Prevalence of bacterial vaginosis among young women in low-income populations of coastal Peru

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Summary: The goal of this study was to determine the prevalence of bacterial vaginosis (BV) in Peruvian women from socioeconomically deprived populations and to determine the association between BV and risk factors for sexually transmitted diseases (STDs). Women were administered an epidemiologic survey to determine sexual risk behaviour and they provided biological samples to test for BV and STDs. The prevalence of BV was high (27%) and was significantly associated with having a bacterial STD or trichomoniasis. Age, marital status, and a history of sex work, but not of sexual experience, frequency of intercourse, and unprotected intercourse, were associated with BV. As BV may be a marker for STDs, screening for STDs should be performed in individuals with BV to promote early detection and treatment of co-infecting sexually transmitted pathogens.

Keywords: bacterial vaginosis, socially marginalized populations, sexually transmitted infections, human immunodeficiency virus, Peru

INTRODUCTION

Bacterial vaginosis (BV) is a disorder of the vaginal ecosystem characterized by a change in the vaginal flora from the normally predominant lactobacillus to one dominated by sialidase-enzyme-producing organisms including *Gardnerella vaginalis*, *Mobiluncus* spp., *Prevotella bivia*, *Bacteroides* spp., *Peptostreptococcus* spp., *Ureaplasma urealyticum*, and *Mycoplasma hominis*.[1,2] Several studies have linked BV to an increased risk of acquisition of sexually transmitted diseases (STDs) and human immunodeficiency virus (HIV)/acquired immune deficiency syndrome,[3–5] as well as a number of gynaecological complications.[6–11]

BV is a common gynaecological condition, reported in 5-51% of women, depending upon demographics and whether or not they are symptomatic.[3,12–14] The natural history of BV is unclear, as are the risk factors for its acquisition. Race has been identified as one potential risk factor as blacks have higher rates than whites.[15,16] It is unclear, however, if this discrepancy is due to racial differences in vaginal microbiology[16,17] or culturally mediated differences in vaginal-cleansing behaviours such as douching.[18,19] Smoking, alcohol consumption, lower socioeconomic status, and lower educational levels have also been associated with BV.[15,18] Oral contraceptives are protective against BV,[18,20] while intrauterine devices have been reported to either increase[21] or have no association[20] with BV risk.

Data regarding the association between sexual activity and BV acquisition are contradictory. Receptive oral sex has been shown to alter the vaginal microflora,[22] and increased frequency of sex, unprotected sex, and recent partner changes have also been reported to increase the risk of BV.[15,20,22,23] Condoms appear to decrease the risk of developing BV.[20] BV, however, has been reported in virgins[24] and one meta-analysis did not find evidence that partner treatment significantly affected recurrence rates,[25] findings suggestive that an exclusive sexual mode of transmission is unlikely.

Information regarding the prevalence of and risk factors for STDs and HIV in Latin America is scarce. As part of the National Institute of Mental Health HIV/STD prevention trial that is being conducted in five countries, population-

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based household surveys were performed to measure the baseline prevalence of STDs in low-income urban populations in Peru prior to the intervention. This report is based on a subgroup analysis of female participants that was done specifically to assess the prevalence of BV and its association, if any, with classical risk factors for STDs.

METHODS

Study design

In order to examine the prevalence of and the risk factors for HIV and other STDs in urban Peru, we recruited 965 women and 670 men aged 18–30 years in a cross-sectional, population-based study from April to August 2001. Approval for the study was granted by ethics committees at the University of California, San Francisco, the Universidad Peruana Cayetano Heredia, and the Naval Medical Research Center Detachment in Lima, Peru. Details of the study design were published recently.[26] Briefly, we selected 20 (only 18 of these were included in the subgroup analysis) neighbourhoods in Lima, six in Trujillo, and eight in Chiclayo, three coastal cities of Peru. All were equally low-income neighbourhoods, according to the scale of Unmet Basic Needs, which is an indicator used in Peru to classify economic resources. Houses were randomly selected by a statistical software program. Interviewers visited these houses and used a random card selection to choose participants from among the eligible members of the household.

After the chosen women provided written consent to participate, they reported to a temporary project office in their neighbourhood. Women participated in a 30-minute audio, computer-assisted self-interview (ACASI), an instrument that was previously validated in this population.[26] After answering the survey, the women received pre-test counselling from a trained interviewer. The women provided self-collected vaginal swabs (SCVS) and venous blood samples were collected.

Laboratory procedures

An SCVS-inoculated In Pouch *Trichomonas vaginalis* (TV) test (BioMed Diagnostics, White City, OR, USA), two additional SCVS, and a serum sample were transported at 4°C to the Bacteriology Laboratory at the Naval Medical Research Center Detachment in Lima, Peru, where diagnostic testing was performed. One SCVS was tested for BV using BVBlue (Gryphus Diagnostics, Birmingham, AL, USA), which contains a chromogenic substrate for bacterial sialidase produced by organisms that commonly cause BV. The other SCVS was tested for *Chlamydia trachomatis* (CT) and *Neisseria gonorrhoeae* (NG) using polymerase chain reaction technology (Amplicor CT/NG Test, Roche, Indianapolis, IN, USA). Serum was tested for syphilis by using the Rapid Plasma Reagin test (RPR-nosticon II Rapid Plasma Reagin kits, Organon Teknika, Dundee, UK) and positives were confirmed by *Treponema pallidum* particle agglutination (Serodia-TPPA, Fujirebio Diagnostics Inc., Tokyo, Japan). Antibody against herpes simplex virus type 2 (HSV-2) was detected by enzyme-linked immunosorbent assay (ELISA) using HerpeSelect 2 ELISA IgG kit (Focus Diagnostics, Cypress, CA, USA). Two different ELISAs were used to detect HIV-1; Vironostika HIV-1 MicroELISA System (Organon Teknika Corporation, Durham, NC, USA) and Genscreen Plus HIV Ag – Ab (Bio-Rad, Marnes la Coquette, France), with confirmation of positive results by Western Blot (Bio-Rad, Marnes la Coquette, France).

Results and treatment

Results were returned to the participants at the project office on a specific preselected date. Patients with positive results were referred to defined government clinics in their neighbourhood, where treatment for STDs other than HIV was provided free of charge, according to the guidelines set forth by the Peruvian National Ministry of Health.

Statistical analysis

Data were analysed using SPSS 10.0.5. Initial significance tests were done using χ^2 for dichotomous variables and Student's *t*-test for continuous variables, and a P value less than 0.05 was regarded as significant. In the logistic regression model, BV was taken as the dependent variable and all independent variables with a P value less than 0.15 were included in the multivariate analysis, using backwards stepwise regression. Cases with missing dichotomous variables were eliminated from the logistic regression, while cases with missing continuous variables were replaced with the mean.

RESULTS

Of the 965 women recruited for the larger study, 779 (80.7%) were tested for BV. Reagents were unavailable to analyse the remaining participants. The average age of the women was 23.8 ($\pm$3.7) years. Almost half (381 of 778; 49%) were married or cohabitating, 73.9% (574 of 777) had completed high school, and 42.2% (328 of 777) had gone on to university or technical institutes. Alcohol consumption was uncommon; only 22.6% (176 of 778) reported drinking at least once a month, while 42.8% (333 of 778) reported never consuming any alcohol. The majority (667 of 774; 86.1%) was sexually experienced; and 86.1% (559 of 649) reported having sexual intercourse within the past year. More than half of the sexually experienced women (267 of 406; 65.8%) reported that 100% of their sexual encounters with a current steady partner were unprotected. Only 8.9% (64 of 779) reported ever having an STD, although 50.7% (379 of 747) reported a history of abnormal vaginal discharge and 18.7% (142 of 759) reported a history of genital ulcers.

Laboratory analysis revealed that 26.6% (207 of 779) of the women were positive for BV. The prevalence of STDs can be found in Table 1. In women who claimed to be virgins ($n = 107$), there were 32 cases (15.5% of total cases) of BV, 10 cases (5.9% of total cases) of HSV-2 infection, three cases (5.6% of total cases) of chlamydia, one case of

Table 1 **Prevalence of bacterial vaginosis (BV) and sexually transmitted diseases (STDs)**

	Prevalence (proportion)
Bacterial vaginosis	26.6% (207/779)
Herpes	21.7% (169/779)
Chlamydia	7.4% (55/745)
Trichomoniasis	3.6% (28/779)
Syphilis	1.4% (11/779)
Gonorrhoea	0.7% (5/722)
HIV	0.13% (1/779)

trichomoniasis (3.6% of total cases), and no cases of gonorrhoea or syphilis.

In the unadjusted analyses, BV was significantly associated with some sexual behaviours and history such as sex work (Table 2), mean number of partners in the past year ($P = 0.036$), and having a diagnosis of trichomoniasis (Table 2). A diagnosis of chlamydia, gonorrhoea, syphilis, or HSV-2 showed no association with BV (all $P>0.05$). More women in the north of Peru (38%) had BV plus another STD than women in Lima (22%; $P = 0.015$). Pregnancy did not affect the risk of developing BV ($P = 0.09$).

On the other hand, many sexual behaviour variables showed no significant association with BV. These variables included the following: being sexually experienced, mean number of lifetime sexual partners, mean number of sexual partners, casual partners, sexual encounters in the past three months, and the mean number of unprotected sexual encounters in the past three months (all $P>0.05$). Similarly, several sexual history variables, such as having a history of STD, genital ulcers, or abnormal vaginal discharge, were not associated with BV (all $P>0.05$).

BV was not associated with completing high school ($P = 0.35$). Being married or cohabitating was protective against BV (Table 2). Variables related to access to health care were also protective, as women who reported getting at least one injection or one HIV test were significantly less likely to have BV (Table 2). Interestingly, women who thought they were likely to contract HIV were more likely to have BV (Table 2).

With regard to drug and alcohol use/abuse, BV was significantly associated with the mean number of drinks consumed at one sitting ($P = 0.036$), but only trended towards an association with ever drinking alcohol ($P = 0.08$) and with the frequency of drinking alcohol ($P = 0.067$). BV was not associated with the use of illegal drugs ($P = 1.0$) in the past three months.

In the multivariate analysis, marital status (odds ratio [OR] = 0.59, 95% confidence interval [CI] (0.42-0.84); $P = 0.003$), trichomoniasis (OR = 2.49, 95% CI (1.15-5.41); $P = 0.021$), a history of sex work (OR = 3.66, 95% CI (1.50-8.90); $P = 0.004$), and age (OR = 2.00, 95% CI (1.09-3.66); $P = 0.026$) were all significantly associated with BV. In addition, there was a significant association between having BV and a bacterial STD when cases of bacterial STDs were grouped (OR = 1.7; 95% CI = 1.0-2.8; $P = 0.047$).

Table 2 **Significant associations between bacterial vaginosis (BV) prevalence and select sociodemographic characteristics among young women in three coastal cities in Peru, April–August 2001**

Variable	BV positive % (No./total*)	OR (95% CI)	*P* value
Marital status			
Married/ cohabitating	21.5 (82/381)	0.60 (0.43–0.82)	0.0017
Not married/ cohabitating	31.5 (125/397)	—	
Ever tested for HIV			
Yes	18.8 (32/170)	0.57 (0.38–0.87)	0.0091
No	28.8 (175/607)	—	
Ever received or given self an injection			
Yes	27.8 (57/279)	0.6 (0.42–0.85)	0.0037
No	39.2 (148/493)	—	
Self-evaluated likelihood of contracting HIV			
Likely	40.5 (32/79)	0.48 (0.30–0.78)	0.0028
Unlikely	24.8 (156/630)	—	
Ever exchanged sex for money or goods			
Yes	54.5 (12/22)	3.46 (1.47–8.13)	0.0026
No	25.8 (194/753)	—	
Trichomonas vaginalis			
Positive	46.4 (13/28)	2.49 (1.16–5.3)	0.0154
Negative	25.8 (194/751)	—	

*Number of BV-positive women with characteristic divided by the total number of women in the study with that characteristic $\times 100$

DISCUSSION

In this study, we found that 27% of the women sampled from the general population in Peru had BV. Two previous studies in Peru reported BV prevalences of 43.7% in 754 women (77% were symptomatic)[27] and 30% in 630 symptomatic women.[28] The lower BV prevalence reported in our study, compared with those previously reported in Peru is due, most likely, to differences in sample population (general versus symptomatic). The prevalence of BV in this study, however, is higher than that reported in other studies of women from the general population.[29,30] This higher prevalence is potentially due either to the low socioeconomic status of the participants or to the differences in diagnostic criteria. Although no study has specifically addressed the association between BV and socioeconomic status, one study showed that the prevalence of BV among women seeking diagnosis at a genitourinary clinic in Sheffield, UK increased with living in a deprived area.[15] A study of pregnant women from Papau, New Guinea, in contrast, did not find such an association.[31]

We used BVBlue rather than the commonly used Amsel[32] or Nugent criteria.[33] BVBlue is a Food and Drug Administration (FDA)-approved, Clinical Laboratory Improvement Act (CLIA)-moderate complexity test that has been

validated in several clinical trials. In a study of 288 symptomatic women, BVBlue was 88% sensitive and 95% specific when compared with the Nugent criteria, and 88% sensitive and 91% specific when compared with the Amsel criteria.[34] Among 57 women attending an STD clinic, BVBlue was 91.7% sensitive and 97.8% specific compared with the Nugent criteria, while the Amsel criteria was only 50% sensitive, but 100% specific.[35] The fact that the high BV prevalence in our study is in concordance with the prevalences reported in other studies from Peru,[27,28] which used the Amsel and Nugent criteria, indicates that BVBlue is useful as a screening tool in this population.

Results from this study neither support nor dispel the notion that BV is sexually transmitted, as BV was associated with some of the sexual-behaviour/history variables but not with others. Sexually experienced women were no more likely to have BV than those who claimed to be virgins. Since 'sex' was not defined in the questionnaire, the data should be viewed with caution. Bump and Buesching[24] reported no difference in the prevalence of BV between virginal and sexually active adolescents.

In the final logistic regression model, BV was associated with current trichomoniasis or bacterial STD, corroborating the findings of several other studies that used common diagnostic criteria.[3–5] The lack of an association between BV and abnormal vaginal discharge is not surprising. Vaginal discharge was a common complaint in a study of rural Peruvian women, and has multiple aetiologies.[27] Although marriage correlated with age, age was an independent risk factor for BV. Age over 30 years has previously been reported as a risk factor for BV.[15] It has been speculated the changing hormonal milieu could account for the BV rates increasing with increasing age.

There are several limitations to our study. First, the survey was designed to assess general sexual conduct and did not examine specific reported risk factors for BV, such as douching or birth-control methods.[18,19,21] Second, owing to logistic issues in reagent availability, women from the north of Peru (Trujillo and Chiclayo) were over-represented, while women from Lima were under-represented, perhaps giving a skewed view of the epidemiology of BV in Peru. The finding that more women in the north of Peru than in Lima had BV plus another STD is due, likely, to the over-representation of northern women.

In summary, this study shows a high prevalence of BV in urban women from lower socioeconomic neighbourhoods in Peru. Our results suggest that age, marital status, a history of sex work, or current trichomoniasis or bacterial STD are associated with BV. We used a new diagnostic kit, BVBlue, which has several advantages over common techniques in low-income populations; the test is easy to use and requires little training, no microscope is required, and swabs can be maintained at room temperature for up to 48 hours and in the refrigerator for up to one week. Since BV may be a marker for STDs, STD screening should be performed in individuals with BV to facilitate early detection and treatment of co-infecting sexually transmitted pathogens.

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