometritis following vaginal delivery,[7] pelvic inflammatory disease,[8] and preterm delivery.[9–14] There is also evidence that bacterial vaginosis may potentiate heterosexual transmission of HIV.[15,16]

Little is known about the natural history of bacterial vaginosis. The highest prevalences have been reported in women attending sexually transmitted disease clinics.[17] Multiethnic comparisons have shown that rates are higher among African American women,[18,19] but there is no clear explanation for this finding. Studies have revealed that bacterial vaginosis can be intermittent,[20] that up to 35% of women with bacterial vaginosis lack symptoms,[17] and that the prevalence exceeds 25% in certain population subgroups.[17,18] Clinical trials aimed at preventing preterm birth by treating asymptomatic bacterial vaginosis in pregnant women have produced mixed results.[21–24]

This study was initiated to identify the health and behavioral aspects of women's lives that are associated with bacterial vaginosis and to consider which, if any, of these factors account for variability in prevalence

Objectives. The purposes of this study were to test the hypothesis that vaginal douching is linked to bacterial vaginosis in both symptomatic and asymptomatic women and to identify other demographic, reproductive, and lifestyle factors associated with bacterial vaginosis.

Methods. In this cross-sectional study involving 3 clinic sites, 496 nonpregnant women completed a self-administered questionnaire. Their vaginal smears were assessed and cross-validated for bacterial vaginosis.

Results. The prevalence of bacterial vaginosis across clinics ranged from 15% to 30%. In analyses restricted to site 1, adjusted odds ratios (ORs) for bacterial vaginosis remained significant for African American women with 13 or fewer years of education (OR = 5.5, 95% confidence interval [CI] = 2.1, 14.5), hormone use within the past 6 months (OR = 0.5, 95% CI = 0.2, 0.8), and vaginal douching within the past 2 months (OR = 2.9, 95% CI = 1.5, 5.6).

Conclusions. Two lifestyle factors emerge as strongly associated with bacterial vaginosis: systemic contraceptives appear protective, whereas douching is linked to an increase in prevalence. The temporal relationship between douching and bacterial vaginosis needs further clarification. (*Am J Public Health.* 2001;91:1664–1670)

rates between population subgroups. Because vaginal douching is more common in subgroups of women with a higher prevalence of bacterial vaginosis,[25] we were particularly interested in assessing the link between vaginal douching and bacterial vaginosis among both symptomatic and asymptomatic women.

METHODS

This cross-sectional study enrolled 496 nonpregnant women, aged 18 to 40 years, who attended 1 of 3 health care clinics in central Michigan: site 1, a county health department clinic (n=298); site 2, a university health center (n=98); or site 3, a community Planned Parenthood clinic (n=100). A greater number of women were sampled from site 1 in anticipation of accruing more bacterial vaginosis cases from this population. All 3 sites offered general gynecologic care. Enrollment was sequential in the 3 clinics, occurring from March through November 1998. Only women scheduled to have a vaginal examination were eligible for the study.

At the time of check-in, eligible women completed a 1-page survey that gathered data on demographic characteristics and reasons

for the clinic visit, and this information was used to compare characteristics of participants and nonparticipants. Participants completed a more detailed, self-administered questionnaire, with the option of remaining anonymous. During the vaginal examination, a health care provider sampled participants' vaginal fluid (Dacron swab) and vaginal pH (pHydrion, Micro Essential Laboratory, Inc, Brooklyn, New York) and prepared 2 smears on microscope slides; these smears were then air dried.

Vaginal smears were Gram stained and independently assessed for bacterial vaginosis by 2 study microbiologists using the Nugent scoring method.[26] Presence of bacterial vaginosis was defined as a Nugent score of 7 or above. Interrater reliability in regard to presence or absence of bacterial vaginosis was excellent (κ=0.81, 95% confidence interval [CI]=0.74, 0.87). A third microbiologist with expertise in assessment of bacterial vaginosis scored smears with discordant assessments. A vaginal pH above 4.5 was not included in the definition of bacterial vaginosis because such information was missing for 9% of participants. Of the 107 women who had bacterial vaginosis according to our study criterion and

who had a pH recorded, only 6 (6%) had a pH of 4.5 or lower.

The questionnaire presented a list of various vaginal symptoms and reported their reasons for vaginal douching. Women were considered positive for vaginal symptoms if they checked yes for any of the following: increase in vaginal discharge, change in color of vaginal discharge, vaginal itching, noticeable vaginal odor, or increase in vaginal odor after sexual intercourse. Analyses were repeated, but this time vaginal itching, a symptom that is more often associated with yeast than with bacterial vaginosis, was omitted.

Douching habits were classified as related to symptoms or infection if women checked yes for any of the following reasons for douching: "to get rid of vaginal infections"; "to prevent vaginal infections"; "to get rid of unpleasant, fishy vaginal odors"; or "to prevent unpleasant, fishy vaginal odors." Women who did not check yes for any of these reasons were considered to have douching habits unrelated to symptoms or infection. Most of these women endorsed the choice "to feel clean."

Data from women at sites 2 and 3 were combined because demographic characteristics and rates of bacterial vaginosis were similar, but together these sites yielded only 29 cases. Therefore, the more detailed analyses were confined to data from site 1, where the prevalence of bacterial vaginosis was considerably higher. Chi-square tests were used in assessing differences in proportions. Unadjusted and adjusted odds ratios (ORs) and their 95% confidence intervals were generated from logistic regression models.[27]

In the final logistic regression model, 11 main effect variables and 3 interactions were selected on the basis of (1) hypotheses generated from previous studies and (2) unadjusted odds ratios in our data suggesting an association with bacterial vaginosis. One of the 11 variables was excluded owing to missing data from 9% of site 1 participants. The remaining 10 variables were modeled via stepwise, forward, and backward regression with an entry criterion of $P \leq .10$ and a stay criterion of $P \geq .15$. For the final model, variables that remained in all models at a level of $P \leq .05$ were retained, along with variables of borderline

significance that altered the odds ratios of retained variables by at least 20%.

RESULTS

Study participation rates at the 3 clinics ranged from 83% to 86%. In comparison with participants, women who declined participation were slightly older (mean age: 26 years vs 24 years; $P < .01$), less likely to be scheduled for a Papanicolaou (Pap) test (57% vs 76%; $P < .01$), less likely to report an unusual vaginal discharge (18% vs 22%; $P = .03$), and more likely to report their ethnic group as "other" (14% vs 5%; $P < .01$). Education levels, percentages of African Americans and Latinas, history of vaginal douching, and number of previous pregnancies were similar among participants and nonparticipants.

Unadjusted Analyses

Demographic characteristics (all sites). Overall, the prevalence of bacterial vaginosis was higher at site 1 than at sites 2 and 3 combined (30% vs 15%; $P < .05$). At all sites, women's age and marital status were unrelated to prevalence of bacterial vaginosis, but the condition was less common among

TABLE 1—Demographic Characteristics and Prevalence of Bacterial Vaginosis (BV) at 3 Sites: Michigan, 1998

	Site 1 (n = 298)		Sites 2 and 3 (n = 198)	
	Overall, % (No.)	BV+, % (No.)	Overall, % (No.)	BV+, % (No.)
Age, y				
<20	11 (32)	31 (10)	23 (45)	24 (11)
20–25	50 (149)	28 (41)	64 (126)	13 (16)
≥26	39 (117)	33 (39)	13 (26)	8 (2)
Marital status				
Married	14 (43)	35 (15)	10 (19)	11 (2)
Never married	67 (199)	28 (55)	84 (165)	15 (24)
Divorced	10 (30)	43 (13)	4 (6)	14 (1)
	8 (26)[b]		3 (6)[b]	
Education, y				
<12	11 (31)	48 (15)*	1 (3)	67 (2)
12–13	32 (95)	38 (36)*	16 (31)	32 (10)
≥14	57 (172)	23 (39)[a]	83 (163)	10 (17)
Parent(s) with > 12 years of education				
None	38 (114)	33 (38)	19 (38)	16 (6)
One parent	25 (74)	35 (26)	23 (46)	17 (18)
Two parents	28 (84)	21 (18)	53 (105)	12 (13)
	9 (26)[b]		5 (9)[b]	
Medicaid insurance				
No	83 (248)	28 (69)[a]	97 (192)	14 (27)
Yes	17 (50)	42 (21)*	3 (5)	40 (2)
Ethnicity				
African American	25 (73)	42 (31)*	11 (21)	19 (4)
Latina	7 (20)	35 (7)	2 (5)	60 (3)
Other	4 (11)	36 (4)	8 (15)	0 (0)
White, non-Latina	65 (194)	25 (48)[a]	79 (156)	14 (22)
Overall		30 (90)*		15 (29)[a]

[a]Reference group.
[b]Missing data.
*$P < .05$ (tested against reference group).

TABLE 2—Prevalence of Bacterial Vaginosis (BV) in Relation to Gynecologic, Reproductive, and Lifestyle Factors: Site1 (n = 298), Michigan, 1998

Factor[a]	Overall, % (No.)	BV+, % (No.)
Day of menstrual cycle at time of sampling among women with regular menses, <35-day cycle, and no exogenous hormones within past 6 months		
Day 1–7	3 (10)	50 (5)
Day 8–14	10 (30)	27 (8)
Day 15–end	14 (41)	41 (17)
Day of menstrual cycle at time of sampling among women using exogenous hormones within past 6 months		
Day 1–7	7 (20)	30 (6)
Day 8–14	14 (42)	21 (9)
Day 15–end	31 (91)	23 (21)
Exogenous hormone use within past 6 months (oral contraceptives, injections, implants)		
No	37 (109)	41 (45)[b]
Yes	62 (185)	24 (44)*
No. of live births		
None	54 (159)	19 (6)[b]
1	23 (68)	31 (21)
2	14 (41)	42 (18)
≥3	9 (27)	56 (15)*
Frequency of sexual intercourse without male or female condom within past 6 months		
No intercourse	6 (19)	32 (6)
Intercourse always with condoms	14 (43)	19 (8)
1/6 mo to <1/d	66 (196)	30 (58)
≥1/ day	1 (4)	75 (3)
No. of male partners in lifetime		
≤5	52 (155)	28 (44)
6–15	32 (94)	26 (24)
>15	7 (22)	45 (10)
Currently taking vitamin/nutritional supplement		
No	70 (209)	34 (71)[b]
Yes	29 (87)	21 (18)*
Tampon use		
No	26 (76)	37 (28)
Yes	63 (187)	28 (52)
No. of showers per week		
None	6 (17)	59 (10)*
1–3	7 (21)	48 (10)*
≥4	86 (256)	28 (68)[b]
No. of baths per week		
None	46 (138)	24 (33)*
1–3	39 (116)	30 (35)*
≥4	13 (40)	50 (20)[b]

Continued

women who had 2 parents with 13 or more years of education (Table 1). At site 1, the prevalence of bacterial vaginosis was significantly higher among women with fewer years of education and women with Medicaid insurance.

The ethnic difference in the prevalence of bacterial vaginosis at site 1 (African Americans: 42%; Whites: 25%; $P<.05$) was not apparent at sites 2 and 3 (Table 1). After stratification of site 1 women by education level (≤13 years, >13 years), ethnic differences in prevalence were more pronounced in the lower-education group (African Americans: 59%; Whites: 35%; $P<.05$) than in the higher-education group (African Americans: 28%; Whites: 17%; $P=.2$). In a logistic regression model, the unadjusted odds ratio for bacterial vaginosis at site 1 vs sites 2 and 3 (2.5, 95% CI=1.6, 4.0) was attenuated after adjustment for education, ethnicity, and Medicaid use (1.6, 95% CI=0.9, 2.7).

Vaginal symptoms (all sites). The prevalence of bacterial vaginosis at site 1 varied little (29% to 33%) in relation to reasons for the clinic visit (i.e., Pap test, family planning, vaginal discharge) or presence or absence of vaginal symptoms. At sites 2 and 3, however, women who reported vaginal symptoms were more likely to have bacterial vaginosis than women without symptoms (23% vs 11%; $P=.05$). Among women with bacterial vaginosis, 31% at site 1 and 55% at sites 2 and 3 indicated that they were experiencing vaginal symptoms.

Gynecologic, reproductive, and lifestyle factors (site 1 only). Bacterial vaginosis was detected more often in women evaluated in the first week of their menstrual cycle, but this increased prevalence was not statistically significant (Table 2). Women who had used hormones within the past 6 months had a significantly lower prevalence of bacterial vaginosis (24% of users vs 41% of nonusers; P<.05). Among hormone users, 23% used implants or injections. Prevalence of bacterial vaginosis was positively associated with a history of pregnancy and with an increased number of live births (Table 2) but was unrelated to history of urinary tract infections and sexually transmitted diseases.

Women who reported having sexual intercourse without a condom at least once per

TABLE 2—Continued

Ever used a vaginal douche		
No	36 (108)	20 (22)
Yes	63 (187)	36 (68)*
Age at first use of vaginal douche, y		
<20 y	68 (127)	42 (53)*
≥20 y	30 (56)	25 (14)
Frequency of douching within past year		
Not at all	63 (188)	23 (43)[b]
>1/y to <1/mo	14 (42)	33 (14)
≥1/mo	18 (56)	48 (27)*
Used vaginal douche within past 2 months		
No	73 (218)	24 (52)
Yes	24 (72)	53 (38)

[a]All factors involved missing or nonapplicable data.
[b]Reference.
*$P<.05$.

day and women who had had more than 15 male sexual partners in their lifetime were more likely to have bacterial vaginosis. Bacterial vaginosis was less prevalent among women who always used condoms during sexual intercourse (Table 2), but none of these comparisons reached statistical significance. There was no association between bacterial vaginosis and oral sex or having a new partner within the past 6 months.

Women taking vitamin or nutritional supplements were less likely to have bacterial vaginosis (Table 2), whereas current smoking status and number of cigarettes smoked had little effect. Tampon users had a somewhat lower prevalence of bacterial vaginosis (28%) than nonusers (37%). Stratification according to ethnicity showed that this association primarily involved African American women, with 32% of tampon users being diagnosed with bacterial vaginosis, compared with 62% of nonusers. Separation of tampons and pads by type (i.e., deodorized and nondeodorized) had no effect on prevalence of bacterial vaginosis.

The prevalence of bacterial vaginosis was lower among women who frequently (4 or more times per week) showered (28% vs 53% among women who showered less frequently; $P<.05$) but higher among women who frequently (4 or more times per week) bathed (50% vs 27% among women who bathed less frequently; $P<.05$) (Table 2). Significant increases in preva-

lence were noted in women who used vaginal douches before the age of 20 years, who had used vaginal douches once or more per month in the past year, and who reported using a vaginal douche within the past 2 months (Table 2).

Adjusted Analyses (Site 1 Only)

In comparison with the referent group of White women having more than 13 years of

education, unadjusted odds ratios for bacterial vaginosis were 1.9 (95% CI=0.8, 4.4) for African American women with more than 13 years of education, 2.6 (95% CI=1.3, 5.1) for White women with 13 or fewer years of education, and 6.8 (95% CI=2.9, 15.7) for African American women with 13 or fewer years of education (Table 3). This strong interaction remained when the years-of-education variable was dichotomized at different cut points.

In the final model (Table 3), the odds ratio for bacterial vaginosis was slightly attenuated, remaining significant only in the demographic subgroup of African American women with 13 or fewer years of education (adjusted OR=5.5, 95% CI=2.1, 14.5). Other significant covariates included hormone use within the past 6 months (adjusted OR=0.5, 95% CI=0.2, 0.8) and use of a vaginal douche within the past 2 months (adjusted OR=2.9, 95% CI=1.5, 5.6). History of 2 or more live births was of borderline significance (adjusted OR=2.1, 95% CI=1.0, 4.2) but was retained in the model because it lowered the bacterial vaginosis odds ratio for African American women with 13 or fewer years of education by more than 20%.

TABLE 3—Factors Associated With Bacterial Vaginosis (BV) in Nonpregnant Women at 3 Sites: Michigan, 1998

	Unadjusted BV Odds Ratio (95% CI)	Final Model Adjusted BV Odds Ratio (95% CI)
Ethnicity/education interaction		
White/>13 years	1.0 ...	1.0 ...
African American/>13 years	1.9 (0.8, 4.4)	1.5 (0.6, 3.7)
White/≤13 years	2.6 (1.3, 5.1)	1.6 (0.8, 3.4)
African American/≤13 years	6.8 (2.9, 15.7)	5.5 (2.1, 14.5)
Medicaid	1.9 (1.0, 3.5)	...
Exogenous hormone use within past 6 months	0.4 (0.3, 0.7)	0.5 (0.2, 0.8)
≥2 Live births	2.9 (1.6, 5.1)	2.1 (1.0, 4.2)
Currently taking vitamin/nutritional supplement	0.5 (0.3, 0.9)	...
Use tampons	0.7 (0.4, 1.2)	...
≥4 Showers per week	0.3 (0.2, 0.7)	...
≥4 Baths per week	2.7 (1.4, 5.4)	...
Use of vaginal douche in past 2 months	3.6 (2.0, 6.2)	2.9 (1.5, 5.6)
>15 Male partners in lifetime[a]	2.2 (0.9, 5.4)	...

Note. Data are from site 1 only. CI = confidence interval.
[a]Data missing for 9% of women, not included in adjusted model.

TABLE 4—Associations Between Vaginal Douching, Vaginal Symptoms, and Bacterial Vaginosis (BV) at 3 Sites: Michigan, 1998

Symptom Status at Clinic Visit	Prevalence of Vaginal Douching in Past 2 Months, %
Reported symptoms[a]	29
No reported symptoms	23
Symptom Status at Clinic Visit	Use of Vaginal Douche in Past 2 Months, Odds Ratio (95% CI)[b]
Symptomatic[a] (BV+ vs BV–)	5.8 (2.2, 16.6)
Asymptomatic (BV+ vs BV–)	2.6 (1.3, 5.2)
Reason for Using Vaginal Douches	BV Odds Ratio (95% CI)[b]
Douching in past 2 months and reasons for douching include symptoms or infection (vs no douching in past 2 months)	3.1 (1.5, 6.8)
Douching in past 2 months and reasons for douching do not include symptoms or infection (vs no douching in past 2 months)	3.4 (1.4, 8.2)

Note. CI = confidence interval.
[a] Vaginal discharge, change in color of vaginal discharge, vaginal odor, vaginal odor after intercourse, vaginal itching.
[b] Adjusted for ethnicity and education.

A combined frequent showering–infrequent bathing variable was not retained in the final model because the confidence interval was wide around the odds ratio of 0.7. In a subgroup analysis of African American women with 13 or fewer years of education whose prevalence of bacterial vaginosis was 59%, the 8 women who had not used a vaginal douche within the previous 2 months, who were using exogenous hormones, and who showered frequently and bathed infrequently exhibited a prevalence of 13%.

Prevalence of douching within the previous 2 months was similar for women with and without vaginal symptoms (Table 4). After adjustment for ethnicity and education, symptomatic bacterial vaginosis was more strongly associated with vaginal douching (OR=5.8, 95% CI=2.2, 16.6) than was asymptomatic bacterial vaginosis (OR=2.6, 95% CI=1.3, 5.2). After adjustment for the same variables, however, the bacterial vaginosis odds ratio among women who used vaginal douches for reasons unrelated to infection or symptoms (3.4; 95% CI=1.4, 8.2) did not significantly differ from that among women who used vaginal douches for reasons related to infection or symptoms (3.1; 95% CI=1.5, 6.8).

DISCUSSION

Our results point to a complex interaction between education and ethnicity in relation to bacterial vaginosis. Among women reporting more than 13 years of education, there was no significant difference in bacterial vaginosis prevalence between African Americans and Whites, although statistical power was low (less than 20%) in assessing odds ratios of 1.5 or below in the high-education subgroup. In unadjusted analyses, lower education level was a significant predictor of bacterial vaginosis among both African American and White women.

Among White women with fewer years of education, the attenuation of the odds ratio for bacterial vaginosis from 2.6 (unadjusted) to 1.6 (adjusted) suggested that their higher prevalence was related, in part, to cofactors in the adjusted model (i.e., recent use of vaginal douches, less use of hormones, and factors linked to having more children). Among African American women with fewer years of education, the odds ratio of 6.8 (unadjusted) was diminished but continued to be high (5.5) in the adjusted model. We conclude that other key mediating factors for bacterial vaginosis remain undefined among this subgroup

of African American women and that limitations in our data may have led to residual confounding (e.g., an inability to account for complex variations in education and social factors as a result of the use of crude measures such as years of schooling and Medicaid insurance status).

Several small longitudinal studies have reported that bacterial vaginosis is more common in the first week of the menstrual cycle.[20,28,29] We, too, noted this pattern, but only 11% of our participants were assessed during the first week of their cycle, and statistical power was limited. These findings raise the possibility that bacterial vaginosis is influenced by factors such as hormonal changes, elevated vaginal pH accompanying menses, products used during menses, and sexual practices (e.g., unprotected sex) that may vary by week of menstrual cycle.

The most compelling evidence for hormonal effects in our study was the 50% reduction in bacterial vaginosis (both adjusted and unadjusted) among women who had used hormones within the past 6 months. Only 2 women in the no-hormone group used an intrauterine device, thereby ruling out confounding by use of these devices. At least 2 other groups of investigators have noted a lower prevalence of bacterial vaginosis among oral contraceptive users,[28,30] and rodent models have shown that exogenous hormones can alter vaginal flora.[31]

The relationship between sexual activity and bacterial vaginosis remains unclear. The occurrence of bacterial vaginosis in adolescents who are sexually inactive,[32] along with unsuccessful attempts to rid women of recurring symptoms by treating their partners,[33] has led many to conclude that bacterial vaginosis is not a typical sexually transmitted disease. However, there are case reports of men with balanoposthitis involving *G vaginalis*,[34] and 2 small studies have shown a cross-sectional link between nongonococcal urethritis in men and bacterial vaginosis in their sexual partners.[35]

Results of studies assessing links between bacterial vaginosis and unprotected sexual intercourse have been inconsistent.[20,29,30] A recent Swedish study reported that bacterial vaginosis is associated with a high number of lifetime sexual partners.[36] In our study, there

was some excess bacterial vaginosis among women having unprotected sexual intercourse at least once a day and among women with more than 15 lifetime sexual partners. These women, however, represented only 1% to 7% of the sample, thus limiting statistical power and implying that the attributable risk of these factors in our study population was low.

Vaginal douching has been associated with some of the same adverse reproductive outcomes, such as pelvic inflammatory disease[37,38] and late miscarriage,[39] that have been linked to bacterial vaginosis. The question remains: Is douching outside the causal pathway, or is it a true mediator? As a mediator of bacterial vaginosis or upper genital tract infections, or both, frequent douching may alter the vaginal ecology and propel vaginal organisms up through the cervical os. There are surprisingly few published studies of the effects of douching on the vaginal environment. One study showed that douches containing providine–iodine had a more profound inhibitory effect on vaginal *Lactobacillus* than did douches containing saline or acetic acid.[40]

Within the limitations of a cross-sectional study, we attempted to determine whether bacterial vaginosis preceded vaginal douching or vice versa, because some argue that the symptoms of bacterial vaginosis precipitate douching. Our data suggest that the causal pathway may go in both directions. Douching was unrelated to prevalence of vaginal symptoms, and douching within the previous 2 months was associated with both symptomatic and asymptomatic bacterial vaginosis. The link between bacterial vaginosis and douching remained equally strong in women who douched for reasons related to symptoms or infection and women who douched for reasons unrelated to infection (e.g., after menses or to feel clean). Without more detailed questioning, however, it is difficult to infer exactly what women mean when they endorse the response "to feel clean" (i.e., whether, in fact, this response includes more subtle symptoms).

With respect to the generalizability of our results, participants were patients seen at health care clinics, and their prevalence of bacterial vaginosis and douching habits may have differed from those of the overall populations served by these clinics. However, 80% of our participants were seeking routine Pap tests and assistance with family planning, and the prevalence of bacterial vaginosis at site 1 did not differ by report of vaginal symptoms or by reason for clinic visit. Approximately 18% of site 1 participants used a vaginal douche at least once per month (30% of African American women and 14% of White, non-Latina women), and 24% had used a douche within the previous 2 months. These figures are similar to data recently collected in a telephone survey.[41]

The relatively high prevalence of regular vaginal douching and the modifiable nature of this behavior argue for more comprehensive studies on (1) the impact of vaginal douching with respect to vaginal ecology and adverse reproductive outcomes and (2) the personal and culture-based motivations for vaginal douching. Our results also point to the need for large studies on the natural history of bacterial vaginosis that can adequately explore interactions among demographic and social characteristics and variations in reproductive history, showering and bathing practices, endogenous and exogenous sources of hormones, and sexual activity. ■

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Contributors

C. Holzman participated in the design and conduct of the study, analyses of data, and the writing and revising of the manuscript. J.M. Leventhal participated in the design and conduct of the study, discussion of results, and revising of the manuscript. H. Qiu and N.M. Jones participated in cleaning and analyses of data, discussion of methods and results, and review and editing of the manuscript. J. Wang participated in the design and conduct of the study, cleaning and analyses of data, discussion of methods and results, and review of the manuscript.

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