

Determinants of Bacterial Vaginosis: A Retrospective Study

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Background: Among women who can have children, bacterial vaginosis (BV) is the most common cause of abnormal vaginal discharge. Due to its high prevalence and morbidity, it is crucial to prevent BV by addressing its risk factors.

Objective: This study aimed to determine the incidence and determinants of BV in the sexually transmitted infection (STI) division of the Dermatovenereology Department at Dr. Soetomo Hospital in Surabaya.

Methods: This retrospective analytical observational study was conducted using a cross-sectional approach. Electronic data from 56 patients were included in the study, covering the period from 2019 to 2022. The patients were divided into two groups: BV patients and controls. BV patients were diagnosed with BV by fulfilling three out of four Amsel criteria, while controls with typical vaginal discharge.

Results: The study included 34 BV patients and 22 control patients. Bivariate analysis showed a significant correlation between the incidence of BV and the number of sexual partners ($p = 0.009$) and the use of intrauterine devices (IUD) ($p = 0.002$). Multivariate analysis confirmed that both factors were determinants of BV incidence, with IUD use being the most dominant determinant (95% CI 1.86~135.02, $p = 0.01$).

Conclusion: The study found that the use of IUDs and the number of sexual partners significantly determined BV incidence.

Key Words: Bacterial vaginosis, Determinants

INTRODUCTION

In women of childbearing age, bacterial vaginosis (BV) is the leading cause of abnormal vaginal discharge. An elevation

in vaginal pH and foul-smelling vaginal discharge characterizes this condition¹. The prevalence of BV is relatively high worldwide, ranging from 23% to 29% in different parts of the world. In North America, when compared to other racial

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Table 1. Distribution of BV and control group

		Year				Total	
		2019	2020	2021	2022		
Diagnosis	BV	Total	6	9	6	13	34
		%	17.6%	26.5%	17.6%	38.2%	100.0%
	Control	Total	15	2	4	1	22
		%	68.2%	9.1%	18.2%	4.5%	100.0%

groupings such as whites (23%) and Asians (11%), the prevalence among women of Hispanic and Black descent was much greater, at 33% and 31% respectively ($p < 0.01$)².

BV is a condition that various factors can influence. Some of the factors associated with BV include age, education level, smoking, employment, marital status, alcohol consumption, douching, condom use, sexual orientation, frequency of sexual intercourse, and number of sexual partners. Women who use intrauterine devices (IUDs) are also more likely to develop BV, while hormonal contraceptives do not increase the risk of BV. Social factors such as marital status, degree of education, and smoking may also contribute to the risk of developing BV^{1,3-5}.

Women with BV are at a higher risk of developing sexually transmitted infections (STIs) like HIV, *Chlamydia trachomatis*, *Trichomonas vaginalis*, *Mycoplasma genitalium*, HPV, and HSV-2^{1,6}. BV can cause severe obstetric and gynecological complications. Women with BV have a higher risk of premature delivery and abortion in the second trimester, with an odds ratio of 1.4 to 7.0. BV can also lead to chorioamnionitis, which is more common in BV women and can trigger the secretion of proinflammatory cytokines, potentially promoting premature delivery⁷. BV can lead to pelvic inflammatory disease (PID) after gynecological surgery, as well as endometritis following childbirth or an abortion. BV-associated microorganisms and their placental-crossing toxins are one of the leading causes of fetal brain injury, which can result in long-term neurological effects in children, such as hyperactivity, learning disabilities, cerebral palsy, and periventricular leukomalacia^{8,9}.

Prevention strategies targeting risk factors are necessary to address the significant morbidity and disability associated with BV. This study aimed to identify the prevalence and determinants of BV incidence.

MATERIALS AND METHODS

1. Data collection

This was a retrospective analytical observational study with a cross-sectional approach conducted at the Sexual STI Division of the Dermatovenereology Outpatient Clinic of Dr. Soetomo Hospital in Surabaya from 2019 to 2022. Sampling was conducted using proportional and stratified random sampling techniques based on secondary data from the medical records of patients diagnosed with BV. The study used a total sampling system to determine the sample size, which meant that all new patients who met the inclusion criteria were included in the research sample, with a minimum of 53 people.

2. Statistical analysis

Data collection sheets were used to gather information for analysis. Once the data was entered, we used Microsoft Excel 2019 to organize and analyze it. The study's outcomes were presented using tables and graphs. To analyze the variables, we performed bivariate and multivariate analyses. To determine the prevalence of BV, we carried out a descriptive analysis. We used the Statistical Package for the Social Sciences (SPSS-26) to compute the chi-square value at a significance level of 5% (0.05).

RESULTS

1. Demographic study

From 2019 to 2022, 1465 patients visited the clinic. Out of these patients, 94 (6.42%) were diagnosed with BV. Additionally, 22 patients were diagnosed with normal fluor albus. Through exclusion and proportional and stratified

Table 2. IUD and number of sexual partner analysis

		Group			<i>p</i> -value	Multivariate analysis			
		Control	BV	Total		B	<i>p</i> -value	OR (95% CI)	
Intrauterine device	No	Total	21	18	0.002	2.76	0.01	15.84 (1.86~135.02)	
		%	53.8%	46.2%					100.0%
		%Diagnosis	95.5%	52.9%					69.6%
	Yes	Total	1	16					17
		%	5.9%	94.1%					100.0%
		%Diagnosis	4.5%	47.1%					30.4%
Total	Jumlah	22	34	56					
	%	39.3%	60.7%	100.0%					
	%Diagnosis	100.0%	100.0%	100.0%					
Number sexual partner	No	Total	6	2	0.009	1.80	0.02	6.01 (1.35~26.5)	
		%	75.0%	25.0%					100.0%
		%Diagnosis	27.3%	5.9%					14.3%
	Unipartner	Total	16	24					40
		%	40.0%	60.0%					100.0%
		%Diagnosis	72.7%	70.6%					71.4%
	Multipartner	Total	0	8					8
		%	0.0%	100.0%					100.0%
		%Diagnosis	0.0%	23.5%					14.3%
	Total	Total	22	34					56
%		39.3%	60.7%	100.0%					
%Diagnosis		100.0%	100.0%	100.0%					

random sampling techniques, 56 samples were selected for this study. Of these, 34 were BV patients, and 22 were control samples of patients with normal fluor albus. A summary of the samples is presented in Table 1.

2. Analysis of BV determinants

The univariate analysis found that only the number of sexual partners (*p* = 0.009) and IUD use (0.002) were significantly associated with BV. These two factors were then entered into a multivariate test using logistic regression, where it was discovered that the number of sexual partners (95% CI 1.35~26.5, *p*-value = 0.02) and IUD use (95% CI 1.86~135.02, *p*-value 0.01) were the determinants of BV incidence.

IUD use was also the most significant determinant of BV incidence, with a smaller *p*-value of 0.01. A summary of the samples is presented in Table 2.

DISCUSSION

The study found that the number of sexual partners and the use of IUDs were the only factors significantly associated with the incidence of BV. Of the BV patients, 70.6% had a single partner, while 23.5% had multiple partners. The analysis revealed that there was a statistically significant correlation between the number of sexual partners and the incidence of BV (*p* = 0.009), which was consistent with the findings

of Moreira et al. ($p = 0.01$) and Abdullateef et al. ($p = 0.00$)^{12,13}.

There is a significant connection between the number of sexual partners and the incidence of BV. According to a study, patients with BV who had multiple partners had a high frequency of 54.1%¹³. Another study suggested that having multiple sexual partners in the last 30 days could increase the risk of BV by 1.13 times¹⁴. These studies indicate that patients may be unaware of the high-risk sexual behavior of their partners, highlighting the importance of practicing safe sex^{10,13}.

According to a study by Moreira, 14 out of 20 people (70%) with BV had sexual partners who exceeded a count of two. A possible explanation for this could be that male sexual partners could be spreading the anaerobic bacteria that causes BV. As the foreskin allows the transmission of microorganisms during sexual intercourse, it appears that the frequency of BV is higher among women whose partners have not undergone circumcision, thus lending credence to this theory¹².

According to Bitew et al., there is no significant correlation between the number of sexual partners a person has over their lifetime and the incidence of BV ($p = 0.103$). This could be because BV is more accurately classified as a disease rather than an infection, with the frequency of sexual encounters having a greater impact on its occurrence¹¹.

A significant correlation was found ($p = 0.002$) between IUD use and the incidence of BV, according to an analysis in this study. In a study by Abdullateef et al., the prevalence of IUD use was reported to be 68.2% in BV patients (OR 1.61, 95%CI 0.543~4.759; p -value = 0.020). This high incidence of BV among IUD users suggests that women who are at risk of BV should consider hormonal contraception or other options before IUDs to reduce the risk of infection. The use of contraceptives at anatomical sites can cause an imbalance in vaginal flora, which can lead to BV. In contrast, estrogen increases vaginal epithelial cell glycogen content, which in turn inhibits the in vitro development of some bacteria. This may explain why hormonal contraception may lessen the risk of BV⁴.

Research indicates that the rate of BV was 153.6 episodes per 100 person-years (95% CI: 145.2, 162.4) in women who used IUDs. The risk of BV was 1.28-fold (95% CI: 1.12, 1.46) higher in women who used IUDs compared to those who did not use any nonhormonal contraceptives. Furthermore, the risk of BV was 1.52-fold (95% CI: 1.16, 2.00) greater in the first six months of using an IUD compared to six months before beginning, and this risk stayed elevated through 18 months of usage ($p < 0.05$)¹⁵.

There are two possible ways in which the use of an IUD could lead to a higher risk of BV. First, the mix of bacteria that causes BV can grow too much in the uterus and vagina if foreign objects like an IUD are present. Second, the relative abundance of two types of bacteria, *Gardnerella vaginalis* and *Lactobacillus* spp., changes during a typical menstrual cycle. *Gardnerella vaginalis* is more common during menstruation, while *Lactobacillus* spp. is less common. When an IUD is inserted, menstrual volume and duration often increase, which can lead to a decrease in *Lactobacillus* spp. If *Gardnerella vaginalis* growth is stimulated by the presence of blood, dysbiosis could occur during this time¹⁵.

CONCLUSION

According to this study, the incidence of BV is influenced by the number of sexual partners and the use of IUDs, with IUD use being the primary determining factor. To reduce the risk of BV, it is essential to educate potential IUD users about the possible side effects, including BV.

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CONFLICT OF INTEREST

In relation to this article, we declare that there is no conflict of interest.

DATA SHARING STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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ETHICAL APPROVAL STATEMENT

The study was approved by the Institutional Review Board of (IRB No. 1326/LOE/301.4.2/VI/2023). This study was conducted in accordance with the principles of the Declaration of Helsinki.

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