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Association between bacterial vaginosis and partner concurrency: a longitudinal study

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Abstract

Objectives—The study aimed to test if there was an association between bacterial vaginosis and women reporting that their partner had other partners at the same time (partner concurrency). This association has not been assessed in a longitudinal cohort.

Methods—The Longitudinal Study of Vaginal Flora recruited a cohort of 3620 non pregnant women aged 15–44 years who presented for routine primary health care at 12 clinics in Birmingham, Alabama. Behavioural questionnaires and vaginal smears were obtained quarterly for a year and BV was defined by a Nugent score 7 or higher as well as Amsel criteria. Mixed effects logistic regression was used to assess the relationship between prevalent BV and reporting that one's partner had had other partners in the preceding 3 to 6 month time interval.

Results—Nugent-score BV was associated with both reporting that one's partner definitely (adjusted Odds ratio [aOR] 1.5; 95% confidence interval [CI], 1.2–1.8) and possibly (aOR 1.5; 95% CI, 1.2–1.8) engaged in partner concurrency in the preceding 3 to 6 month time period. BV diagnosed by Amsel criteria were similar.

Conclusion—A diagnosis of BV was associated with reporting that one's partner possibly or definitely engaged in partner concurrency.

Keywords

Partner concurrency; bacterial vaginosis; vaginal microbiota; sexual network; Nugent score

Background

Despite bacterial vaginosis (BV) being the most common vaginal infection in women of reproductive age, both its pathogenesis and the reasons for the large differences in BV prevalence between different populations are incompletely understood¹. Sexual activity appears to play an important role. BV has, for example, been associated with a number of individual level sexual risk factors such as number of partners, type of sex and inconsistent condom use¹². In keeping with a number of STIs, individual level risk factors have not been able to explain the large differences in BV prevalence between ethnic/racial groups. In the USA, for example, being black remained a residual risk for BV after controlling for a range of individual and partner level variables¹². A number of authors have speculated that racial differences in the composition of the vaginal microbiota may explain differences in BV prevalence³. Others have however hypothesized that sexual network factors may be responsible²⁴. Studies with other STIs such as chlamydia, HIV, HSV-2 and syphilis have found that differences in network structure, including differences in partner concurrency, can explain a large part of the ethnic differences in STI prevalence⁵.

Sexual partner concurrency can be defined as one's partner having sex with someone else during one's sexual relationship with them⁵. It is thought to enhance STI transmission via a number of mechanisms that include enhancing network-connectivity and removing the protective effect of partner-sequencing⁵.

Evidence has been found of a positive association between the prevalence of male concurrency and BV at inter country and inter ethnic group comparisons but these analyses involved small sample sizes⁴. This association has also been found at an individual level. A study from rural Peru found an association between prevalent BV and reporting that one's partner had another partner in the past year⁶. However, this study was cross sectional and controlled for a very limited number of potential confounders (and no other sexual behavioural variables). In this study, we assess, for the first time, the association between partner concurrency and prevalent BV in a longitudinal cohort. In a supplementary analysis, we also looked at incident BV.

Methods

This study involves a secondary data analysis of the Longitudinal Study of Vaginal Flora. The study recruited 3620 15 to 44 year old women between 1999 and 2003 when they presented for a routine health check up at any one of 12 clinics in the Birmingham, Alabama area. A total of 3,228 women contributed 10,067 visits to the multivariable analysis. Women were excluded if they were pregnant, had significant gynaecological or medical conditions, or were planning to leave the area in the upcoming 12 months. All participants provided informed consent and the study was approved by local Institutional Review Boards (FLORA, 1999–2002)⁷.

Participants were seen at an initial visit and then every three months over a one-year timeframe for a total of 5 visits. At each visit they followed a structured interview performed in private by a female researcher. They were asked a range of questions including those pertaining to their sexual behavior and that of their partners since their last visit. For the baseline and follow up visits, these questions typically referred to the 6 and 3 month time period preceding the interviews, respectively. It was made explicit that women could decline/refuse answering any questions they so chose.

Partner concurrency (PC)

Women were asked 'Do you think that any of your sex partners had sex with anyone other than you in the past 6 months (baseline visit)/30 days (visits 2–5)?' They were asked to choose between the following options which were read out to them: 'Yes, definitely', 'Yes, possibly', 'Do not think so', 'Definitely not'. If they were unable to answer the interviewer could classify their answer to this question 'Unknown' or 'Refused to answer.' Only on one occasion did a person refuse to answer and we recoded this event as missing.

BV

At each study visit, each woman had a vaginal swab collected at the time of pelvic examinations. This was used to diagnose BV via the Nugent method. BV was defined as a score of 7 or more⁸. Amsel criteria were also used to diagnose BV and analyses using Amsel criteria are presented in the supplementary file.

Race/ethnicity

Previous analyses of this cohort have found that women's self-reported race was associated with incident BV⁹. Only 51 women in the cohort were not white or black. To simplify the analyses we limited the analyses to woman who reported themselves to be black or white.

Mixed effects logistic regression was used to assess the odds ratio for a diagnosis of prevalent BV by self-reported partner concurrency in the preceding time period. Each woman could be diagnosed with prevalent BV at each study visit and thus up to 5 times.

Secondary analyses

A number of secondary analyses were conducted (see Supplementary file Box 1).

Potential confounders

The pathways for BV transmission are moderated by a number of factors, including the timing, frequency and type of sex, the use of douching, smoking, race, education attained, hormonal contraception and condom use. These may also be related to reported PC and were thus controlled for in each of the models. These confounders were selected based on a literature review and biological plausibility.

Results

The 3620 participants in the study were young (mean age 25.3, Standard Deviation 6.95) and predominantly African American (79.9%). Participant characteristics are displayed by

reported partner concurrency status at baseline visit in the Supplementary file Table 1. Respondents reporting partner concurrency were more likely to be black, smoke, report douching and always using condoms. They reported a higher mean number of sex partners, and were more likely to report rectal and oral sex. A lower proportion reported vaginal sex four or more times per week or using hormonal contraception. Prevalent BV was more common in those reporting definite/possible partner concurrency (PC) (46.4%/55.4%) than those reporting no PC (34.9% - $P < 0.001$ for both comparisons).

Association between BV and partner concurrency

A diagnosis of prevalent BV was associated with both reporting that one's partner definitely (adjusted Odds ratio [aOR] 1.5; 95% Confidence Interval [CI], 1.2–1.8) and possibly (aOR 1.5; 95% CI, 1.2–1.8) engaged in partner concurrency in the preceding time period (Table 1). In various secondary analyses the diagnosis of BV remained associated with PC (Supplementary files Box 1 & Table 2).

Discussion

We found that women who reported possible or definite PC were more likely to be diagnosed with prevalent BV. The strengths of this analysis include the fact that it includes a large cohort of woman with detailed information about their behavior and that of their partners followed prospectively for one year. Previous analyses of this cohort have established the association between BV and vaginal douching⁷, partners' race⁹ and incident STIs². No other analysis of this or any other cohort that we are aware of has investigated the relation between BV and PC in a prospective cohort. We used a number of models to investigate the relationship between BV and PC and they all provided similar results. There are however a number of limitations to the study. We do not know how accurate our respondents' assessments of PC was. Our definition of PC may also be subject to two non-differential misclassification biases. It may have misclassified serial monogamy as PC and if a woman reported multiple partners we could not ascertain which of these partners had engaged in PC.

Our analyses controlled for a wide range of factors but we cannot exclude the possibility that there may be some other attributes of women who report PC or an attribute of their partners, rather than the PC itself, that is responsible for the association between BV and PC. For example, men who engage in PC may have had more partners in the preceding year than other men and it may be this higher number of partners, rather than the PC, which is responsible for the association between PC and BV.

BV is not only very prevalent but it also is associated with enhanced susceptibility to a number of STIs². If PC is found to play a role in generating higher BV prevalences then this would have important implications for the modeling and control of STIs. In populations with high PC rates this may increase the prevalence of BV and other STIs directly. PC may also indirectly increase the prevalence of other STIs indirectly via its susceptibility-enhancing effect through BV. Furthermore, the main way that PC enhances STI transmission is via its effect on enhancing network connectivity. This effect operates at a network level and is difficult to accurately capture at the individual or partner level⁵. The accurate delineation of

these effects will require prospective studies that include accurate descriptions of sexual networks and regular sampling/characterization of the rectal/oropharyngeal/vaginal/penile microbiotas of women and their partners. This would enable us to assess changes in the vaginal microbiota in relation to that of changes in the partners' microbiotas and possible extra dyadic sex. Ultimately, the link between PC and BV may provide additional motivation to interventions which have shown to be effective at reducing PC, such as Uganda's 'Zero Grazing' campaign and a Social-Cognitive-Therapy-based health promotion intervention ¹⁰.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Key messages

- Previous studies have found an ecological association between partner concurrency and bacterial vaginosis.
- In a longitudinal cohort, we found that reporting partner concurrency was an independent risk factor for the acquisition of bacterial vaginosis.
- Interventions to reduce partner concurrency should be investigated as a means to reduce the prevalence of BV.

Table 1

Multivariable model of the association between prevalent bacterial vaginosis and reported partner concurrency (adjusted Odds Ratios [95% Confidence Intervals] P-values *).

Prevalent BV	
Partner concurrency	
None	Ref
Yes	1.5 (1.2–1.8) **
Possibly	1.5 (1.2–1.8) **
Don't think so	1.1 (1.0–1.3)
Unknown	1.1 (0.7–1.1)
Age	
15–25	Ref
26–35	1.0 (0.9–1.2)
36–46	0.9 (0.7–1.1)
No. sex partners	1.0 (0.9–1.1)
Race	
White	Ref
Black	4.5 (3.7–5.5) **
Douche	
No	Ref
Yes	1.4 (1.3–1.6) **
Rectal sex	
No	Ref
Yes	0.7 (0.6–1.0)
Oral Sex (receptive)	
No	Ref
Yes	1.0 (0.9–1.1)
Frequency of vaginal sex/week	
0–1	Ref
2–3	1.2 (1.1–1.3) **
4	1.4 (1.2–1.7) **
Hormonal contraception	
No	Ref
Yes	0.6 (0.5–0.7) **
Condom use	
Never	Ref
Seldom	1.0 (0.9–1.1)
Always	0.9 (0.8–1.0)

Prevalent BV	
Education completed	
<12 years	Ref
12 years	0.8 (0.7–1.0) *
>12years	0.6 (0.5–0.7) **
Smoked	
No	Ref
Yes	1.4 (1.2–1.6) **

*
P<0.05,

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P<0.005