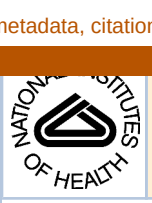

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Genital tract infections among HIV-infected pregnant women in Malawi, Tanzania and Zambia

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Summary

The aim of this study was to compare the prevalence and factors associated with genital tract infections among HIV-infected pregnant women from African sites. Participants were recruited from Blantyre and Lilongwe, Malawi; Dar es Salaam, Tanzania; and Lusaka, Zambia. Genital tract infections were assessed at baseline. Of 2627 eligible women enrolled, 2292 were HIV-infected. Of these, 47.8% had bacterial vaginosis (BV), 22.4% had vaginal candidiasis, 18.8% had trichomoniasis, 8.5% had genital warts, 2.6% had chlamydia infection, 2.2% had genital ulcers and 1.7% had gonorrhoea. The main factors associated with genital tract infections included genital warts (adjusted odds ratio [AOR] 1.8, 95% CI 1.2–2.7), genital ulcers (AOR 2.4, 95% CI 1.2–5.1) and abnormal vaginal discharge (AOR 2.5, 95% CI 1.9–3.3) for trichomoniasis. BV was the most common genital tract infection followed by candidiasis and trichomoniasis. Differences in burdens and risk factors call for enhanced interventions for identification of genital tract infections among HIV-infected women.

Keywords

sexually transmitted infections; genital tract infections; pregnant women; human immunodeficiency virus; Africa

INTRODUCTION

Genital tract infections are known to facilitate the sexual transmission of HIV type 1.[1–3] Genital tract infections are a major global cause of acute illness, infertility, long-term disability with severe medical and psychological consequences affecting millions of men, women and children. The World Health Organization (WHO) estimated that 340 million cases of syphilis, gonorrhoea, chlamydia infection and trichomoniasis occurred throughout the world in 1999 in men and women aged 15–49 years.[4] Data from epidemiological surveys show that within countries and between countries in the same region, the prevalence and incidence of genital tract infections may vary widely even in similar population groups.[4]

Identifying factors associated with genital tract infections in HIV-infected pregnant women in diverse African population can contribute to the development of prevention and control strategies. The aim of this study was to compare the prevalence and risk factors associated with genital tract infections among HIV-infected pregnant women enrolled in a clinical trial in Blantyre and Lilongwe, Malawi; Dar es Salaam, Tanzania; and Lusaka, Zambia (HPTN 024).

MATERIALS AND METHODS

HPTN 024 trial

The HPTN 024 trial was a randomized, double-blinded, placebo-controlled Phase III trial which enrolled both HIV-infected and -uninfected pregnant women. The primary objective of this clinical trial was to determine the efficacy of a low-cost antibiotic intervention for prevention of chorioamnionitis-associated mother-to-child transmission (MTCT) of HIV and of preterm birth.[5] This multicenter trial was conducted at clinical sites in four sub-Saharan African cities: Blantyre and Lilongwe, Malawi; Dar es Salaam, Tanzania; and Lusaka, Zambia.

The trial was approved by USA and in-country institutional ethical review boards or committees in each country. Written informed consents were obtained from all enrolled participants. Enrolment commenced in July 2001 and ended in February 2003. The methods of the trial have been described elsewhere.[5]

Data on sociodemographic characteristics and sexual history were obtained through participant interview at the enrolment visit (20–24 weeks gestation). The external genitalia, vagina and cervix were examined and a bimanual examination was performed. Laboratory investigations included HIV-1 serology screening by dual rapid-testing algorithm and western blot confirmation of all positive or indeterminate results at Blantyre, Lilongwe and Lusaka sites. Dar es Salaam site performed two enzyme-linked immunosorbent assays (ELISAs); Dade Behring Enzygnost anti-HIV-1/2 Plus as first ELISA followed by Abbott Murex Wellcozyme anti-HIV-1 recombinant with discrepant results between the two ELISAs being confirmed by western blot. In addition, laboratory screening for the following genital tract infections was performed: syphilis,[6] trichomoniasis, vaginal candidiasis, bacterial vaginosis (BV) (diagnosed by Nugent score), gonorrhoea and chlamydia infection. Women were screened for syphilis using rapid plasma reagin (RPR) test (Blantyre, Lilongwe and Lusaka) or Venereal Disease Research Laboratory test (Dar es Salaam). Confirmation of the syphilis screening was performed with the microhaemagglutination *Treponema pallidum* test (MHA-TP) (Lilongwe), *T. pallidum* particle agglutination test (TPPA; Dar es Salaam) or *T. pallidum* haemagglutination assay (TPHA; Blantyre). Both TPPA and TPHA tests were used to confirm positive RPR samples from Lusaka. Women with confirmed syphilis were treated with intramuscular benzathine penicillin at no cost. A sterile cotton-tipped applicator, used to swab the lateral vaginal wall, was placed in a test tube container containing 1 mL sterile saline. The fluid was examined in the site laboratory for the presence of motile *Trichomonas vaginalis*, clue cells and hyphae buds. Cotton-tipped applicator was also used to collect vaginal specimen for Gram stain. Applicator was gently rolled (not rubbed) across the surface of a glass slide to create a monolayer of cells. The slide was then allowed to air-dry, and then stored at room temperature in a slide box. The slides were then shipped to University of Alabama at Birmingham for evaluation. For BV, women were considered positive if they had a Nugent score $\geq$7. The Nugent score is based on counting the bacterial cell types on Gram-stained slides of vaginal smears.[7] For gonococcal culture, cotton-tipped swab was placed in the endocervical canal and allowed to sit for at least 10 s. This swab was then used to inoculate a plate for gonococcal isolation. The inoculated plate was then stored in a candle jar in the clinic and immediately transported to the site laboratory for streaking. The plates were incubated in a candle jar at 37°C and inspected at 24 and 48 hours. *Neisseria gonorrhoeae* were identified by typical Gram stain appearance and positive oxidase reaction. Dacron swabs provided in the manufacturer's collection kit (Syva MicroTrak) were placed in the endocervical canal and allowed to sit for at least 10 s. They were placed in the vial provided, the handle of the swab was snapped-off and the vials were capped for transport to the site laboratory. *Chlamydia trachomatis* antigen was extracted from the swabs and enzyme immunosorbent assay was performed on the extract according to the manufacturer's instructions (Syva MicroTrak). Flow cytometry for CD4 count was also performed. HIV-infected women and their infants were offered MTCT prophylaxis with Nevirapine 200 mg during labour onset and 2 mg/kg for infants within 72 hours of birth.[8]

Study population for this analysis

All HIV-infected pregnant women who had been screened for the genital tract infections were included in the analyses. HIV-uninfected pregnant women were excluded because not all four clinical sites recruited HIV-uninfected women.

Statistical analyses

Sociodemographic characteristics of the study population were assessed among women from the four clinical sites. The prevalences of the following genital tract infections were calculated in univariate analysis (overall and by site): trichomoniasis, vaginal candidiasis, BV (based on Nugent score), gonorrhoea, Chlamydia infection, genital warts and genital ulcers. Data regarding syphilis correlated with HIV-infected pregnant women enrolled in HPTN 024 trial and were published in another study.[6] χ^2 Tests or *t*-tests were conducted to assess the statistical associations between each genital tract infection and sociodemographic characteristics, sexual history, pelvic examination findings in univariate analyses, respectively.

Multiple logistic regression analyses were performed to obtain AORs for the variables of interest, for each outcome. Due to the large number of variables, a model building strategy using deviance tests was employed. A complete model containing all variables of interest was initially fitted; this model was then reduced by removing variables with *P* values greater than 0.4 and comparing the change in deviance between the two models. If the change in deviance was not significant, more variables were removed (using $P > 0.4$ criteria) from the reduced model. This procedure was repeated until a significant change in deviances was observed. Findings are presented as AOR, 95% CI and *P* value for the individual variables. All the statistical analyses were performed with SAS™ version 9.1 (SAS, Inc., Cary, NC, USA).

RESULTS

Size and characteristics of the study population

Overall, 2627 eligible women were enrolled in the HPTN 024 trial. Of this, 2292 (87.2%) were HIV-infected. All these women were screened for genital tract infections. Thus, the study population comprised 2292 women, of whom 474 (20.7%) were from Blantyre, 748 (32.6%) from Lilongwe, 428 (18.7%) from Dar es Salaam and 642 (28%) from Lusaka. Baseline sociodemographic and sexual history characteristics of the study population, overall and stratified by clinical site are shown in Table 1. The distribution of all these characteristics varied significantly across sites. Findings on pelvic examination, overall and stratified by clinical site are shown in Table 1. The proportion of subjects with vaginal bleeding, cervical abnormalities (discharge, friability/epithelial disruption, vesicles, ulcerations, and ectopy), adnexal and uterine tenderness, and adnexal masses differed significantly by site.

Prevalences of genital tract infections

Overall, the most common genital tract infection was BV and the least common was genital ulcers (Table 2). There were statistically significant differences in the prevalences of genital tract infections by site for all infections except genital warts and genital ulcer (Table 2). The highest prevalence of genital tract infection by site was: BV (60.6%) in Dar es Salaam, candidiasis (29.0%) in Blantyre, trichomoniasis (24.1%) and gonorrhoea (3.6%) in Lilongwe, genital warts (9.5%) and chlamydia infection (6.1%) in Lusaka.

Factors associated with genital tract infections

Univariate analyses of factors associated with genital tract infections are shown in Table 3 (trichomoniasis, vaginal candidiasis and BV) and Table 4 (gonorrhoea and chlamydia infection). Sociodemographic characteristics (formal employment, marital status, spouse occupation, Blantyre site, housing and cook with stove, firewood) and sexual history (lifetime sexual partners), along with certain pelvic examination findings (genital warts, genital ulcers, vaginal bleeding, abnormal vaginal discharge, cervical discharge and 1–25% ectopy), were associated with trichomoniasis, vaginal candidiasis and BV. Fewer of such factors were associated with gonorrhoea or chlamydia infection.

The results of multiple logistic regression analyses of factors associated with the five genital tract infections are shown in Tables 5 and 6. Factors associated with trichomoniasis were: education of the sexual partner, site (Dar es Salaam), treatment for genital ulcers, genital warts, genital ulcers and abnormal vaginal discharge. Factors associated with vaginal candidiasis included lifetime sexual partners, abnormal vaginal discharge and CD4 count. Only sociodemographic factors (spouse's occupation and clinical site) were associated with BV. Only socio-demographic (maternal age, clinical site) and sexual history (treated for genital ulcers in the past year) were associated with gonorrhea. Finally, only clinical site was associated with chlamydia infection.

DISCUSSION

Among HIV-infected pregnant women who presented for antenatal care at sites in Malawi, Tanzania and Zambia, the prevalences of genital tract infections were generally high. The prevalence of trichomoniasis was very high at all sites except Dar es Salaam despite the fact that the technique used to diagnose trichomoniasis entailed microscopic examination of wet-mount preparation, a relatively insensitive method. Dar es Salaam, Tanzania having the lowest prevalence of trichomoniasis (4.2%) is in contrast with the recent report from Ministry of Health documenting higher rates and noting that Dar es Salaam was among the regions that reported the highest number of genital tract infections among antenatal clinic attendees.[9] This apparent difference could be due to the use of syndromic approach to diagnosis in the later report compared with the laboratory-based diagnostic approach used in the current study.

We noted a high prevalence of BV across all sites and Dar es Salaam had the highest prevalence of BV (60.6%). This condition has important implications in the context of HIV infection. For example, one study suggested that disturbances of vaginal flora and BV were associated with an increased risk of HIV acquisition during pregnancy.[10] The utility of Nugent score and leukocyte count in vaginal secretions for BV diagnosis has been documented.[11]

The genital tract infection with the lowest prevalence in all settings in our study population was gonorrhoea. The prevalences of gonorrhoea and other genital tract infections such as trichomoniasis and genital ulcers in HIV-infected women in Malawi are similar to those reported earlier, although genital warts appear to be on the increase (2.7% in 1995 vs. currently 8.9%).[12] The prevalence of gonorrhoea (0.4% vs. 3.6%) was found to be significantly higher in Lilongwe (3.6%) when compared with Blantyre (0.4%) ($P < 0.0001$). Populations from both the sites are similar in sociodemographic and sexual behaviour characteristics. However, at population level, the spread of a sexually transmitted infection (STI) depends on the average number of new cases of infection generated by an infected person, health-seeking behaviour and also differences in the access to appropriate treatment.[4]

Chlamydia infection was very low in Malawi but relatively high in Zambia. The highest prevalence of chlamydia infection (6.1%) found in Lusaka compared with the other clinical sites is noteworthy but difficult to explain. However, the prevalence is relatively low when compared with the 9% prevalence of infection reported among female sex workers in other cities in sub-Saharan Africa.[13] Previous studies among pregnant women revealed a prevalence rate of 6% in Tanzania, 12.4% in South Africa and 13% in Cape Verde.[14–16]

Women with five or more lifetime sexual partners were more likely to be diagnosed with trichomoniasis compared with those having one lifetime partner. Findings of reported multiple sexual partners has been documented previously to be a risk factor for gonorrhoea, chlamydia infection[17,18] and trichomoniasis.[19] We also noted that having been treated for genital ulcer disease in the last year was associated with lower risk for trichomoniasis. This finding provides support for the concept that appropriate management of STIs reduces the risk of recurrent

episodes of infection. We also found that abnormal vaginal discharge was strongly associated with trichomoniasis and vaginal candidiasis. Similar findings about the coexistence of genital ulcers and genital discharge have been reported recently in Uganda.[20]

Women at the Lilongwe site and those who received treatment for genital ulcer disease in the prior year were more likely to be diagnosed with gonorrhoea. This may be explained by the fact that having genital ulcer disease is a marker for high-risk behaviour that, if continued, would put an individual to a future risk for gonorrhoea. The finding of genital ulcer disease treatment during the last year being associated with gonorrhoea supports the significance of previous medical history as well as treatment to predict the current status of genital tract infections of an individual. More than two-thirds of women in the study had CD4 counts ≤500 cells/μL at enrolment and this was found to be a significant factor for vaginal candidiasis. A 10-year prospective study conducted among 1215 female sex workers in Nairobi, Kenya, showed that risks of vaginal candidiasis and genital ulcer disease were significantly higher among HIV-infected women than among HIV-uninfected women, and risks of the two diseases rose with increasing level of immunosuppression.[21]

Noted strengths of our study are its large size and the inclusion of women from four cities in sub-Saharan Africa with significant variations in sociodemographic and sexual behavioural characteristics. One limitation of this study is that we are not able to comment on the prevalence of genital tract infections or their predictors among the larger population of HIV-uninfected women in these settings. Thus, the study findings cannot be generalized to all pregnant women because the women in our study population could have been seeking research-related care, perhaps due to known HIV infection, obstetrical complications or genital tract infections.

BV was the most common genital tract infection followed by candidiasis and trichomoniasis. The different genital tract infection burdens in different settings, and difference in risk factors for such infections across sites, call for enhanced interventions for the identification of genital tract infections among HIV-infected women.

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References

1. Wasserheit JN. Epidemiological synergy. Interrelationships between human immunodeficiency virus infection and other sexually transmitted diseases. Sex Transm Dis 1992;19:61–77. [PubMed: 1595015]
2. Clottey C, Dallabetta G. Sexually transmitted diseases and human immunodeficiency virus. Epidemiologic synergy? Infect Dis Clin North Am 1993;7:753–70. [PubMed: 8106728]

3. Fleming DT, Wasserheit JN. From epidemiological synergy to public health policy and practice: the contribution of other sexually transmitted diseases to sexual transmission of HIV infection. Sex Transm Infect 1999;75:3–17. [PubMed: 10448335]
4. World Health Organization. Global Prevalence and Incidence of Selected Curable Sexually Transmitted Infections Overview and Estimates. WHO/CDS/CSR/EDC/2001.10. Geneva: 2001.
5. Taha TE, Brown ER, Hoffman IF, et al. A phase III clinical trial of antibiotics to reduce chorioamnionitis-related perinatal HIV-1 transmission. AIDS 2006;20:1313–21. [PubMed: 16816561]
6. Potter D, Goldenberg RL, Read JS, et al. Correlates of syphilis seroreactivity among pregnant women: the HIVNET 024 trial in Malawi, Tanzania, and Zambia. Sex Transm Dis 2006;33:604–9. [PubMed: 16601659]
7. Mastrobattista JM, Bishop KD, Newton ER. Wet smear compared with gram stain diagnosis of bacterial vaginosis in asymptomatic pregnant women. Obstet Gynecol 2000;96:504–6. [PubMed: 11004348]
8. Guay LA, Musoke P, Fleming T, et al. Intrapartum and neonatal single-dose nevirapine compared with zidovudine for prevention of mother-to-child transmission of HIV-1 in Kampala, Uganda: HIVNET 012 randomised trial. Lancet 1999;354:795–802. [PubMed: 10485720]
9. The United Republic of Tanzania. Ministry of Health. National AIDS Control Programme HIV/AIDS Surveillance Report. Report No. 16. 2001
10. Taha TE, Hoover DR, Dallabetta GA, et al. Bacterial vaginosis and disturbances of vaginal flora: association with increased acquisition of HIV infection. AIDS 1998;12:1699–706. [PubMed: 9764791]
11. Culhane JF, Desanto D, Goldenberg RL, McCollum KF, King F, Guaschino S. Variation in Nugent score and leukocyte count in fluid collected from different vaginal sites. Obstet Gynecol 2005;105:120–3. [PubMed: 15625152]
12. Taha TE, Dallabetta GA, Hoover DR, et al. Trends of HIV-1 and sexually transmitted diseases among pregnant and postpartum women in urban Malawi. AIDS 1998;12:197–203. [PubMed: 9468369]
13. Morison L, Weiss HA, Buve A, et al. Commercial sex and the spread of HIV in four cities in sub-Saharan Africa. AIDS 2001;15(Suppl 4):S61–9. [PubMed: 11686467]
14. Mayaud P, Ka-Gina G, Cornelissen J, et al. Validation of a WHO algorithm with risk assessment for the clinical management of vaginal discharge in Mwanza, Tanzania. Sex Transm Infect 1998;74 (Suppl 1):S77–84. [PubMed: 10023356]
15. Sturm AW, Wilkinson D, Ndovela N, Bowen S, Connolly C. Pregnant women as a reservoir of undetected sexually transmitted diseases in rural South Africa: implications for disease control. Am J Public Health 1998;88:1243–5. [PubMed: 9702160]
16. Wessel HF, Herrmann B, Dupret A, Moniz F, Brito C, Bergstrom S. Genital infections among antenatal care attendees in Cape Verde. Afr J Reprod Health 1998;2:32–40. [PubMed: 10214427]
17. Riedner G, Rusizoka M, Hoffmann O, et al. Baseline survey of sexually transmitted infections in a cohort of female bar workers in Mbeya Region, Tanzania. Sex Transm Infect 2003;79:382–7. [PubMed: 14573833]
18. Buve A, Weiss HA, Laga M, et al. Study group on heterogeneity of HIV epidemics in African cities. The epidemiology of gonorrhoea, chlamydial infection and syphilis in four African cities. AIDS 2001;15(Suppl 4):S79–88. [PubMed: 11686469]
19. Buve A, Weiss HA, Laga M, et al. Study group on heterogeneity of HIV epidemics in African cities. The epidemiology of trichomoniasis in women in four African cities. AIDS 2000;15(Suppl 4):S89–96. [PubMed: 11686470]
20. Pickering JM, Whitworth JAG, Hughes P, et al. Aetiology of sexually transmitted infections and response to syndromic treatment in southwest Uganda. Sex Transm Infect 2005;81:488–93. [PubMed: 16326853]
21. Thomas J. HIV infection elevates Kenyan sex workers' STI risk, which rises further as immunosuppression increases. Int Fam Plan Perspect 2005;31:44. [PubMed: 15997499]

Table 1

Baseline sociodemographic, sexual history characteristics and pelvic examination findings of the study population, overall and according to clinical site (*n* = 2292)

Characteristic	Overall (*n* = 2292)		Blantyre (*n* = 474)		Lilongwe (*n* = 748)		Dar es Salaam (*n* = 428)		Lusaka (*n* = 642)	
	n	**(%)**	***n***	**(%)**	***n***	**(%)**	***n***	**(%)**	***n***	**(%)**
Sociodemographic										
Age (years)										
15–19	242	(10.6)	51	(10.8)	60	(8.0)	26	(6.1)	105	(16.4)
20–24	852	(37.2)	171	(36.1)	300	(40.1)	142	(33.2)	239	(37.3)
25–29	779	(34.0)	171	(36.1)	258	(34.5)	153	(35.7)	197	(30.7)
30–34	318	(13.9)	62	(13.1)	104	(13.9)	77	(18.0)	75	(11.7)
35+	101	(4.4)	19	(4.0)	26	(3.5)	30	(7.0)	25	(3.9)
Years of education*	7	(3–10)	8	(4–10)	6	(3–8)	7	(7–7)	7	(5–9)
Occupation										
Homemaker	1782	(77.7)	390	(82.3)	645	(86.2)	305	(71.3)	442	(68.8)
Self-employed	263	(11.5)	44	(9.3)	47	(6.3)	72	(16.8)	100	(15.6)
Formal employment	195	(8.5)	39	(8.2)	54	(7.2)	38	(8.9)	64	(10)
Other	52	(2.3)	1	(0.2)	2	(0.3)	13	(3)	36	(5.6)
Marital status										
Married	2097	(91.5)	444	(93.7)	722	(96.5)	367	(85.7)	564	(87.9)
Other	195	(8.5)	30	(6.3)	26	(3.5)	61	(14.3)	78	(12.1)
Occupation of spouse			(*n* = 454)		(*n* = 726)		(*n* = 369)		(*n* =570)	
None	86	(4.1)	19	(4.2)	38	(5.2)	2	(0.5)	27	(4.7)
Self-employed	826	(39.0)	149	(32.8)	279	(38.4)	176	(47.7)	222	(38.9)
Formal employment	1158	(54.6)	279	(61.5)	401	(55.2)	167	(45.3)	311	(54.6)
Other	49	(2.3)	7	(1.5)	8	(1.1)	24	(6.5)	10	(1.8)
Education of sexual partner (years)*	9	(7–12)	10	(8–12)	8	(7–12)	7	(7–11)	10	(9–12)
Housing										
Rent house	1023	(44.6)	282	(59.5)	420	(56.1)	75	(17.5)	246	(38.3)
Rent room	450	(19.6)	5	(1.1)	20	(2.7)	234	(54.7)	191	(29.8)
Own house	589	(25.7)	144	(30.4)	251	(33.6)	97	(22.7)	97	(15.1)
Staff quarters	91	(4.0)	22	(4.6)	35	(4.7)	13	(3)	21	(3.3)

Characteristic	Overall (*n* = 2292)		Blantyre (*n* = 474)		Lilongwe (*n* = 748)		Dar es Salaam (*n* = 428)		Lusaka (*n* = 642)	
	n	**(%)**	***n***	**(%)**	***n***	**(%)**	***n***	**(%)**	***n***	**(%)**
Stay with relatives	133	(5.8)	20	(4.2)	22	(2.9)	9	(2.1)	82	(12.8)
Other	6	(0.3)	1	(0.2)	—		—		5	(0.8)
Have electricity	928	(40.5)	189	(39.9)	123	(16.4)	323	(75.5)	293	(45.6)
Have running water	965	(42.1)	190	(40.1)	222	(29.7)	294	(68.7)	259	(40.3)
Cook with										
Electric stove	396	(17.3)	71	(15.0)	45	(6.0)	14	(3.3)	266	(41.4)
Paraffin stove	456	(19.9)	18	(3.8)	61	(8.2)	376	(87.9)	1	(0.2)
Charcoal stove	1588	(69.3)	389	(82.1)	453	(60.6)	374	(87.4)	372	(57.9)
Firewood	757	(33.0)	161	(34.0)	578	(77.3)	8	(1.9)	10	(1.6)
Sexual history										
Number of lifetime partners										
1	466	(20.3)	97	(20.5)	194	(26.0)	77	(18.0)	98	(15.7)
2	744	(32.5)	169	(35.7)	276	(36.9)	118	(27.6)	181	(29.0)
3	607	(26.5)	125	(26.4)	177	(23.7)	127	(29.7)	178	(28.5)
4	246	(10.7)	48	(10.1)	52	(7.0)	55	(12.9)	91	(14.6)
5+	211	(9.2)	35	(7.4)	48	(6.4)	51	(11.9)	77	(12.3)
Number of partners this pregnancy										
0	27	(1.2)	8	(1.7)	9	(1.2)	3	(0.7)	7	(1.1)
1	2216	(96.7)	457	(96.4)	732	(97.9)	409	(95.6)	618	(96.4)
2+	48	(2.1)	9	(1.9)	7	(0.9)	16	(3.7)	16	(2.5)
Condom use										
Never	1723	(75.1)	413	(88.6)	453	(61.3)	393	(92.5)	464	(73.2)
Sometimes	460	(20.1)	52	(11.2)	234	(31.7)	24	(5.6)	150	(23.7)
Always	81	(3.5)	1	(0.2)	52	(7.0)	8	(1.9)	20	(3.2)
Received treatment for syphilis during the past year	118	(5.1)	11	(2.3)	13	(1.7)	18	(4.2)	76	(11.8)
Received treatment for genital ulcer disease during the past year	92	(4.0)	20	(4.2)	20	(2.7)	6	(1.4)	46	(7.2)
Received treatment for vaginal discharge during the past year	150	(6.5)	37	(7.8)	29	(3.9)	44	(10.3)	40	(6.2)
Pelvic examination findings										

Characteristic	Overall (*n* = 2292)		Blantyre (*n* = 474)		Lilongwe (*n* = 748)		Dar es Salaam (*n* = 428)		Lusaka (*n* = 642)	
	n	**(%)**	***n***	**(%)**	***n***	**(%)**	***n***	**(%)**	***n***	**(%)**
External genitalia										
Warts	195	(8.5)	42	(8.9)	61	(8.2)	31	(7.2)	61	(9.5)
Ulcers	51	(2.2)	12	(2.5)	18	(2.4)	5	(1.2)	16	(2.5)
Vagina										
Vaginal bleeding	22	(1.0)	2	(0.4)	14	(1.9)	0	(0)	6	(0.9)
Subepithelial haemorrhage	3	(0.1)	0	(0)	2	(0.3)	0	(0)	1	(0.2)
Oedema	3	(0.1)	0	(0)	1	(0.1)	0	(0)	2	(0.3)
Condyloma – vagina	41	(1.8)	12	(2.5)	6	(0.8)	12	(2.8)	11	(1.7)
Vesicles	8	(0.3)	1	(0.2)	5	(0.7)	0	(0)	2	(0.3)
Bullae	1	(0.04)	0	(0)	1	(0.1)	0	(0)	0	(0)
Abnormal vaginal discharge	14	(0.6)	1	(0.2)	5	(0.7)	5	(1.2)	3	(0.5)
Cervix										
Cervical discharge	444	(19.4)	79	(16.7)	138	(18.4)	14	(3.3)	213	(33.2)
Friability/epithelial disruption	177	(7.7)	21	(4.4)	50	(6.7)	26	(6.1)	80	(12.5)
Condyloma – cervix	23	(1.0)	9	(1.9)	5	(0.7)	6	(1.4)	3	(0.5)
Vesicles – cervix	19	(0.8)	2	(0.4)	6	(0.8)	0	(0)	11	(1.7)
Ulcerations	107	(4.7)	7	(1.5)	79	(10.6)	8	(1.9)	13	(2.0)
Ectopy										
0	1583	(69.1)	445	(93.9)	175	(23.4)	414	(97.0)	549	(85.5)
1–25%	676	(29.5)	26	(5.5)	552	(73.8)	12	(2.8)	86	(13.4)
26–50%	32	(1.4)	3	(0.6)	21	(2.8)	1	(0.2)	7	(1.1)
Bimanual exam										
Adnexal tenderness	34	(1.5)	15	(3.2)	0	(0)	4	(0.9)	15	(2.3)
Uterine tenderness	17	(0.7)	2	(0.4)	0	(0)	3	(0.7)	12	(1.9)
Adnexal masses	12	(0.5)	1	(0.2)	0	(0)	0	(0)	11	(1.7)

*Median and range

Table 2

Prevalence of genital tract infections in the study population, overall and according to clinical site (*n* = 2292)

Infection	Total no. screened	Total no. with infection (%)	Blantyre, no. (%)	Lilongwe, no. (%)	Dar es Salaam, no. (%)	Lusaka, no. (%)
Trichomoniasis	2287	430 (18.8)	98 (20.8)	180 (24.1)	18 (4.2)	134 (20.9)
Vaginal candidiasis	2175	488 (22.4)	137 (29.0)	145 (19.4)	79 (25.1)	127 (19.8)
Bacterial vaginosis	2248	1074 (47.8)	239 (51.5)	329 (44.8)	255 (60.6)	251 (40.0)
Gonorrhoea	2253	39 (1.7)	2 (0.4)	26 (3.6)	1 (0.2)	10 (1.6)
Chlamydia	2156	57 (2.6)	4 (0.9)	2 (0.3)	12 (3.5)	39 (6.1)
Genital warts	2292	195 (8.5)	42 (8.9)	61 (8.2)	31 (7.2)	61 (9.5)
Genital ulcer	2292	51 (2.2)	12 (2.5)	18 (2.4)	5 (1.2)	16 (2.5)

Table 3

Univariate analyses of factors associated with trichomoniasis, vaginal candidiasis and BV (n = 2292)

Associated factor	Trichomoniasis UOR (95% CI)	Vaginal candidiasis UOR (95% CI)	BV UOR (95% CI)
Sociodemographic			
Maternal age at enrolment (per five year increase)	0.8 (0.7–0.9)	1.0 (0.9–1.1)	0.9 (0.8–1.0)
Years of education (per one year increase)	0.9 (0.9–1.0)	1.0 (1.0–1.0)	0.9 (0.9–1.0)
Occupation			
Self-employed	1.0	1.0	1.0
Formal employment	1.1 (0.7–1.8)	1.2 (0.8–1.9)	1.7 (1.2–2.5)
Homemaker	1.2 (0.9–1.7)	0.9 (0.7–1.3)	2.0 (1.5–2.6)
Other	1.9 (0.9–3.8)	1.0 (0.5–2.1)	0.9 (0.5–1.7)
Marital status			
Married	1.0		1.0
Other	0.7 (0.5–1.0)	1.1 (0.7–1.6)	2.0 (1.5–2.8)
Partner years of education			
One year increase	0.9 (0.9–1.0)	1.0 (1.0–1.1)	1.0 (0.9–1.0)
Spouse occupation			
Self-employed	1.0	1.0	1.0
Formal employment	1.1 (0.9–1.4)	1.0 (0.8–1.3)	1.1 (0.9–1.3)
None	1.2 (0.7–2.1)	0.8 (0.4–1.4)	1.7 (1.1–2.8)
Other	0.9 (0.4–2.0)	0.7 (0.3–1.6)	0.5 (0.3–0.9)
Site			
Lusaka	1.0	1.0	1.0
Blantyre	1.0 (0.7–1.3)	1.7 (1.3–2.2)	1.7 (1.3–2.1)
Lilongwe	1.2 (0.9–1.6)	1.4 (1.0–1.9)	931.6 (220.3 to >999.9)
Dar es Salaam	0.2 (0.1–0.3)	0.8 (0.8–1.3)	0.2 (0.1–0.3)
Housing			
Stay with relatives	1.0	1.0	1.0
Own house	0.6 (0.4–0.9)	0.8 (0.5–1.3)	2.0 (1.3–2.9)
Rent house	0.6 (0.4–1.0)	0.8 (0.5–1.2)	1.9 (1.3–2.7)
Rent room	0.4 (0.2–0.6)	0.7 (0.5–1.2)	0.4 (0.3–0.6)
Staff quarters	0.5 (0.2–0.9)	0.9 (0.5–1.6)	1.7 (1.0–2.9)
Other	0.5 (0.1–4.4)	0.6 (0.1–5.0)	0.3 (0.03–2.4)
Cook with			
Electric stove	0.8 (0.6–1.0)	0.9 (0.7–1.1)	2.0 (1.6–2.4)
Paraffin stove	0.3 (0.2–0.5)	0.9 (0.7–1.2)	5.3 (4.2–6.9)
Charcoal stove	0.9 (0.7–1.1)	1.0 (0.8–1.2)	1.4 (1.2–1.7)
Firewood	1.7 (1.4–2.1)	1.2 (1.0–1.5)	0.1 (0.1–0.11)
Sexual history			
Lifetime sex partners			
5+	1.0	1.0	1.0
4	0.5 (0.3–0.9)	0.9 (0.5–1.4)	1.0 (0.7–1.4)

Associated factor	Trichomoniasis UOR (95% CI)	Vaginal candidiasis UOR (95% CI)	BV UOR (95% CI)
3	0.7 (0.5–1.1)	1.0 (0.7–1.5)	1.3 (0.9–1.8)
2	0.8 (0.6–1.2)	1.2 (0.8–1.8)	1.6 (1.2–2.1)
1	0.8 (0.5–1.1)	1.4 (1.0–2.1)	1.9 (1.3–2.6)
Number of partners during this pregnancy			
2+	1.0	1.0	1.0
1	0.9 (0.4–1.8)	1.5 (0.7–3.4)	1.8 (1.0–3.3)
0	0.9 (0.3–2.9)	3.1 (1.0–9.6)	2.3 (0.9–6.0)
Condom use			
Always	1.0	1.0	1.0
Sometimes	1.5 (0.7–2.9)	0.7 (0.4–1.3)	0.9 (0.5–1.5)
Never	1.5 (0.8–2.9)	0.8 (0.5–1.4)	0.3 (0.2–0.5)
Last year syphilis treatment			
Yes	1.0	1.0	1.0
No	1.1 (0.7–1.7)	1.0 (0.6–1.5)	0.6 (0.4–0.9)
Last year treated for genital ulcers			
Yes	1.0	1.0	1.0
No	0.6 (0.3–1.1)	1.3 (0.8–2.1)	0.6 (0.3–1.0)
Last year vaginal discharge treatment			
Yes	1.0	1.0	1.0
No	0.8 (0.5–1.2)	1.2 (0.8–1.7)	0.6 (0.5–0.9)
Pelvic exam findings			
External genitalia			
Genital warts			
Yes	1.0	1.0	1.0
No	1.6 (1.2–2.3)	1.0 (0.7–1.4)	1.3 (1.0–1.7)
Genital ulcers			
Yes	1.0	1.0	1.0
No	2.4 (1.3–4.3)	0.9 (0.4–1.8)	1.0 (0.6–1.8)
Vagina			
Vaginal bleeding	4.9 (2.0–11.5)	0.6 (0.2–2.0)	4.3 (1.4–12.9)
Subepithelial haemorrhage	8.7 (0.8–95.9)	6.9 (0.6–76.5)	2.0 (0.2–22.2)
Oedema	4.3 (0.3–69.3)	3.5 (0.2–55.5)	—
Condyloma – vagina	1.2 (0.6–2.6)	1.3 (0.6–2.6)	0.6 (0.3–1.1)
Vesicles	1.4 (0.3–7.3)	0.5 (0.1–4.0)	3.0 (0.6–15.0)
Bullae	—	—	—
Vaginal epithelial disruption	1.2 (0.3–4.2)	1.9 (0.6–5.8)	1.8 (0.6–5.4)
Abnormal vaginal discharge	2.1 (1.7–2.7)	1.7 (1.3–2.3)	1.0 (0.8–1.2)
Cervix			
Cervical discharge	1.4 (1.1–1.9)	0.9 (0.7–1.2)	1.2 (1.0–1.5)
Friability/epithelial disruption	1.6 (1.1–2.3)	0.6 (0.4–1.0)	0.9 (0.7–1.3)
Condyloma – cervix	1.9 (0.8–4.7)	1.2 (0.4–3.2)	0.8 (0.3–1.8)
Vesicles – cervix	3.2 (1.3–8.0)	0.6 (0.2–2.2)	1.7 (0.7–4.4)

Associated factor	Trichomoniasis UOR (95% CI)	Vaginal candidiasis UOR (95% CI)	BV UOR (95% CI)
Ulcerations	1.5 (1.0–2.3)	0.3 (0.2–0.6)	4.3 (2.7–7.1)
Ectopy			
0%	1.0	—	1.0
1–25%	1.5 (1.2–1.9)	0.8 (0.7–1.0)	12.1 (9.5–15.5)
26–50%	1.4 (0.6–3.3)	0.6 (0.2–1.6)	5.0 (2.3–10.8)
Bimanual exam			
Adnexal tenderness	2.1 (1.0–4.3)	1.8 (0.9–3.8)	0.5 (0.3–1.1)
Uterine tenderness	1.3 (0.4–4.1)	1.4 (0.5–4.1)	0.7 (0.3–1.8)
Adnexal masses	0.9 (0.2–4.0)	0.7 (0.2–3.1)	0.3 (0.1–1.2)
CD4 count (cells/μL)			
>500	1.0	1.0	1.0
200–500	0.9 (0.8–1.2)	1.4 (1.0–1.8)	1.2 (0.9–1.4)
<200	0.7 (0.4–0.9)	1.5 (1.1–2.1)	1.0 (0.8–1.3)

UOR = unadjusted odds ratio; CI = confidence interval; BV = bacterial vaginosis

Table 4

Univariate analyses of factors associated with gonorrhoea and Chlamydia infection (n = 2292)

	UOR (95% CI)	
Associated factor	**Gonorrhoea**	**Chlamydia**
Sociodemographic		
Maternal age at enrolment (per five year increase)	0.6 (0.4–0.9)	0.8 (0.6–1.0)
Years of education (per one year increase)	1.0 (0.9–1.0)	1.0 (0.9–1.1)
Occupation		
Self-employed	1.0	1.0
Formal employment	1.0 (0.2–4.6)	0.4 (0.1–2.2)
Homemaker	1.2 (0.4–3.4)	1.2 (0.5–2.8)
Other	1.0 (0.3–4.5)	0.8 (0.1–7.1)
Marital status		
Married	1.0	1.0
Other	1.1 (0.3–3.7)	1.2 (0.4–3.3)
Partner's years of education		
One year increase	1.0 (0.9–1.1)	1.0 (1.0–1.1)
Spouse's occupation		
Self-employed	—	1.0
Formal employment	—	0.7 (0.4–1.2)
None	—	0.7 (0.2–3.1)
Other	—	1.5 (0.7–3.5)
Site		
Lusaka	1.0	1.0
Blantyre	0.3 (0.1–1.2)	0.1 (0.04–0.4)
Lilongwe	2.4 (1.1–4.9)	0.6 (0.3–1.1)
Dar es Salaam	0.2 (0.02–1.2)	0.04 (0.01–0.2)
Housing		
Stay with relatives	1.0	1.0
Own house	2.1 (0.3–16.6)	0.6 (0.2–1.6)
Rent house	2.8 (0.4–21.0)	0.5 (0.2–1.4)
Rent room	1.8 (0.2–15.0)	1.2 (0.5–3.4)
Staff quarters	2.9 (0.3–33.0)	0.3 (0.03–2.7)
Other	—	—
Cook with		
Electric stove	2.6 (0.8–8.4)	0.6 (0.3–1.0)
Paraffin stove	4.6 (1.1–19.3)	0.8 (0.4–1.5)
Charcoal stove	0.8 (0.4–1.6)	1.2 (0.7–2.1)
Firewood	0.6 (0.3–1.2)	9.3 (2.9–30.0)
Sexual history		
Lifetime sex partners		
5+	1.0	1.0

	UOR (95% CI)	
Associated factor	**Gonorrhoea**	**Chlamydia**
4	0.9 (0.2–3.5)	1.6 (0.6–4.5)
3	1.2 (0.4–3.8)	1.0 (0.4–2.6)
2	0.8 (0.2–2.5)	0.7 (0.2–1.7)
1	0.7 (0.2–2.4)	0.6 (0.2–1.8)
Number of partners during this pregnancy		
2+	1.0	1.0
1	0.8 (0.1–5.9)	0.2 (0.1–0.5)
0	1.8 (0.1–29.5)	—
Condom use		
Always	—	—
Sometimes	—	—
Never	—	—
Received treatment for syphilis during the past year		
Yes	1.0	1.0
No	1.5 (0.5–5.1)	0.6 (0.2–2.7)
Received treatment for genital ulcers during the past year		
Yes	1.0	1.0
No	4.5 (1.9–11.1)	1.3 (0.4–4.3)
Received treatment for vaginal discharge during the past year		
Yes	1.0	1.0
No	2.1 (0.8–5.6)	1.1 (0.4–3.1)
Pelvic exam findings		
External genitalia		
Genital warts		
Yes	1.0	1.0
No	1.3 (0.4–3.6)	2.1 (1.0–4.3)
Genital ulcers		
Yes	1.0	1.0
No	4.1 (1.2–13.8)	2.8 (0.8–9.3)
Vagina		
Vaginal bleeding	—	2.5 (0.3–19.1)
Subepithelial haemorrhage	—	—
Oedema	—	
Condyloma – vagina	—	1.0 (0.1–7.4)
Vesicles	—	—
Bullae	—	
Abnormal vaginal discharge		1.2 (0.7–2.2)
Cervix		
Cervical discharge	2.1 (1.1–4.2)	—
Friability/epithelial disruption	1.5 (0.5–4.2)	—
Condyloma – cervix	2.7 (0.4–21.0)	—

	UOR (95% CI)	
Associated factor	**Gonorrhoea**	**Chlamydia**
Vesicles – cervix	0.6 (0.1–4.5)	—
Ulcerations		
Ectopy		
0	—	—
1–25%	—	—
26–50%	—	—
Bimanual exam		
Adnexal tenderness	1.7 (0.2–13.0)	—
Uterine tenderness	—	2.3 (0.3–17.8)
Adnexal masses	—	—
CD4 count (cells/μL)		
>500	1.0	1.0
200–500	1.0 (0.5–2.2)	1.4 (0.7–2.7)
<200	0.7 (0.2–.1.9)	1.1 (0.5–2.7)

UOR = unadjusted odds ratio; CI = confidence interval

Table 5

Multivariate analyses of factors associated with Trichomoniasis, vaginal candidiasis and bacterial vaginosis in the study population (n = 2292)

	AOR (95% CI)		
Associated factor	**Trichomoniasis**	**Vaginal candidiasis**	**BV**
Sociodemographic			
Maternal age at enrolment (per five year increase)	0.8 (0.8–1.0)	—	0.9 (0.8–1.0)
Years of education (per one year increase)	1.0 (0.9–1.0)	1.0 (0.9–1.0)	1.0 (1.0–1.0)
Partner's years of education			
One year increase	0.9 (0.9–1.0)	1.0 (1.0–1.1)	—
Spouse's occupation			
Self–employed	1.0	1.0	1.0
Formal employment	1.2 (0.9–1.6)	1.0 (0.7–1.2)	1.2 (1.0–1.5)
None	0.9 (0.5–1.7)	1.0 (0.5–1.8)	1.8 (1.1–3.0)
Other	1.2 (0.5–3.0)	0.7 (0.3–1.5)	0.9 (0.4–1.7)
Site			
Lusaka	1.0	1.0	1.0
Blantyre	1.0 (0.6–1.6)	1.5 (1.0–2.1)	1.6 (1.2–2.3)
Lilongwe	1.0 (0.6–1.6)	0.9 (0.7–1.2)	1.4 (0.9–2.0)
Dar es Salaam	0.2 (0.1–0.3)	1.3 (0.9–2.0)	1.8 (1.1–2.9)
Sexual history			
Lifetime sex partners			
1	1.0	1.0	—
2	1.1 (0.8–1.6)	0.9 (0.6–1.2)	—
3	1.0 (0.7–1.4)	0.6 (0.4–0.9)	—
4	0.8 (0.5–1.3)	0.6 (0.4–1.0)	—
5+	1.6 (1.0–2.6)	0.6 (0.4–1.0)	—
Received treatment for genital ulcers during the past year			
No	1.0	1.0	—
Yes	0.3 (0.1–07)	1.3 (0.7–2.3)	—
Pelvic exam findings			
Genital warts			
No	1.0	1.0	1.0
Yes	1.8 (1.2–2.7)	0.8 (0.5–1.3)	1.2 (0.9–1.8)
Genital ulcers			
No	1.0	—	1.0
Yes	2.4 (1.2–5.1)	—	1.4 (0.7–3.0)
Abnormal vaginal discharge			
No	1.0	1.0	1.0
Yes	2.5 (1.9–3.3)	1.7 (1.3–2.3)	0.9 (0.7–1.1)
CD4 count (cells/μL)			
>500	1.0	1.0	1.0

	AOR (95% CI)		
Associated factor	**Trichomoniasis**	**Vaginal candidiasis**	**BV**
200–500	0.9 (0.7–1.2)	1.6 (1.2–2.1)	1.0 (0.8–1.2)
<200	0.7 (0.5–1.0)	1.6 (1.1–2.2)	1.3 (1.0–1.8)

AOR = adjusted odds ratio; CI = confidence interval; BV = bacterial vaginosis

Table 6

Multivariate analyses of factors associated with gonorrhoea and Chlamydia in the study population (n = 2292)

	AOR (95% CI)	
Associated factor	**Gonorrhoea**	**Chlamydia**
Sociodemographic		
Mothers age at enrolment		
Five year increase in age	0.9 (0.8–1.0)	1.0 (0.9–1.0)
Years of education		
One year increase	1.0 (0.9–1.1)	1.0 (0.9–1.1)
Partner's years of education		
One year increase	1.0 (0.9–1.2)	1.0 (0.9–1.1)
Spouse's occupation		
Self–employed	—	
Formal employment	—	0.9 (0.5–1.6
None	—	1.1 (0.2–5.0)
Other	—	0.5 (0.1–4.0)
Site		
Lusaka	1.0	1.0
Blantyre	0.5 (0.1–4.2)	0.1 (0–5.0)
Lilongwe	7.5 (2.4–23.7)	0 (0–0.2)
Dar es Salaam	0.7 (0–9.6)	0.2 (0–1.9)
Sexual history		
Lifetime sex partners		
1	1.0	1.0
2	1.2 (0.4–3.7)	0.8 (0.3–2.1)
3	2.8 (1.0–8.1)	1.2 (0.5–2.8)
4	1.9 (0.4–8.5)	1.3 (0.5–3.5)
5+	2.6 (0.7–10.4)	0.4 (0.1–1.5)
Received treatment for genital ulcers during the past year		
No	1.0	1.0
Yes	3.7 (1.2–11.8)	1.3 (0.3–5.2)
Pelvic exam findings		
Genital warts		
No	1.0	1.0
Yes	0.8 (0.2–3.0)	1.7 (0.7–4.1)
Genital ulcers		
No	—	—
Yes	—	—
Abnormal vaginal discharge		
No	—	—
Yes	—	—
CD4 count (cells/μL)		

	AOR (95% CI)	
Associated factor	**Gonorrhoea**	**Chlamydia**
>500	1.0	1.0
200–500	0.9 (0.4–2.1)	1.4 (0.6–2.9)
<200	0.7 (0.2–2.3)	1.3 (0.5–3.5)

AOR = adjusted odds ratio; CI = confidence interval; BV = bacterial vaginosis