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Prevalence and Correlates of Genital Infections Among Newly Diagnosed Human Immunodeficiency Virus–Infected Adults Entering Human Immunodeficiency Virus Care in Windhoek, Namibia

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Abstract

Background—Identifying and treating genital infections, including sexually transmitted infections (STI), among newly diagnosed human immunodeficiency virus (HIV)-infected individuals may benefit both public and individual health. We assessed prevalence of genital infections and their correlates among newly diagnosed HIV-infected individuals enrolling in HIV care services in Namibia.

Methods—Newly diagnosed HIV-infected adults entering HIV care at 2 health facilities in Windhoek, Namibia, were recruited from December 2012 to March 2014. Participants provided behavioral and clinical data including CD4+ T lymphocyte counts. Genital and blood specimens were tested for gonorrhea, *Chlamydia*, trichomoniasis, *Mycoplasma genitalium*, syphilis, bacterial vaginosis, and vulvovaginal candidiasis.

Results—Among 599 adults, 56% were women and 15% reported consistent use of condoms in the past 6 months. The most common infections were bacterial vaginosis (37.2%), trichomoniasis (34.6%) and *Chlamydia* (14.6%) in women and *M. genitalium* (11.4%) in men. Correlates for trichomoniasis included being female (adjusted relative risk, [aRR], 7.18; 95% confidence interval [CI], 4.07–12.65), higher education (aRR, 0.58; 95% CI, 0.38–0.89), and lower CD4 cell count (aRR, 1.61; 95% CI, 1.08–2.40). Being female (aRR, 2.39; 95% CI, 1.27–4.50), nonmarried (aRR, 2.30; (95% CI, 1.28–4.14), and having condomless sex (aRR, 2.72; 95% CI, 1.06–7.00) were

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independently associated with chlamydial infection. Across all infections, female (aRR, 2.31; 95% CI, 1.79–2.98), nonmarried participants (aRR, 1.29; 95% CI, 1.06–1.59), had higher risk to present with any STI, whereas pregnant women (aRR, 1.16, 95% CI 1.03–1.31) were at increased risk of any STI or reproductive tract infection.

Sexually transmitted infections (STIs) are well-established risk factors for acquisition and transmission of human immunodeficiency virus (HIV) infection.[1,2] Bacterial and viral STIs are known to enhance the probability of HIV acquisition and transmission, through local genital tract inflammation that increases HIV shedding.[3] Identifying and treating STIs in HIV-infected patients may therefore be an important prevention strategy. However, this approach is subject to considerable debate because the majority of randomized trials targeting STIs at the community level or among individuals at risk for HIV-1 infection have largely failed to demonstrate HIV prevention benefits from STI treatment.[4]

Although unresolved questions remain about the importance of STI treatment for HIV prevention, the World Health Organization (WHO) recommends that STI screening and treatment continue to be an integral part of comprehensive HIV strategies to improve the health of HIV-infected persons, their partners and families, and reduce the spread of HIV.[5] Treatment of curable STIs is also an essential part of primary health care and should be promoted in communities where the burden of STIs is substantial.[4]

The WHO recommends that health care workers ask newly diagnosed persons with HIV infection about STI symptoms and conduct laboratory screening for syphilis. When practical, women should also receive testing for gonorrhea and *Chlamydia*. Persons diagnosed with an STI should be treated, and treatment offered to their sexual partners. Etiologic approaches should be considered for persons who exhibit persistent or recurrent symptoms after initial treatment.[5] However, it is unclear how often these directives are implemented in HIV care programs, especially in resource-limited settings.

Namibia, an upper middle income country with approximately 2.2 million people, has one of the largest income disparities in the world, with more than 38% living in poverty.[6] With an estimated adult HIV prevalence of 14%[7] in 2013, Namibia has one of the most severe HIV epidemics in Africa. In 2013, a Demographic Health Survey indicated 10% of women and 6% of men reported having an STI in the past 12 months[7]; however, data on rates of genital infections among HIV-infected individuals attending HIV care and treatment clinics are not available.

To inform Namibia's HIV care and treatment program about the potential use of routine STI screening and treatment among HIV-infected persons, we conducted an STI etiologic survey in 2 HIV clinics in Windhoek, Namibia, to assess the burden of genital infections among newly diagnosed HIV-infected adults entering HIV care. Our main objectives were to estimate STI prevalence, quantify recent sexual risk behaviors, and identify corresponding risk factors in HIV-STI coinfected persons.

METHODS

Study Design, Eligibility and Study Procedures

From December 2012 to March 2014, HIV-infected adults attending HIV testing and counseling clinics at 2 health facilities in Windhoek were offered enrollment in a genital infection study. The clinics were located in Katutura and Okuryangava, historically disadvantaged urban and periurban townships on the outskirts of Windhoek. Consecutive patients were approached after receiving an HIV diagnosis and screened for inclusion in the study. Enrollment eligibility criteria included: HIV-positive status, not yet enrolled in HIV care or treatment, 18 years or older, and ability to provide informed consent to participate in the study. Women were excluded from enrollment if they were more than 36 weeks pregnant or less than 8 weeks postpartum.

At enrollment, participants were administered a structured questionnaire and underwent a physical examination to assess for genital infections. Genital infections were classified as STIs or as endogenous infections, not sexually transmitted, labeled as other reproductive tract infections (RTIs). Blood and genital specimens were collected for laboratory testing of genital infections and CD4 T-lymphocyte counts assessment. Patients reporting symptoms and/or with signs of genital infections at examination were treated by the study nurse according to Namibian Ministry of Health and Social Services (MOHSS) STI syndromic treatment guidelines.

Asymptomatic participants with positive laboratory tests were contacted and asked to return to the clinic to receive appropriate antimicrobial treatment. All participants treated for genital infections were given a referral card for their sexual partner(s) to seek STI care and HIV testing and counseling.

Specimens and Laboratory Testing

Testing for *Chlamydia trachomatis, Neisseria gonorrhoeae, Trichomonas vaginalis, Mycoplasma genitalium*, and *Treponema pallidum*, was performed on all participants. Men provided first-catch urine specimens. Vaginal swabs were collected for molecular biology analysis and preparation of vaginal smears, and a urine sample for pregnancy testing. All participants had 5 mL of blood drawn on dry tube and 5 mL on ethylenediaminetetraacetic acid tube for syphilis serology and CD4 T-lymphocyte counts, respectively.

First-catch urine and vaginal swabs specimens were tested for *C. trachomatis, N. gonorrhoeae, T. vaginalis*, and *M. genitalium* by real-time multiplex polymerase chain reaction (M-PCR) assay and the Rotor-Gene 6000 instrument (Qiagen Inc., Valencia, Calif).[8] Genital ulcer swabs were collected from participants presenting with genital ulcers and M-PCR was used to detect herpes simplex virus type 1 (HSV-1), HSV type 2 (HSV-2), *T. pallidum*, and *C. trachomatis*. The rapid plasma reagin assay was used to screen for syphilis and confirmation was performed using *T. pallidum* hemagglutination assays. Asymptomatic participants with positive rapid plasma reagin and *T. pallidum* hemagglutination assay results were categorized as having syphilis. Vaginal smears were prepared and evaluated for bacterial vaginosis (BV) and vulvovaginal candidiasis (VVC). Gram-stained vaginal smear slides were examined for BV using Nugent scoring system.[9]

Scores of 0 to 3 represented normal vaginal flora, 4 to 6 represented abnormal flora, and 7 to 10 were classified as BV. Vulvovaginal candidiasis was defined as the presence of budding yeast or pseudohyphae on Gram-stained vaginal smear along with self-reported genital itching and/or vaginal discharge on examination. Bacterial vaginosis and VVC were classified as RTIs not sexually transmitted and referred to as RTIs. CD4 counts were assessed using point-of-care CD4 analyzer (Alere PIMA CD4, Waltham, Mass). Human immunodeficiency virus testing was performed by government-supported clinics that follow the national HIV testing guidelines in Namibia.

Statistical Analysis

Data were captured on article forms by trained study nurses and a research assistant, and later double-entered into EpiInfo 7. Sexually transmitted infection prevalence was calculated for men and women, and prevalence differences between men and women and their 95% confidence intervals were computed. Associations between STI infection and sexual risk factors were calculated using Poisson regression.[10] Robust Huber-White sandwich variance estimators were used to mitigate any clinic-specific cluster effect on variances. The following characteristics were evaluated as potential risk factors for genital infections: sex, age, marital status, education, employment status, sex partners during previous 6 months (≤1 vs ≥2), number of sexual encounters with current partner during the previous 6 months, residence with last sex partner, having had sex during the past week, condom use during last sexual encounter, condom frequency with last partner, history of STIs, and CD4 count category. A separate analysis of risk factors was conducted among women to identify any possible associations between genital infections and pregnancy status. Potential correlates with P values ≤ 0.25 in bivariate associations were included in full multivariate models for each genital infection. Factors that were not at least marginally significant ($P \leq 0.10$) were sequentially deleted to obtain final models. Statistical analyses were performed using STATAv.13.0 (StataCorp, College Station, Tex).

Ethical Considerations

The study was approved by the institutional review board of both the Namibian MOHSS and the US Centers for Disease Control and Prevention.

RESULTS

Study Population

Overall, 559 newly diagnosed HIV-infected participants were enrolled in the study. Of these, 56% were women; the median age was 30 years (interquartile range, 25–35 years) among women and 35 years (interquartile range, 32–43 years) among men (Table 1). The distribution of education differed significantly by sex: males typically had lower levels of education. Men were more likely than women to be employed and married. Ninety-four participants (15.6%) reported using condoms consistently over the past 6 months; patterns of condom use differed significantly by sex (Table 1). Among those who reported only 1 partner in the past 6 months, women (63%) were more likely to have had condomless sex than men (37%). The reverse was observed among those reporting 2 or more partners. At the

time of enrollment, 27% of women were pregnant. Women had significantly higher median CD4 counts compared with men.

Prevalence of STIs

Overall, 62.7%of women reported at least 1 symptom with vaginal discharge as the most common. Approximately 9.5% of women and 9.8% of men reported symptoms consistent with genital ulcers and only 1.5% of men reported symptoms of urethral discharge.

Among 335 women, 34.6%, 14.6%, 12.8%, and 4.5% had a diagnosis of trichomoniasis, *Chlamydia, M. genitalium* and gonorrhea, respectively (Table 2). For RTIs, the prevalence of BV and VVC was 37.2% and 18.2%, respectively (Table 2). About 32.5% of women had 2 or more concurrent genital infections, including BV and VVC; 80% presented with at least 1 RTI or STI. The 264 male participants in this study had distinctly lower prevalence of *Chlamydia* and trichomoniasis compared with women. Only 2.4%, 5.2%, and 11.4% had gonorrhea, *Chlamydia* and *M. genitalium*, respectively; 3.8% of men had multiple infections. The prevalence of syphilis was 4 times higher in men than in women (2.4% vs 0.6%). Among participants presenting with genital ulcers, the prevalence of HSV-2 was 33.3% and 47.8% among women and men, respectively. Two participants, who had a serologic diagnosis of syphilis, also had a diagnosis of *Treponema pallidum* in genital ulcers. No other ulcer-causing pathogen was identified. Prevalence of STIs or RTIs generally did differ with respect to pregnancy status among women. Pregnant women had a higher prevalence of STI/RTI especially for chlamydia (18.6 %vs 10.7%) and VVC (25%vs 14.9%) than nonpregnant women.

Correlates of STIs

We found significant behavioral and demographic correlates with laboratory-confirmed trichomoniasis, chlamydial infection, VVC, and any genital infection (Table 3). The risk of trichomoniasis was 7.18 times greater among females (95% confidence interval [CI], 4.07–12.65) compared to males, and the risk was 1.61 time greater among those with CD4 < 200 cells/μL than among those with CD4 > 500 cells/μL. Female participants (adjusted relative risk [aRR], 2.39; 95% CI 1.27–4.50), nonmarried participants (aRR, 2.30; 95% CI, 1.28–4.14) and those who reported never using condoms (aRR, 2.72; 95% CI, 1.06–7.00) were more likely to present with *Chlamydia*. Single women (aRR, 1.63; 95% CI, 1.01–2.66), women with CD4 count ≤ 200 cells/μL (aRR, 2.05; 95% CI, 1.07–3.93), and women with vaginal discharge (aRR, 1.86; 95% CI, 1.06–3.27) had an elevated risk of VVC. Across all STIs excluding HSV-2, after adjusting for sex, nonmarried participants were 1.29 (95% CI, 1.06–1.59) times more likely to have multiple infections than participants who were married or cohabiting. After adjusting for sex, the risk of infection with any RTI or STI was 1.22 (95% CI, 1.07–1.41) times greater for nonmarried participants versus those who were married or cohabiting. Pregnant women had an elevated risk of presenting with chlamydia (aRR, 1.90; 95% CI, 1.07–3.39), VVC (aRR, 1.93; 95% CI 1.15–3.23), and any RTI or STI (aRR, 1.16; 95% CI, 1.3–1.31), excluding HSV-2.

DISCUSSION

This is the first report of etiological data among adults newly diagnosed with HIV infection at health facilities in 2 large townships in Windhoek, Namibia. Overall, the prevalence of vaginal infections was high, especially in pregnant women. Approximately 37.2%, 34.6%, and 18.2% of women had laboratory confirmed BV, trichomoniasis, and VVC, respectively. The prevalence of other STIs, such as *Chlamydia, M. genitalium*, and gonorrhea, was lower.

These results are consistent with other sub-Saharan African studies where similar rates of genital infections were reported among HIV-infected pregnant and nonpregnant women.[11–15] The risk of individual infection showed in a multivariate model that pregnancy was associated with higher risk of chlamydia, VVC, and any STI or RTI.

The highest prevalence of coinfections HIV/STI occurs among individuals newly diagnosed with HIV.[16] Similarly, studies of persons who tested HIV positive at the time of STI testing found a mean point prevalence of 16.3%,[17] reflecting the importance STIs may play as reliable markers for HIV transmission.

Although the existence of higher STI prevalence among HIV-infected individuals is well established,[17] our findings are contextually important for the Namibian MOHSS. Our results will help the MOHSS not only to plan and procure drugs and other commodities for HIV and STI/RTIs but also to develop public health messaging and communication strategies about STI, safer sex practices, and positive prevention.

Similar to other studies of HIV-infected women,[16,18,19] trichomoniasis had the highest prevalence in our study. Trichomoniasis, the second most common STI in the world,[20] is also known to be more prevalent in HIV-positive women[21] and is associated with significant morbidity, including pelvic inflammatory disease, cervical dysplasia, and adverse reproductive health outcomes.[22] Although women were disproportionately affected by trichomoniasis in this study, any public health approach to control trichomoniasis among women should also address the role of men in transmission, because up to 77% of trichomoniasis is asymptomatic in men[23] and those may represent critical sources of infection and reinfection in women.

Bacterial infections such as gonorrhea, *Chlamydia* and *M. genitalium* accounted for a group of genital infections with the second highest prevalence in this study. Rates of gonorrhea and *Chlamydia* were significantly higher in women compared with men. Furthermore, the prevalence of *Chlamydia* was significantly higher in pregnant women compared with nonpregnant women. Pregnant women tended to be younger, which may have severe implications for reproductive health outcomes, such as infertility, chronic pelvic or rectal pain, increased risk of ectopic pregnancy, and spontaneous abortion.[20] Approximately 62% of women reported vaginal discharge, whereas 80% of women had laboratory confirmation of any STI or RTI, excluding HSV-2. This indicates a relatively high frequency of asymptomatic infections. Those asymptomatic infections may severely impact the effectiveness of syndromic case management, thus significantly impeding disease control. In this study, condomless sex was independently associated with chlamydial infection among

men and women, indicating that a behavioral intervention may also be needed for effective *Chlamydia* control efforts.

M. genitalium was the most prevalent genital infection among men, with a similar rate of infection identified among women. *M. genitalium* remains an important cause of urethritis in men and a likely cause of cervicitis and endometritis in women[24,25] and is associated with genital HIV shedding,[26] thus potentially intensifying the risk of HIV transmission. Men were more likely to have multiple sex partners yet had lower STI rates compared with women. Because sexual behavior was self-reported, it is possible that women were not truthful about the number of partners because of social desirability. Men had significantly lower CD4 counts at entry into HIV care. A study reporting on the distribution of CD4 counts and viral load among antiretroviral naive, first time testers in South Africa concluded that HIV-infected men at their first HIV diagnosis were more likely to have lower CD4 counts and higher viral loads. This may be due to the fact that women may have earlier opportunity to engage with HIV testing through antenatal care or prevention of mother to child transmission.

Age was intrinsically confounded with sex in the data, with little overlap between age ranges for men and women. However, univariate and multivariable analyses provided no evidence of associations between age and any of the STIs, including chlamydial infection or trichomoniasis, which are classically associated with younger age.[13,27] Regardless, age cannot be eliminated as a risk factor in this population because age is confounded with sex, and the age ranges were narrow and excluded adolescents and young adults (Table 1).

The HSV-2 infection was measured only in the small sample of participants who presented with genital ulcers. This likely is an underestimation of prevalent herpes infection as we did not test for HSV-2 antibodies because of limited funding. Genital ulcers may not be noted in routine enrollment into HIV care without examination or questions regarding genital wounds. We wanted to explore how feasible WHO recommendation of episodic acyclovir treatment to accelerate healing and decrease HIV shedding in ulcers[5] would be in the field. To date, no completely effective interventions are available for HSV-2 to complement primary prevention, such as condoms and fewer sex partners.

Our assessment was conducted in 2 clinics located in 2 townships in the northern outskirts of the capital city which includes large communities living in informal settlements. Residents of these townships come from all over Namibia and are often transient.[6] However, our results are not generalizable to the entire population of persons newly diagnosed with HIV in Namibia.

In summary, women entering HIV care in these 2 HIV clinics in Namibia are substantially affected by prevalent genital infections. Given the relatively high prevalence of curable genital infections in our study, promotion and implementation of STI screening and treatment along with partner management strategies may be beneficial at entry into HIV care in Namibia.

One pivotal goal of our study was to build capacity in improving screening of genital infections at the national level. Although the startup cost of molecular diagnosis for genital

infections is initially higher, it is offset by its efficiency. Diagnosis timeliness and accuracy are enhanced, with the ability of processing multiple specimens and diagnosing multiple pathogens using a single specimen. Capacity building before, during, and after the study materialized through training of laboratory technicians in PCR techniques and good laboratory practice for ownership, laboratory equipment donation (M-PCR platform), procurement of reagents and implementation of quality control systems and standard operating procedures for sustainability.

Because of the relatively high prevalence of vaginal infections, such as BV and VVC, it is critical to emphasize approaches to increase women's awareness of urogenital symptoms with health care provider's proactive inquiry of genital symptoms and appropriate treatment.[28]

We unexpectedly found a pregnancy rate of 27% among newly HIV diagnosed women in these HIV counseling and testing clinics. This reinforces continuing vigilance for referral to reproductive health services from point of diagnosis, for safer pregnancy counseling and for referral to antenatal care and HIV prevention of mother-to-child transmission. The Namibian MOHSS has been strengthening integration and linkage to those services.

Based on the rates of trichomoniasis found in this study, implementation of primary and secondary prevention that include at least annual laboratory-based screening for trichomoniasis and other vaginal infections and prompt treatment[19,29] may be warranted to reduce morbidity, improve quality of life, and decrease HIV genital shedding associated with the risk of HIV transmission. These strategies should be coupled with aggressive partner notification and management. A substantial number of infections with *T. vaginalis* may be asymptomatic, and repeat infections appear to be remarkably high among both HIV-positive and HIV-negative women in other settings.[30] This underscores the critical need for the development and routine use of affordable point-of-care STI diagnostics for resource-constrained settings where laboratory capacity is often lacking.

It is also desirable that active and frequent *Chlamydia* screening and treatment with partner management strategies be performed in this population. These strategies are crucial to reduce repeat infections and adverse outcomes, decrease genital shedding, and suppress inflammation associated with the risk of HIV transmission. Because condomless sex was associated with chlamydial infection in our study, it is vital to target this population for intensive risk reduction and promotion and provision of commodities such as male and female condoms for safer sex practices. Lastly, this etiologic assessment among adults recently diagnosed with HIV infection provides evidence that STI screening and treatment would be beneficial if promoted and systematically implemented at entry in HIV care services in Namibia.

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TABLE 1

Sociodemographic, Sexual Behavior and Clinical Characteristics of Newly Diagnosed HIV-infected Adults Entering HIV Care in Windhoek, Namibia

Variable	Males	Females	Total	*P**
Total, n (%)	264 (44%)	335 (56%)	599	
Age, median (IQR)	35 (32–43)	30 (25–35)		<0.01
Nonpregnant		31 (26–36)	228	
Pregnant		27 (24–32)	89	<0.01†
Education Level, n (% row)				<0.01
No education	24 (80%)	6 (20%)	30	
Col %	(9%)	(2%)		
Primary level	93 (55%)	77 (45%)	170	
Col %	(36%)	(23%)		
Secondary level	121 (36%)	218 (64%)	339	
Col %	(44%)	(66%)		
Postsecondary	3 (16%)	16 (84%)	19	
Col %	(3%)	(4%)		
Unknown	23 (56%)	18 (44%)	41	
Col %	(8%)	(4%)		
Employment status,‡ n (%)				<0.01
Employed	228 (55%)	188 (45%)	416	
Marital status,§ n (% row)				<0.01
Married	32 (62%)	20 (38%)	52	
Col %	(17%)	(7%)		
Cohabiting	106 (49%)	112 (51%)	218	
Col %	(41%)	(31%)		
Single/divorced/widowed	122 (38%)	203 (62%)	325	
Col %	(41%)	(62%)		
Reported number of sex partners with no condom usage in the past 6 mo,¶ n (%)				<0.01
0	39 (41%)	55 (59%)	94	
Col %	(15%)	(16%)		
1	138 (37%)	232 (63%)	370	
Col %	(52%)	(69%)		
2–5	48 (74%)	17 (26%)	65	
Col %	(18%)	(5%)		
> 5	3 (75%)	1 (25%)	4	
Col %	(1%)	(<1%)		
Unknown	36 (55%)	30 (45%)	66	
Col %	(14%)	(%9)		
Pregnancy				
No	—	228 (68%)		

Variable	Males	Females	Total	*P*[*]
Yes	—	89 (27%)		
No test result		18 (5%)		
CD4 count, median (IQR)	248 (150–359)	318 (208–457)		<0.01

[*] Based upon the Pearson χ^2 statistic except as noted.

[†] Based upon the 2-sample Wilcoxon rank-sum test.

[‡] Excludes 2 men and 2 women who did not report status.

[§] Excludes 4 men who did not report status.

[¶] Excludes 36 men and 30 women who did not report status.

TABLE 2

Prevalence of Syndromic Diagnoses and Laboratory-Confirmed Genital/Sexually Transmitted Infections at Enrollment Among Newly Diagnosed HIV-infected Adults Attending HIV Care Clinics in Windhoek, Namibia

	Females			Males				
Syndrome/Infection	**N***	**p†**	**(95% CI)**	**N***	**p†**	**(95% C)**	**Difference**	**(95% CI)**
Syndromic diagnoses								
Genital ulcer	335	9.5	(6.6–13.2)	264	9.8	(6.5–14.1)	0.3	(−4.5 to 5.1)
Nonpregnant	228	9.2	(5.4–13.0)					
Pregnant	89	12.3	(5.4–19.3)					
Urethral discharge		264	1.5	(0.4–3.8)				
Vaginal discharge	335	62.7	(57.4–67.9)					
Nonpregnant	228	58.3	(51.9–64.8)					
Pregnant	89	77.5	(68.7–86.4)					
Laboratory-confirmed infections								
STI								
Treponema pallidum	312	0.6	(0.2–1.5)	251	2.4	(0.4–4.3)	−1.7	(−3.8 to 0.3)
Nonpregnant	215	0.4	(0–1.4)					
Pregnant	82	1.2	(0–3.6)					
Chlamydia trachomatis	308	14.6	(10.9–19.0)	250	5.2	(2.8–8.7)	9.4	(4.6–14.2)
Nonpregnant	205	10.7	(6.4–15.0)					
Pregnant	70	18.6	(9.2–27.9)					
Neisseria gonorrhoeae	309	4.5	(2.5–7.5)	252	2.4	(0.9–5.1)	2.1	(−0.8 to 5.1)
Nonpregnant	216	4.1	(1.5–6.8)					
Pregnant	78	6.4	(0.8–12.0)					
Trichomonas vaginalis	312	34.6	(29.3–40.2)	250	4.8	(2.5–8.2)	29.8	(23.9–35.7)
Nonpregnant	219	36.5	(30.1–43.0)					
Pregnant	78	28.2	(18.0–38.4)					
Mycoplasma genitalium	305	12.8	(9.2–17.1)	246	11.4	(7.7–16.0)	1.4	(−4.0 to 6.8)
Nonpregnant	213	12.2	(7.8–16.6)					
Pregnant	77	14.3	(6.3–22.3)					
Any one or more of above	308	56.3	(50.5–62.0)	237	23.2	(18.0–29.1)	33.1	(25.3–40.8)

	Females			Males				
Syndrome/Infection	**N***	**P†**	**(95% CI)**	**N***	**P†**	**(95% C)**	**Difference**	**(95% CI)**
Nonpregnant	212	54.2	(47.5–61.0)					
Pregnant	76	62.5	(49.3–71.8)					
Herpes simplex type 2‡	30	33.3	(17.3–52.8)	23	47.8	(26.8–69.4)	−14.5	(−41.0 to 12.0)
Nonpregnant	23	39.1	(17.5–60.7)					
Pregnant	7	14.3	(0–49.2)					
RTI								
Bacterial vaginosis	325	37.2	(31.9–42.7)					
Nonpregnant	224	35.3	(29.0–41.6)					
Pregnant	87	41.4	(30.8–51.9)					
Vulvovaginal candidiasis	313	18.2	(14.1–22.9)					
Nonpregnant	214	14.9	(10.1–19.8)					
Pregnant	84	25.0	(15.5–34.4)					
Either female RTI	313	53.3	(47.7–59.0)					
Nonpregnant	214	48.6	(41.8–55.3)					
Pregnant	85	63.5	(53.1–74.0)					
Any STI or RTI	308	80.0	(74.9–84.2)	237	23.2	(18.0–29.1)	56.7	(49.7–63.7)
Nonpregnant	213	77.0	(71.3–82.7)					
Pregnant	81	86.4	(78.8–94.0)					
Multiple STI/RTI§	335	32.5	(27.5–37.8)	264	3.8	(1.8–6.8)	28.7	(23.2–34.3)
Nonpregnant	227	29.1	(23.1–35.1)					
Pregnant	88	38.6	(28.3–49.0)					

Pregnancy status was not determined/disclosed for all women.

*Number tested.

†Prevalence (%).

‡Among the subset of patients who presented with a genital ulcer. This does not represents the prevalence of HSV-2 among the general clientele of male and female participants.

§Defined as 2 or more concurrent STIs or RTIs, excluding HSV-2.

TABLE 3

Sociodemographic, Behavioral, and HIV/Medical Correlates of Laboratory Confirmed *Trichomonas, Chlamydia, Candidiasis*, and any Genital Infection Among Newly Diagnosed HIV Infected Adults Entering Care in Windhoek, Namibia*, as Measured by RR

				Unadjusted			Adjusted		
Characteristics	**Tests**	**Cases**	**(%)**	**RR**	**(95% CI)**	***P***	**RR**	**(95% CI)**	***P***
Trichomonas vaginalis									
Sex									
Male†	312	108	34.6	—	—	—	—	—	—
Female	251	12	4.8	7.21	(4.06–12.79	<0.01	7.18	(4.07–12.65)	<0.01
Education									
>Primary†	375	98	26.1	—	—	—	—	—	—
≤Primary	188	22	11.7	0.45	(0.29–0.69)	<0.01	0.58	(0.38–0.89)	0.01
CD4 count									
>500†	173	45	26.0	—	—	—	—	—	—
350–499	176	29	16.5	0.84	(0.49–1.42)	0.72	0.86	(0.52–1.42)	0.55
200–349	109	22	20.2	0.68	(0.41–1.12)	0.13	0.78	(0.49–1.25)	0.31
<200	87	21	24.1	1.08	(0.69–1.70)	0.72	1.61	(1.08–2.40)	0.02
Chlamydia trachomatis									
Sex									
Male†	312	108	34.6	—	—	—	—	—	—
Female	251	12	4.8	2.81	(1.55–5.09)	<0.01	2.39	(1.27–4.50)	0.01
Marital status									
Married/cohabiting†	305	78	25.6	—	—	—	—	—	—
Single	255	42	16.5	2.20	(1.26–3.82)	<0.01	2.30	(1.28–4.14)	<0.01
Condom use									
Always†	83	14	16.9	—	—	—	—	—	—
Sometimes	239	56	23.4	1.79	(0.71–4.52)	0.22	1.91	(0.76–4.82)	0.17
Never	182	37	20.3	2.09	(0.82–5.32)	0.12	2.72	(1.06–7.00)	0.04
Chlamydia among females									
Pregnancy status									

				Unadjusted			Adjusted		
Characteristics	**Tests**	**Cases**	**(%)**	**RR**	**(95% CI)**	***P***	**RR**	**(95% CI)**	***P***
Nonpregnant †	217	24	11.1	—	—	—	—	—	—
Pregnant	76	16	21.0	1.90	(1.07–3.39)	0.03	1.90	(1.07–3.39)	0.03
Refused/unknown	15	5	33.3	3.01	(1.34–6.78)	<0.01	3.01	(1.34–6.78)	<0.01
Vulvovaginal candidiasis (females)									
Pregnancy status									
Nonpregnant †	2214	32	14.9	—	—	—	—	—	—
Pregnant	84	21	25.0	1.67	(1.02–2.73)	0.04	1.93	(1.15–3.23)	0.01
Refused/unknown	15	4	26.7	1.78	(0.72–4.38)	0.21	2.01	(0.84–4.79)	0.11
Marital status									
Married/cohabiting †	169	36	21.3	—	—	—	—	—	—
Single	118	16	13.6	1.35	(0.81–2.24)	0.25	1.63	(1.01–2.66)	0.04
CD4 count									
>500 †	60	10	16.7	—	—	—	—	—	—
350–499	70	6	8.6	0.51	(0.20–1.33)	0.17	0.51	(0.20–1.29)	0.16
200–349	99	17	17.2	1.03	(0.50–2.10)	0.93	0.95	(0.47–1.92)	0.89
<200	75	23	30.7	1.84	(0.95–3.56)	0.07	2.05	(1.07–3.93)	0.03
Vaginal discharge									
Negative †	115	14	12.2	—	—	—	—	—	—
Positive	198	43	21.7	1.78	(1.02–3.12)	0.04	1.86	(1.06–3.27)	0.03
Any STI (excluding HSV-2)									
Sex									
Male †	237	55	23.2	—	—	—	—	—	—
Female	302	170	56.3	2.43	(1.88–3.12)	<0.01	2.31	(1.79–2.98)	<0.01
Marital status									
Married/cohabiting †	247	83	33.6	—	—	—	—	—	—
Single	290	142	49.0	1.46	(1.18–1.80)	<0.01	1.29	(1.06–1.59)	0.01
Any RTI or STI (excluding HSV-2)									
Sex									

				Unadjusted			Adjusted		
Characteristics	**Tests**	**Cases**	**(%)**	**RR**	**(95% CI)**	***P***	**RR**	**(95% CI)**	***P***
Male †	237	55	23.2	—	—	—	—	—	—
Female	308	246	80.0	3.44	(2.71–4.36)	<0.01	3.29	(2.59–4.18)	<0.01
Marital status									
Married/cohabiting †	243	107	44.6	—	—	—	—	—	—
Single	300	194	64.7	1.47	(1.24–1.73)	<0.01	1.22	(1.07–1.41)	<0.01
Any RTI or STI (excluding HSV-2) among females									
Pregnancy status									
Nonpregnant †	213	164	77.0	—	—	—	—	—	—
Pregnant	81	70	86.4	1.22	(1.00–1.26)	0.05	1.16	(1.03–1.31)	0.02
Refused/unknown	15	12	80.0	1.03	(0.80–1.35)	0.78	1.17	(0.92–1.48)	0.20
Living with last partner									
Yes †	114	83	72.8	—	—	—	—	—	—
No	169	140	82.8	1.14	(1.00–1.30)	0.05	1.16	(0.01–1.32)	0.03

Separate analyses of risks among females are shown for those infections which showed a significant association with pregnancy status

*Correlates of STIs and RTIs which were not significant are not shown. Similarly, STIs and RTIs for which there were no significant correlates are not shown.

†Reference category.

RR, risk ratios.