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Vaginal symptoms in postmenopausal women: self-reported severity, natural history, and risk factors

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Abstract

Objective—This study aimed to examine factors other than estrogen deficiency influencing the development and persistence of vaginal dryness, itching, and painful sexual intercourse after menopause.

Methods—We analyzed data from a 2-year, population-based cohort of 1,017 postmenopausal women aged 55 to 75 years. Vaginal symptoms were assessed by interviewer-administered questionnaire, and vaginal swabs were performed to assess vaginal pH and microbial flora at baseline, 12 months, and 24 months. Generalized estimating equations were used to identify characteristics associated with symptoms.

Results—Half of the women (n = 471) reported problematic vaginal dryness, a third (n = 316) reported itching, and 40% of sexually active women (n = 166) reported painful intercourse at baseline. Of women not taking estrogen, half of those reporting baseline symptoms were symptomatic after 24 months. Vaginal dryness was associated with younger age (odds ratio [OR], 0.81; 95% CI, 0.69–0.94, per 5-y increase), nonwhite race (ie, African American, Hispanic, Asian or Pacific Islander, or American Indian [OR, 1.53; 95% CI, 1.04–2.27]), diabetes (OR, 1.51; 95% CI, 1.07–2.12), lower 36-item Short-Form Health Survey physical functioning scores (OR, 0.90; 95% CI, 0.85–0.97, per 10-point increase), lower body mass index (OR, 0.81; 95% CI, 0.71–0.93, per 5 kg/m^2 increase), recent sexual activity (OR, 1.14; 95% CI, 1.08–1.21), and vaginal colonization with enterococci (OR, 1.25; 95% CI, 1.04–1.51). Vaginal itching was also associated with lower physical functioning scores (OR, 0.86; 95% CI, 0.80–0.92, per 10-point increase). Risk factors for painful intercourse included younger age (OR, 0.72; 95% CI, 0.56–0.93, per 5-y increase), diabetes (OR, 3.48; 95% CI, 1.93–

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6.27), lower body mass index (OR, 0.76; 95%CI, 0.61–0.95, per 5 kg/m^2 increase), and higher vaginal pH (OR, 1.10; 95% CI, 1.00–1.21, per 0.5 units).

Conclusions—Vaginal symptoms affect a large proportion of postmenopausal women, particularly those with diabetes and those with lower body mass index, but may resolve for up to half of women without estrogen therapy.

Keywords

Vaginal dryness; Menopause; Vaginal atrophy; Dyspareunia; Sexual dysfunction

The postmenopausal years are characterized by profound atrophic and inflammatory changes in the vaginal tissues, including changes in vaginal epithelial cytology, pH, and microbial flora.[1–3] For some women, these changes are accompanied by painful and sensitive vaginal symptoms such as vaginal dryness, itching, or pain/discomfort during sexual intercourse that can have a marked impact on quality of life.[1,4] Unlike other menopausal symptoms such as hot flashes or night sweats, vaginal symptoms tend to increase as women transition through menopause, with less than a third of perimenopausal or early postmenopausal but up to half of late postmenopausal women expressing these complaints.[5,6] In addition, for some women, vaginal symptoms such as dryness, itching, and painful intercourse may persist for many years after menopause, causing ongoing discomfort and distress in older age.[7]

To date, clinical research on vaginal atrophy has focused primarily on measuring the effects of estrogen deprivation on physical signs of atrophy and inflammation in the vagina. Nevertheless, although all women experience a dramatic decline in estrogen levels during menopause, and most older women develop some signs of estrogen deficiency in the vaginal tissues, not all postmenopausal women develop severe or persistent vaginal symptoms.[8] At this time, very little is known about other factors other than estrogen deficiency that influence the development and persistence of vaginal symptoms after menopause. We examined the natural history of and risk factors for symptoms of vaginal dryness, itching, and painful sexual intercourse in a large, population-based cohort of postmenopausal women.

METHODS

Study population

We analyzed data on vaginal symptoms from the Prospective Evaluation of Postmenopausal Cystitis study, a 2-year longitudinal cohort study of risk factors for urinary tract infection in 1,017 community-dwelling postmenopausal women. Participants were recruited from 1998 to 2002 from the Group Health Cooperative, a group model health maintenance organization with approximately 450,000 members in Washington State. Details about participant recruitment and retention for this cohort have been described elsewhere.[9] Briefly, women were eligible if they were between the ages of 55 and 75 years, had not had a natural menstrual cycle in 12 months, and were members of the Group Health Cooperative for at least a year. To enrich the sample with diabetic women, women in the Group Health Cooperative diabetes registry were also oversampled to achieve a baseline prevalence of diabetes of approximately 20%. Women were excluded from participation if they had a history of urinary catheterization, dementia or severe psychiatric disorder, restriction to a wheelchair, end-stage renal disease requiring dialysis, active malignancy other than skin cancer, acute urinary tract infection in the past 90 days, or chronic antibiotic use.

Study measures

After providing informed consent, women completed questionnaires administered by trained interviewers and underwent physical examination at baseline, 12 months, and 24 months. Three

common postmenopausal vaginal symptoms—vaginal dryness, vaginal itching, and painful sexual intercourse—were assessed by asking women if they had problems with each symptom, with response options including “not at all,” “a little,” “a moderate amount,” and “a lot.”

Demographic characteristics, medical and surgical history, reproductive history, sexual history, medication use, and health-related habits were also assessed using a questionnaire at each visit. Physical function was assessed using the validated Medical Outcomes Study 36-item Short-Form Health Survey, which provides scores from 0 to 100, with higher scores indicating better overall physical function.[10] In addition, detailed information about prior reproductive events and gynecologic surgeries were abstracted from medical records archived at the Group Health Cooperative.

At each visit, swabs of the lateral vaginal wall were collected during pelvic examinations and transported in Amies medium (Becton Dickinson) for semiquantitative culture of aerobic gram-negative rods, enterococci, lactobacilli, and other species using standard laboratory methods.[11,12] Cultures were considered to show “any growth” of an organism if at least some colonies were detected in the first streak zone after overnight culture and “heavy” growth if more than 10 colonies were seen in the third streak zone after overnight culture. At each visit, the pH of vaginal secretions was also measured from 4.0 to 7.0 by taking a sample with a cotton-tip applicator and applying it to a pH strip. Body mass index was calculated at baseline from a Group Health Cooperative mammography surveillance database, based on self-reported height and weight, using the measurement closest to study enrollment. All study procedures were approved by the institutional review boards at both the University of Washington and Group Health Cooperative.

Statistical methods

We first examined the self-reported prevalence and severity of vaginal symptoms in the baseline cohort using descriptive statistics, stratifying by years since menopause. In addition to unadjusted statistics, we generated weighted prevalence figures to accommodate the oversampling of diabetic women in the cohort (ie, 20% diabetic women in the cohort vs approximately 6% in the population at large).[13] Among participants who denied estrogen use throughout the study and who contributed data on vaginal symptoms at both baseline and 24 months, we also examined change in severity of symptoms for 24 months. At each visit, the symptom of painful intercourse was assessed only among women who reported intercourse in the year before that visit, whereas vaginal dryness and vaginal itching were assessed among all participants regardless of sexual activity.

We then estimated the strength of associations between various participant characteristics and three types of vaginal symptoms (ie, dryness, itching, and painful intercourse) using generalized estimating equations multinomial models, incorporating data from all study visits.[14] For these models, women were considered as having a “problematic” vaginal symptom at a given visit if they reported that they had at least “a little” problem with that symptom at that visit. Age, race, physical function, years since menopause, hysterectomy, oophorectomy, diabetes status, smoking status, sexual activity, body mass index, vaginal pH, and vaginal microbial flora were included in all models as predictors. Because one variable, body mass index, was measured only at baseline, we were forced to treat this predictor as a fixed covariate in all of our models; for all other predictor variables, updated data were available at the 12- and 24-month visits. These models were also adjusted for participants’ use of oral and vaginal estrogen at each time point. The outcome of painful vaginal intercourse was assessed only in women who reported sexual intercourse in the past year, whereas other vaginal symptoms were assessed regardless of sexual activity. All analyses were preformed using SAS software, version 9.1 (SAS Institute, Inc., Cary, NC).

RESULTS

The mean ± SD age of participants was 64 ± 6 years, and more than 70% were at least 10 years past menopause at baseline (Table 1). Fifteen percent had undergone both hysterectomy and oophorectomy. Approximately one third reported at least monthly sexual intercourse. More than half had a vaginal pH of at least 5.0, and a quarter had vaginal colonization of *Escherichia coli*. More than half had used oral estrogen in the past year, whereas 7% had used vaginal estrogen in the past year.

Slightly less than half of participants reported problematic vaginal dryness at baseline, whereas just less than a third reported problematic vaginal itching (Table 2). Among participants who reported having at least some sexual intercourse in the past year, more than 40% reported problems with painful sexual intercourse at baseline. The proportion of women reporting each type of vaginal symptom did not differ significantly by time since menopause (for trend by increasing age, P > 0.10 for all).

Approximately 28% (n = 280) of study participants reported no oral or vaginal estrogen use throughout the 2-year study period. Compared with women who reported at least some estrogen use, women reporting no estrogen use were slightly older (mean ± SD age, 66 ± 6 y vs 63 ± 6 y; $P < 0.001$), were less likely to have undergone hysterectomy (8% vs 16%; $P < 0.001$), were less likely to have been sexually active in the past year (36% vs 54%; $P = 0.02$), were more likely to be overweight or obese (68% vs 58%; $P = 0.02$) , tended to have higher vaginal pH (60% vs 19% with pH of 6 or higher; $P < 0.001$), were less likely to have vaginal colonization with H_2O_2-producing lactobacillus (18% vs 43% with heavy growth; $P < 0.001$), and were less likely to have vaginal colonization with *Candida albicans* (7% vs 13%; $P = 0.01$) at baseline.

Of the women who reported no oral or vaginal estrogen use during the study, 94% (n = 263) also contributed data on vaginal symptoms at both the baseline and 24-month visits. Approximately half of participants who denied estrogen use throughout the study period and who reported a problematic vaginal symptom at baseline continued to have problems with that symptom after 24 months (Table 3). Among estrogen-free women who were asymptomatic at baseline, less than 10% reported developing vaginal symptoms at 24 months.

In multivariable analyses using data from all study visits, women were more likely to report problematic vaginal dryness if they were younger, nonwhite (ie, African American, Hispanic, Asian or Pacific Islander, or American Indian), or sexually active or had diabetes. Vaginal dryness was also associated with poorer physical functioning, lower body mass index, and vaginal colonization with enterococci, but not other vaginal microbial factors (Table 4). Women were more likely to report problematic vaginal itching if they had poorer physical functioning, whereas smoking was inversely associated with itching. Among sexually active women, painful sexual intercourse was associated with younger age, diabetes status, lower body mass index, and higher vaginal pH.

Of the 580 women who reported using oral estrogen in the past year at baseline, 97 (17%) indicated that they did so to relieve vaginal symptoms. In multivariable analysis including other predictors, women were less likely to have vaginal dryness or painful sexual intercourse if they had used oral estrogen in the past month (odds ratio [OR], 0.69; 95% CI, 0.52–0.92, for vaginal dryness; OR, 0.61; 95% CI, 0.40–0.94, for painful intercourse). Of the 69 women who reported using estrogen cream at baseline, 49 (71%) indicated that they did so to relieve vaginal symptoms. In multivariable analysis, estrogen cream use in the past month was positively correlated with all three types of vaginal symptoms (OR, 2.95; 95% CI, 1.83–4.76, for vaginal dryness; OR, 1.69; 95% CI, 1.08–2.65, for vaginal itching; OR, 1.99; 95% CI, 1.05–3.76, for painful intercourse).

DISCUSSION

In this large, population-based cohort of community-dwelling postmenopausal women, nearly half of women reported at least “a little” problem with one or more vaginal symptoms, and nearly 20% of women reported at least “a moderate” problem. Of those women reporting problematic vaginal symptoms at baseline, approximately half were asymptomatic after 24 months without using estrogen therapy. These findings indicate that although vaginal symptoms such as dryness, itching, and painful sexual intercourse are a significant problem for a large proportion of women for many years after menopause, they may resolve in up to half of women even in the absence of estrogen supplementation.

Very little is known about the natural history of symptoms such as vaginal dryness, itching, and painful intercourse during the postmenopausal years. Although the physical changes associated with vaginal atrophy are thought to persist as women age, it may be that these changes cease to cause bothersome symptoms in some older postmenopausal women. Possible explanations for attenuation of women’s symptoms over time include stabilization of acute fluctuations in women’s sex hormone levels, up-regulation of sex hormone receptors in vaginal tissue, changes in sexual practices or toileting habits that reduce the severity of vaginal symptoms, and other changes in women’s day-to-day activities such as physical exercise that may affect women’s experience of vaginal dryness and itching.

We found that diabetes was significantly associated with multiple vaginal symptoms in this cohort, independent of vaginal pH or colonization with *C. albicans.* This finding suggests that diabetes may influence the development and/or severity of vaginal symptoms after menopause through mechanisms other than alteration of the vaginal bacterial milieu. Other potential reasons for the increased prevalence among diabetic women include changes in the vagina due to functional vascular changes, neuropathy, or tissue glycosylation related to diabetes and side effects from diabetic medications. In addition, women may be more likely to perceive their vaginal symptoms as being more problematic or burdensome in the setting of a comorbid chronic health condition, a possibility that is supported by our additional finding that lower overall physical functioning was also associated with self-reporting of these symptoms.

Lower body mass index also emerged as a risk factor for more than one vaginal symptom in our study, independent of age and physical function status. Women with lower body mass index are thought to have lower circulating estrogen levels due to decreased adipocyte-based aromatization of estrone and conversion of androstenedione to estrone.[15] However, previous studies involving primarily middle-aged women have not found a significant relationship between body mass index and symptoms of vaginal dryness[16] or dyspareunia,[17] and further research is needed to confirm the relationship between body mass index, estrogen levels, and vaginal symptoms in postmenopausal women.

Although we detected associations between vaginal pH and painful sexual intercourse, as well as between vaginal enterococcus colonization and vaginal dryness, vaginal physical assessments were not the dominant predictors of vaginal symptoms in our study. A previous study of postmenopausal women also found only weak correlations between self-reported vaginal symptoms and physical examination parameters such as vaginal pH.[18] Taken together, these findings suggest that contextual and behavioral factors may play a greater role in a woman’s subjective experience of vaginal symptoms than purely physical signs of atrophy or inflammation.

Although oral estrogen use was associated with decreased reporting of vaginal symptoms in this cohort, vaginal estrogen use was associated with increased symptom reporting. We expect that the latter finding was the result of confounding by indication (ie, women with more severe vaginal symptoms were more likely to be prescribed vaginal estrogen) rather than a reflection

of the true clinical effect of vaginal estrogen therapy on vaginal symptoms, given that the beneficial effect of vaginal estrogen on vaginal atrophy symptoms has been established in randomized controlled trials where confounding by indication is not an issue.[19,20]

To date, there have been relatively few population-based studies of vaginal symptoms in postmenopausal women. A recent analysis of women in the combined US-based Women's Health Initiative observational study and clinical trials reported that 27% of women had problems with vaginal dryness and 19% had irritation or itching,[21] whereas a survey of women aged 61 years living in Uppsala County, Sweden, found that 43% had difficulty with vaginal dryness and 10% had difficulty with vaginal burning.[22] In contrast, a study of postmenopausal women 55 years and older living in Great Britain found that only 8% reported dryness and 11% had itching.[23] None of these studies followed women longitudinally over time to assess the natural history of their symptoms, however, and only the Women's Health Initiative study examined symptoms by years since menopause.

This study benefits from a large, community-dwelling cohort of women, repeated assessment of vaginal symptoms over time, and evaluation of a variety of covariates with the potential to affect women's urogenital function. Nevertheless, several important limitations of this study should be noted. First, vaginal symptoms were assessed primarily by interviewer-administered questionnaire, and it is possible that some participants may have been uncomfortable acknowledging vaginal dryness, itching, or painful intercourse because of the sensitive nature of these symptoms. However, one symptom, painful intercourse, was also assessed by daily diaries that women completed at home, and we were able to confirm that reporting of painful intercourse by questionnaire was significantly associated with reporting of painful intercourse by diary in the baseline month ($P < 0.001$). For example, among women who reported having "a lot" of problems with painful intercourse on their baseline questionnaires, 30% reported at least one episode of painful intercourse by diary in the month immediately after their baseline visit, compared with less than 1% of women who indicated that they were "not at all" bothered by painful intercourse on their baseline questionnaires. Second, participants in this study did not undergo focused diagnostic evaluation for their vaginal dryness, itching, or dyspareunia, and we are therefore unable to confirm the specific etiology of their vaginal symptoms. Some of the women's symptoms of itching or pain could have been caused by conditions such as vulvovaginal lichen planus that would not be expected to respond to estrogen therapy.

In addition, although our study sample was enriched with diabetic women, we adjusted our estimates of the baseline prevalence of vaginal symptoms to take into account this sampling frame. Our finding that diabetes was associated with increased risk of problematic vaginal symptoms independent of vaginal microbial factors raises intriguing questions about the potential relationship between diabetes, vaginal atrophy and inflammation, and symptom reporting in older women.

CONCLUSIONS

In summary, a substantial proportion of community-dwelling older women experience problems with vaginal symptoms such as dryness, itching, and painful intercourse, but these symptoms may resolve over time in up to half of women in the absence of estrogen therapy. Postmenopausal women who have diabetes, who have worse physical functioning, or who have lower body mass index may be at particular risk for vaginal symptoms. Further examination of risk factors may facilitate detection and treatment of these symptoms and help alleviate their functional and quality of life consequences in older women.

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TABLE 1

Demographic and clinical characteristics of participants at baseline

Characteristic	Participants (n = 1,017)
Demographic characteristics	
Age, y	64 ± 6
White race	888 (88%)
Years since menopause	
<5	116 (12%)
5 to 9	168 (17%)
10–19	370 (37%)
20 or more	338 (34%)
Other gynecologic history	
Previous hysterectomy without oophorectomy	141 (14%)
Hysterectomy plus oophorectomy	155 (15%)
General medical characteristics	
Diabetes diagnosed by provider	205 (20%)
Body mass index, kg/m^2	28 ± 6
SF-36 physical functioning score	77 ± 22
Sexual activity and other behaviors	
None in the past year	574 (57%)
Yearly, but less than monthly	116 (11%)
1–3 times per month	181 (18%)
4 or more times per month	137 (14%)
Other health-related behaviors	
Current smoking	65 (6%)
Douche in past month	77 (8%)
Vaginal pH	
4.0–4.4	277 (28%)
4.5–4.9	172 (17%)
5.0–5.4	149 (15%)
5.5–5.9	102 (10%)
6.0 or higher	298 (30%)
Vaginal microbial flora	
H_2O_2-producing lactobacillus (heavy growth)	457 (45%)
Non–H_2O_2-producing lactobacillus (heavy growth)	451 (45%)
Escherichia coli (any growth)	259 (26%)
Enterococci (any growth)	249 (25%)
Other gram-negative rods[a] (any growth)	113 (11%)
Candida albicans (any growth)	118 (12%)
Medication history	
Oral estrogen use in the past year	580 (58%)
Estrogen cream use in the past year	69 (7%)

Data are presented as mean ± SD, or as number (percentage). SF-36, 36-item Short-Form Health Survey.

[a] Including *Klebsiella*, *Enterobacter*, *Proteus*, *Serratia*, *Citrobacter*, *Pseudomonas*, and other gram-negative rod species aside from *Escherichia coli*.

TABLE 2

Self-reported vaginal symptoms at baseline stratified by years since menopause[a]

Years since menopause	n	Do you have problems with vaginal dryness?[b] Not at all	A little	A moderate amount	A lot	P[c] for trend
<10 y postmenopausal	273	47%	36%	12%	5%	0.77
10–19 y postmenopausal	352	52%	29%	11%	8%	
≥20 y postmenopausal	321	55%	25%	11%	8%	

Years since menopause	n	Do you have problems with vaginal itching?[b] Not at all	A little	A moderate amount	A lot	P[c] for trend
<10 y postmenopausal	276	68%	25%	16%	1%	0.25
10–19 y postmenopausal	363	70%	24%	5%	2%	
≥20 y postmenopausal	330	71%	25%	3%	1%	

Years since menopause	n	Do you have problems with painful sexual intercourse?[b,d] Not at all	A little	A moderate amount	A lot	P[c] for trend
<10 y postmenopausal	144	61%	25%	12%	3%	0.93
10–19 y postmenopausal	157	62%	20%	10%	7%	
≥20 y postmenopausal	119	67%	17%	9%	7%	

[a] Prevalence figures are weighted by the inverse of the sampling fraction of diabetic women in the study cohort.

[b] Data missing for 71 participants for vaginal dryness, 48 participants for vaginal itching, and 10 participants for painful intercourse.

[c] *P* values are from tests for trend in the proportion of women with at least “a little” problem by increasing years since menopause.

[d] Painful sexual intercourse was assessed only among participants who reported sexual intercourse in the past year.

TABLE 3

Change in self-reported vaginal symptoms over 24 months among women reporting no estrogen use[a]

Vaginal symptom	n	Asymptomatic at baseline and at 24 mo	Asymptomatic at baseline, symptomatic at 24 mo	Symptomatic at baseline and at 24 mo	Symptomatic at baseline, asymptomatic at 24 mo
Vaginal dryness	239	106 (44%)	5 (2%)	70 (29%)	58 (24%)
Vaginal itching	262	176 (67%)	9 (3%)	34 (13%)	43 (16%)
Painful intercourse[b]	70	42 (60%)	5 (7%)	11 (15%)	12 (17%)

[a]Prevalence figures are weighted by the inverse of the sampling fraction of diabetic women in the study cohort.

[b]Painful intercourse was assessed only among women reporting sexual intercourse in the past year at both baseline and 24 months.

TABLE 4

Demographic and clinical characteristics associated with having problematic vaginal symptoms

	OR (95% CI)[a]		
Characteristics	**Vaginal dryness**	**Vaginal itching**	**Painful sexual intercourse[b]**
Demographic characteristics			
Age (per 5-y increase)	0.81 (0.69–0.94)[c]	0.96 (0.82–1.12)	0.72 (0.56–0.93)[c]
Nonwhite race	1.53 (1.04–2.27)[c]	1.40 (0.93–2.09)	1.19 (0.56–2.56)
Menopausal and gynecologic history			
Years since menopause (per 5-y increase)	0.97 (0.88–1.08)	0.94 (0.84–1.04)	0.98 (0.83–1.16)
Hysterectomy only	1.09 (0.76–1.57)	1.22 (0.81–1.85)	1.07 (0.60–1.91)
Hysterectomy + oophorectomy	0.98 (0.68–1.41)	0.76 (0.52–1.13)	1.04 (0.57–1.89)
General medical characteristics			
Diabetes diagnosed by provider	1.51 (1.07–2.12)[c]	1.34 (0.93–1.92)	3.48 (1.93–6.27)[c]
Body mass index (per 5 kg/m^2)	0.81 (0.71–0.93)[c]	1.07 (0.94–1.23)	0.76 (0.61–0.95)[c]
SF-36 physical function score (per 10-point increase)	0.90 (0.85–0.97)[c]	0.86 (0.80–0.92)[c]	0.90 (0.80–1.00)[c]
Sexual activity and other behaviors			
Sexual activity in the past month	1.14 (1.08–1.21)[c]	0.97 (0.92–1.01)	0.95 (0.88–1.02)
Current smoking	0.61 (0.31–1.19)	0.45 (0.21–0.96)[c]	0.58 (0.20–1.70)
Vaginal physical examination variables			
Vaginal pH (per 0.5 point)	1.03 (0.97–1.09)	0.99 (0.93–1.06)	1.10 (1.00–1.21)[c]
H_2O_2-producing lactobacillus (heavy growth)	1.01 (0.83–1.24)	0.95 (0.74–1.22)	0.97 (0.69–1.38)
Non-H_2O_2-producing lactobacillus (heavy growth)	0.90 (0.73–1.09)	1.05 (0.83–1.33)	1.34 (0.96–1.87)
Escherichia coli (any growth)	0.94 (0.80–1.13)	1.14 (0.92–1.42)	0.88 (0.63–1.23)
Enterococci (any growth)	1.25 (1.04–1.51)[c]	1.08 (0.87–1.33)	0.96 (0.69–1.32)
Other gram-negative rods (any growth)	1.14 (0.89–1.46)	0.84 (0.63–1.12)	1.17 (0.77–1.78)
Candida albicans (any growth)	1.15 (0.86–1.55)	1.05 (0.74–1.50)	1.17 (0.69–1.99)

OR, odds ratio; SF-36, 36-item Short-Form Health Survey.

[a] OR and CI estimates are obtained from multivariable repeated-measures logistic regression and are adjusted for oral and vaginal estrogen use in the past month as well as all variables included in the table.

[b] Painful sexual intercourse was assessed only among participants who reported sexual intercourse in the past year.

[c] $P < 0.05$.