

Prevalence of bacterial vaginosis and associated factors among pregnant women attending at Bugando Medical Centre, Mwanza, Tanzania

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Abstract: Bacterial vaginosis (BV) is an extremely common reproductive tract condition worldwide with reported high prevalence among African population. Factors associated with this condition include preterm labour, premature rupture of membranes, preterm delivery and possibly spontaneous abortion. Nevertheless, antenatal screening and treatment is not routinely available in most poor-resource countries including Tanzania. A cross-sectional descriptive study was conducted among delivering women at Bugando Medical Centre (BMC), Mwanza, Tanzania to determine the magnitude of the BV using the Nugent's criteria and to document factors associated with the condition. A total of 284 women who presented for delivery at BMC labour ward from February to March 2011 were recruited into the study. For each consented women, a vaginal swab was taken, samples collected tested and a Nugent's score of at least seven indicated bacterial vaginosis. Overall, bacterial vaginosis was diagnosed in 28.5% (n=81) of all participants. *Gardnerella* was the commonest morphotypes found in approximately 66.2% (n=188) of all participants while 11.6% (33 participants) had *Mobiluncus*. There were no evidence for the association between bacterial vaginosis having formal education, (OR, 1.42[95%CI, 0.29-6.97; p=0.667]). Urban residence (OR, 1.29 [95% CI, 0.76-2.19; p=0.352]), ever delivered before (OR 0.66[95%CI, 0.39-1.12; p=0.126]), vaginal practice to enhance dry sex (OR, 1.16[95%CI, 0.43-3.17; p=0.768]) or wet sex (OR 1.31[95%CI, 0.46-3.7; p=0.613]), gestation age less than 37 weeks (OR 0.82[95%CI, 0.45-1.51; p=0.534]) and HIV infection (OR 0.90[95%CI, 0.28-2.92; p=0.863]) were not associated with bacterial vaginosis. Bacterial vaginosis is common among women delivering at Bugando Medical Centre and more studies to include antenatal clinic attendees initiating care are required to reliably document the magnitude the condition.

Keywords: bacterial vaginosis, Nugent score, pregnancy, Tanzania

Introduction

Bacterial vaginosis (BV) is among the most common reproductive tract condition worldwide characterised by low levels of lactobacilli and an increased frequency of facultative anaerobic bacteria. Its prevalence among African population has been estimated to range from 20% to 50%, and even higher levels have been documented among female sex workers (Fleury, 1981; Cristiano *et al.*, 1989; Ramjee *et al.*, 1998; McGregory, 2000; Holzman *et al.*, 2001; Fonck *et al.*, 2001; Riedner *et al.*, 2003; Myer *et al.*, 2005). Although the aetiology of BV is still unknown, the condition is associated with changes in vaginal ecology, resulting into overgrowth of certain bacteria such as *Gardnerella vaginalis*, *Mycoplasma hominis*, *Ureaplasma urealyticum*, *Mobiluncus* spp., *Prevotella* spp., *Bacteroides* spp. and the depletion of hydrogen producing lactobacilli (Hill, 1993) (Hill 1993). Other factors known to increase the risk of BV include sexual activities, vaginal hygiene practices, HIV infection, marital status, black race and sexually transmitted infections including Herpes simplex type 2 (Goldenbert *et al.*, 1996; Ness *et al.*, 2002; Bukusi *et al.*, 2006; Hassan *et al.*, 2007; Fethers *et al.*, 2008, 2012; Chepes *et al.*, 2008; Haggerty *et al.*, 2009).

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Among pregnant women, BV is associated with adverse perinatal and pregnancy outcomes such as increased risk of preterm labour, premature rupture of membranes, preterm delivery, chorioamnionitis and possibly, spontaneous abortion (Hillier *et al.*, 1988, 1995; Krohn *et al.*, 1993; Usui *et al.*, 2002; Leitich *et al.*, 2003). In addition, BV has also been associated with an increased risk of acquiring human immunodeficiency virus (HIV) infection (Cohen *et al.*, 1995; Sewankambo *et al.*, 1997; Taha *et al.*, 1998; Schellenberg *et al.*, 2012). Similar evidence from Tanzania is scarce, although studies among other population groups such as bar and hotel workers in the country suggest high prevalence (Kapiga *et al.* 2005).

Most women with BV may be asymptomatic (Amsel *et al.* 1983), thus early detection, especially among pregnant women is essential for timely treatment to prevent related complication(s). Antenatal BV screening is not a routine practice at Bugando Medical Centre and no study on BV has ever been conducted at the hospital. This cross-sectional analytical study was conducted to determine the magnitude and factors associated with BV among women delivering at Bugando Medical Centre in Mwanza, Tanzania.

Materials and Methods

Study design

This analytical cross-sectional survey was carried out at Bugando Medical Centre (BMC) labour ward among women reporting in labour. Bugando Medical Centre is a 850-bed referral and teaching hospital located in Mwanza, north-western Tanzania. Approximately 600 women deliver in the facility every month (www.bugandomedicalcentre.go.tz).

Study subjects and sample size

Study subjects were pregnant women who consented to participate in the study. Women were excluded if they declined to participate, had already ruptured membranes, were diagnosed of antepartum haemorrhage, carcinoma of the cervix and if for some reason(s) she was unable to consent despite the eligibility. Women in the last group included those with altered mental status or severe illness. For participants aged less than 18 years, consent was requested from accompanying adults and where such adults were unavailable, women were excluded.

The sample size for the study was 284 women, and was calculated using a formula by (Cochran, 1963) based on the prevalence of BV among pregnant women of 24.4% reported in Zimbabwe (Tolosa *et al.*, 2006).

Data collection

Data was collected from mid February to mid March 2011. Data were collected from all participants using a pre-tested structured questionnaire that included demographic, gynaecological, medical and obstetric characteristics. The demographic data were age, occupation, level of education, marital status and household possessions. The household possessions were used to calculate the woman's wealth quintile. The obstetric history included information on the rank of the present pregnancy (gravidity), the number of deliveries the participant had ever had (parity-delivery of a live or dead foetus from a pregnancy of at least seven months gestation), any previous pregnancy loss including perinatal death. The gynaecological characteristics collected were history of gynaecological infections in the past and age at first menstruation (menarche). History of any chronic

medical conditions such as diabetes mellitus, HIV infection or AIDS, hypertension and sickle cell anaemia were also collected. HIV serostatus for all women were documented from available records on the antenatal cards women carry along when they report to labour ward. This is part of the routine antenatal investigation done to almost all pregnant women countrywide. HIV testing was offered to all women with unknown status.

Vaginal sample collection and laboratory procedures

Each participant was instructed to assume a lithotomy position and a sterile unlubricated speculum inserted into the vagina and a sterile cotton swab used to swab the vagina walls (lateral, anterior and posterior fornices) before it was streaked on a sterile examination glass to obtain a vaginal smear. The smear was then heat fixed by passing through a flame at least 3 times and a sticker with a unique identification number applied. The number of the specimen was also recorded into the results template.

The slide was gram stained and evaluated microscopically at a high magnification (x1500) based on the Nugent score (Nugent *et al.*, 1991). A score of 0 to 10 was assigned on the basis of the relative proportions of easily distinguished bacterial morphological types. The morphotypes were large gram-positive rods (*Lactobacillus* species), small gram-negative or gram-variable rods (*Bacteroides* or *Gardnerella* species), and curved gram-negative to gram-variable rods (*Mobiluncus* species). A score of 0-3 was categorized as normal, 4-6 intermediate and 7-10 was considered diagnostic of BV. A score of 0 was assigned to the most lactobacillus predominant vaginal flora and a score of 10 was assigned to those in which lactobacilli floras were largely replaced by *Gardnerella*, *Bacteroides* and *Mobiluncus*. Two experienced microscopists were used to score the vagina smear and in case of a discrepancy, a third opinion was sought and her/his opinion was final. Furthermore, five randomly selected slides were scored by an independent microscopist against a collection of smears pre-scored. In all, there was 90% concordance, indicating that scoring was comparable and consistent.

Data analysis

Collected data were reviewed daily for completeness and consistence of the responses. Data were doubly entered to ensure that entered data quality did not rely on a single person. Where discrepancies were found, the two data entry clerks were summoned together with the questionnaire to identify and rectify the difference.

Collected data were double entered into SPSS statistical database. Consistent, validity checks and cleaning were done using the same package. Data were later imported into STATA statistical package in Windows version 11 (StataCorp LP College Station, Texas, USA 2005) for analysis. Frequency distribution and proportions were used to describe participants' baseline characteristics as well as factors associated with BV. In calculating the wealth quintile, the household possessions that an individual had: type of house (walls, roof and floor), source of drinking water, source of power for cooking for the household, source of power for lighting, whether the family had a radio, bicycle, refrigerator or television and the type of toilet the family used were entered in a principal component analysis model in STATA and the Kaiser-Mayer-Olkin (KMO) measure of sampling adequacy applied. Household possessions with a KMO of less than 60% were excluded in a later model which was used to calculate the wealth index. Having a bicycle, a motorcycle and the type of roofing of the house had less KMO and thus were excluded in the final model.

Subsequently, the index was divided into quintiles: the lowest, the second, the third, the fourth and the highest in order of the wealth the individual household had.

For numerical data mean \pm standard deviation was calculated at 95% confidence level. Scores 0-3 and 4-6 were grouped and categorized as 0 and category 7-10 as 1 to denote absence and presence of BV respectively and entered in the binary logistic regression model to determine the association of various factors and BV. The association is reported as odds ratio together with the 95% confidence intervals and respective p-values.

Ethical consideration

Ethical clearance was sought and obtained from Bugando University College of Health Sciences /Bugando Medical Centre Research Ethics Committee. Written informed consent was requested and obtained from all participants. For literate women, the consent information was provided followed by a consent form which each participant was required to sign to signify her consent while the consent information sheet was read in its entirety to non-literate participants. The later were also required to thumb print on the consent form to signify their informed consent to participate in the study. Explanation was made that participation was voluntary and those declining to participate were still entitled to the standard care provided to all women in the labour ward. All filled questionnaires were examined for completeness daily by the principal investigator and stored securely in a locker. Data entries were done on the following day. For each participant, only a study unique participant identification number was recorded on the laboratory forms and questionnaire. All filled questionnaires were destroyed after the data entry and cleaning.

Results

Of the total 626 pregnant women who attended the hospital for delivery 284 were recruited into the study. The median age of the participants was 26 years. The majority 87.7% (N=249) were married, and just over 12.3% were single or separated. Generally, most participants (65.8%) had primary school education. Over half (53.5%) of all participants were housewives. Of the 187 participants who had ever delivered, the median number of parity was two. Slightly over half (58.8%; N=167) of the study participants were from rural areas. Participants were also almost evenly distributed in the wealth quintiles (Table 1).

Bacterial vaginosis (Nugent score 7-10) was found in 28.5% and *Gardenella* was the commonest morphotype accounting for approximately 66.2% of all BV cases followed by *Mobilincus* (11.6%).

Table 1: Baseline social demographic characteristics of study participants

Characteristics	Responses	Number (%)
Education	None	9 (3.2)
	Primary	187 (65.8)
	Secondary	74 (26.1)
	Post Secondary	14 (4.9)
Marital status	Single	319 (10.9)
	Married	249 (87.7)
	Separated	4 (1.4)
Occupation	Housewife	152 (53.5)
	Petty trader	61(4.5)
	Employed	38 (13.4)
Residence	Urban	117 (41.2)
	Rural	167 (58.8)
Wealth quintile	Lowermost	56 (19.7)
	2 nd	57 (20.1)
	3 rd	54 (19.0)
	4 th	59 (20.8)
	Highest	58 (20.4)
Total		284

Table 2 shows the association between BV and various predetermined factors in a binary logistic regression model. There was no evidence to suggest association between bacterial vaginosis and practices of inserting materials into the vagina to enhance dry or wet sex (OR 1.20 CI 0.43-3.17 and 0.80 CI 0.37-1.77, respectively) and HIV (OR 0.90 CI 0.28-2.92). Bacterial vaginosis was also not associated with factors such as level of education (at least primary education and less or none), residence (urban, semi-urban or rural) and marital status.

Table 2: Predictors of bacteria vaginosis among 284 pregnant women who delivered at BMC

Variable	Response	Bacterial vaginosis absent N (%)	Bacterial vaginosis present N (%)	Crude (OR and 95% CI interval)
Gestational age	<=37	29(30.2)	67(69.8)	0.88(0.52-1.53)
	>=37	52(27.8)	135(72.2)	1.00
Education	No education	2(22.2)	7(77.2)	1
	Educated	79(28.8)	195(71.2)	1.42(0.29-6.97)
Marital status	Not married	10(28.6)	25(71.4)	1
	Married	71(28.6)	177(71.4)	1.00(0.46-2.19)
Occupation	None	9(36.0)	16(64.0)	1
	Housewife	45(29.6)	107(70.4)	0.71(0.31-1.81)
	Employed	6(15.8)	36(84.2)	0.33(0.10-1.10)
	Business	18(30.0)	18(30.0)	0.76(0.28-2.04)
	Peasant	3(42.9)	3(42.9)	1.33(0.24-7.33)
Residence	Urban	30(25.6)	87(74.4)	0.84(0.46-1.55)
	Semi urban	27(29.03)	66(71.0)	1
	Rural	24(32.9)	202(71.4)	1.20(0.61-2.32)
Wet sex	No	76(29.2)	184(70.8)	1.00
	Yes	5(23.8)	16(76.2)	0.80(0.37-1.77)
Dry sex	No	75(28.4)	189(71.6)	1
	Yes	6(31.6)	13(68.4)	1.2(0.43-3.17)
Booking	Not booked	25(35.2)	46(64.8)	1
	Booked	56(26.4)	156(73.6)	0.66 (0.37-1.17)
Candidiasis	No	63(30.1)	146(69.9)	1
	Yes	18(24.3)	56(75.7)	0.74(0.41-1.37)

HIV	No	77(28.7)	191(71.3)	1
	Yes	4(26.7)	11(73.3)	0.90 (0.28-2.92)

Discussion

The magnitude of bacterial vaginosis found in this study was slightly higher than the one reported 14 years ago by Mayaud *et al.*, (1998). In a recent study in Dar es Salaam, a prevalence of 60.6% has been reported by Aboud *et al.* (2008). Levels as high as 83.3% and 62.9 % have been reported among non-pregnant women in previous studies elsewhere in Tanzania (Tanton *et al.* 2011; Baisley *et al.*, 2009) and elsewhere in Africa (Pepin *et al.*, 2011). The current study was conducted among women delivering in a tertiary health facility who are usually referred from lower level facilities for various pregnancy-related conditions. Their health care seeking behaviour might have been influenced by ante-natal care (ANC) clinic attendance and some might have received antimicrobial drugs for other conditions with effect on vaginal flora. Nevertheless, similar to previous studies from other settings, *Gardnella* was the most predominant morphotype (Nelson *et al.*, 2009; Dumonceaux *et al.*, 2009).

In this study bacterial vaginosis was not associated with factors such as practices of inserting materials into the vagina to enhance dry or wet sex and marital status. Studies from elsewhere have highlighted the association between bacterial vaginosis and such conditions (Cohen *et al.*, 1995; Sewankambo *et al.*, 1997; Ness *et al.*, 2002; Bukusi *et al.*, 2006; Hassan *et al.*, 2007; Cherpes *et al.*, 2008; McClelland *et al.*, 2008; Aboud *et al.*, 2008; Haggert *et al.*, 2009; Mitchell *et al.*, 2009). This variation may be explained by the difference in study population - pregnant women were used in the current study while non-pregnant women were used in other studies. Additionally, in the current study details of the practices such as type of materials used, the duration as well as how frequent they were used were not recorded. Therefore, the possible effect(s) of such practices on vaginal flora could not be explained.

Our study found no association between bacterial vaginosis and HIV infection. Previous studies have highlighted a strong association of both symptomatic and asymptomatic bacterial vaginosis and HIV infection as well as possible maternal and foetal morbidity (Hillier *et al.*, 1988; Cohen *et al.*, 1995; Sewankambo *et al.*, 1997; Subtil *et al.*, 2002; Usui *et al.*, 2002; Leitich *et al.*, 2003; Mitchell *et al.*, 2009; Schellenberg *et al.*, 2012). A near universal uptake of prevention of mother to child transmission of HIV services in the study setting meant that women are possibly identified early and initiated on prophylaxis or treatment, thus influencing systemic and local vaginal immunity likely to affect the pattern of vaginal flora.

The major strength of this study is the rigour in arriving at the diagnosis of bacterial vaginosis. However, the limitations of this study need to be highlighted. Notably, the study involved women who sought delivery care at the hospital in a one-month period, and thus may not be representative of the annual population served by the hospital. Additionally, only women delivering at the hospital were included in this study, and therefore the results will not apply to antenatal women seen at the hospital in the same period. Nevertheless, the results suggest a high magnitude of the condition, and a need for a similar study among antenatal women at the ANC clinic to document the magnitude of the problem.

In conclusion, BV is common among women delivering at this facility. A similar study among ANC women in the facility is required to reliably document the magnitude

and the association of the condition with HIV. Studies to determine the effect of bacterial vaginosis on pregnancy outcomes are also required to provide evidence for (or lack thereof) practice change to include routine bacterial vaginosis screening in the minimum ANC package.

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Competing interest

Authors declare no conflict of interest.

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