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Sexual Behavior and Vaginal Practices during Pregnancy and Postpartum: Implications for HIV Prevention Strategies

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Abstract

Background—Understanding sexual behaviors and vaginal practices of pregnant and breastfeeding women in sub-Saharan Africa is critical to inform HIV prevention strategies during these periods.

Methods—HIV-uninfected women presenting for antenatal care in western Kenya were enrolled and followed through 36 weeks postpartum. Sexual behavior and vaginal practices were ascertained by structured questionnaires. Logistic regression was used to assess correlates of unprotected sex, vaginal washing, and vaginal drying.

Results—Among 1252 women enrolled, 78.4% were married (of whom 15.1% were in polygamous unions), 1.4% had a known HIV-infected partner and 33.6% partner of unknown HIV status. At enrollment, 58.5% reported sex in past month (94.3% unprotected) and 4.5% reported forced sex. Odds of unprotected sex at enrollment was >11-fold higher in married compared to unmarried women ($p<0.001$) and lower among women who reported partners of unknown HIV status or HIV-infected compared to HIV-uninfected partners. Median time to postpartum resumption of sex was 7 weeks (IQR 4–12). Prevalence of unprotected sex in past week increased from 6.6% to 60.0% between 2 to 36 weeks postpartum ($p<0.001$). Vaginal washing was reported by 60.1% of women at enrollment and prevalence remained stable postpartum; vaginal drying was reported by 17.9% at enrollment and decreased to 6.1% at 36 weeks postpartum ($p<0.001$). Vaginal washing and drying were associated with forced sex.

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Conclusion—High rates of unknown partner HIV status, polygamy, and low condom use among pregnant/postpartum women underscores need for female-controlled HIV prevention interventions. Vaginal washing and drying may present challenges to microbicide use.

Keywords

Sexual intercourse; vaginal washing; vaginal washing; HIV incidence

Introduction

During pregnancy and postpartum, women in high HIV prevalence regions continue to be at high risk for acquiring HIV¹⁻⁵. In order to tailor HIV prevention strategies for the pregnancy and postpartum periods, it is important to define peripartum sexual and vaginal practices that increase risk of HIV acquisition. Reduced desire and frequency of sexual intercourse occurs among women as pregnancy progresses^{6,7}. While some male partners may consequently abstain, others may develop concurrent relationships as a way to satisfy their unmet sexual needs^{8,9}. Concurrent sexual partnerships put men, and subsequently their female partners, at risk of acquiring sexually transmitted infections including HIV^{8,9}. Sexually transmitted infections increase risk of HIV and are associated with adverse maternal and fetal outcomes^{10,11}.

Some couples may opt for anal intercourse which carries considerably higher risk of HIV acquisition compared to vaginal intercourse¹². Condom use is an efficient intervention to reduce the risk of sexual transmission of HIV^{13,14}. However, use during pregnancy and after delivery remains low in many settings in sub-Saharan Africa¹⁵⁻¹⁷. Understanding sexual behaviors during pregnancy and postpartum period is useful for development of HIV preventive strategies to mitigate the high HIV incidence noted among women in sub-Saharan Africa during these periods^{1,3-5,16,17}.

Vaginal practices, such as douching with water or detergents, and inserting substances into the vagina, are prevalent in sub-Saharan Africa¹⁸⁻²⁰. Although both vaginal washing and drying have been associated with increased risk of HIV infections^{18,21-23}, data on the prevalence of these practices during pregnancy and postpartum are lacking. We aimed to characterize frequency and types of sexual behaviors and vaginal practices among HIV-uninfected women during pregnancy and up to 9 months postpartum

Methods

Study setting and population

We conducted a prospective study among pregnant HIV-uninfected women who presented at the Ahero sub-District and Bondo District Hospitals in Nyanza Province, Kenya for antenatal care. These facilities provide services to women in peri-urban and rural communities. The methodology for the study has been described previously⁵. Briefly, HIV-uninfected women who were at least 14 years of age, planned to stay in the study area until 36 weeks after delivery, willing to return for scheduled study visits that were integrated with

maternal antenatal care clinic and after delivery at 2, 6, 10, 14, 24, and 36 weeks) and willing to provide written consent were eligible to enroll in the study.

Recruitment and data collection

Pregnant HIV-uninfected women attending antenatal care clinics at the Ahero sub-District and Bondo District Hospital were informed about the study by the nurse counselor and invited to participate. After providing written informed consent, women completed a structured questionnaire that assessed social demographics and obstetrical history. Women were regarded as unemployed if they sought employment but were unsuccessful and housewife if they had not. At enrollment and during scheduled follow visits during pregnancy (at 20, 24, 32, 36 weeks gestation) and after delivery (at 2, 6, 10, 14, 24, and 36 weeks), we administered a questionnaire to ascertain sexual behaviors, and vaginal washing/drying practices. We measured frequency of vaginal and anal sexual activity during the past month including proportion of unprotected (without condom) sex acts, number of new sexual partners in previous month, forced sex and time to resumption of sexual activity after delivery. Vaginal washing was defined as using soap and water, water only, or either antiseptic or detergent to clean the vagina beyond the vaginal introitus. Women were classified as engaging in vaginal drying if they reported using herbs, chemicals, cloths, or other items to dry their vagina.

Ethical approval

Ethical approval for the study was obtained from the Kenya National Hospital & University of Nairobi Ethics and Research Committee and from the Human Subjects Division at the University of Washington. Authorization was also obtained from Provincial Medical Officer, Nyanza and the Medical Superintendent for the Ahero sub-District and Bondo District Hospitals.

Statistical analysis

SPSS Version 22 (IBM Corp., Armonk, NY, USA) was used to analyze data. The proportions of women reporting sex, vaginal washing, and vaginal drying during different time periods were compared using Chi-square tests. Correlates of unprotected sex, vaginal washing, and vaginal drying during pregnancy (enrollment visit) and at 36 weeks postpartum were assessed using logistic regression. Correlates of time to resumption of sex postpartum were assessed using Cox regression models. Multivariable analyses for each outcome were conducted using similar models as univariate modeling with covariates included that were significantly ($p < 0.05$) different on univariate analyses, after assessing covariates for collinearity. In cases of collinearity the covariate that was most biologically plausible or the covariate with the strongest association with the outcome was included.

Results

Baseline characteristic of study population

We included 1252 of 1304 (96.0%) of women with completed study visits at enrollment and 36 weeks postpartum in this analysis. The mean age was 23.3 years (95% CI: 23.0-23.6), most (78.4%) women were married (of whom 15.1% were in polygamous relationship), and

35.7% had more than primary level education (Table 1). Only 6.6% of women were in salaried employment, 36.9% reported they were self-employed and 25.9% were unemployed. The mean number of live births was 1.6 (95% CI: 1.5, 1.7), age at sexual debut was 16.1 (95% CI: 16.0, 16.3) and number of lifetime partners was 2.3 (95% CI: 2.2, 2.4).

Most (92.1%) women reported having a current partner, 1.5% reported the partner was HIV-infected and 36.5% had a partner of unknown HIV status. Almost one-third (30.0%) of women had a partner who was circumcised. Male partners were on average 6.4 years older (95% CI: 6.1, 6.7) and mean relationship duration was 5.1 years (95% CI: 4.8, 5.4). History of trading sex was reported by 10.2% of women and new sex partnerships in the past month were reported by 114 (0.9 %) at enrolment and by 17 (1.4%) women at 36 weeks postpartum. Fifty nine percent of women reported sexual activity in the previous month; of these, most (94.3%) reported at least one act of unprotected sex; 1.5% reported anal sex, and 4.5% reported forced sex.

Sexual behavior, vaginal washing and drying during pregnancy and postpartum

The proportion of women reporting sexual activity declined during pregnancy from 73.4% at 20 weeks to 37.0% at 36 weeks gestation ($p<0.001$); with a gradual increase after delivery from 8.0% to 70.7% between 2 weeks and 36 weeks postpartum ($p<0.001$) (Figure 1). The proportion of women reporting unprotected sex in the past month increased from 6.6% to 60.0%, between 2 and 36 weeks postpartum ($p<0.001$).

Vaginal washing was reported by 60.1% of women, most (50.1%) using soap and water, 9.3% using water only and less than 1% reported using either antiseptic or detergent. Vaginal washing remained relatively constant (~60%) throughout antenatal and postpartum follow-up. Vaginal drying, usually performed by wiping with a cloth, was reported by 17.9% of women at enrollment and declined over time; 12.3% at 2 weeks postpartum and 6.9% at 24 weeks postpartum ($p<0.001$).

Correlates of unprotected sex during pregnancy

Women who were older (Odds Ratio [OR] =1.04 for each year increase, 95% CI: 1.02, 1.06), who were married (OR=11.39, 95% CI: 7.94, 16.34), who had older age at sexual debut (OR=1.06 for each year increase, 95% CI: 1.01, 1.11) and who had more lifetime sexual partners (OR=1.30 for each additional partner, 95% CI: 1.18, 1.44) were more likely to report unprotected sex in the past month compared to women who reported having protected sex or no sexual activity (Table 2). In addition, women who reported forced sex (OR=13.15, 95% CI: 3.13, 55.18) and anal sex (OR=8.24, 95% CI: 1.05, 64.56) were more likely to report unprotected sex. Compared to women who were unemployed, women who were housewives, self-employed or salaried were more likely to report unprotected sex (OR=3.14, 95% CI: 2.30, 4.27), (OR=3.86, 95% CI: 2.86, 5.22) and (OR=4.33, 95% CI: 2.59, 7.24) respectively, although employment status was collinear with marital status. Women with partners of unknown HIV status or HIV-infected partners were less likely to report unprotected sex compared to women with HIV-uninfected partners (OR=0.65, 95% CI: 0.50, 0.85 and OR=0.13, 95% CI: 0.04, 0.44; respectively). Number of live births was also associated with unprotected sex; however, this was collinear with age. Education level,

history of trading sex, age difference with partner, male partner circumcision, and duration of relationship were not associated with unprotected sex during pregnancy.

In a multivariable model including age, marital status, partner HIV status, age at sexual debut, forced sex, anal sex, and lifetime number of sexual partners (employment status was excluded due to collinearity with marital status and number of live births due to collinearity with age), younger age (adjusted OR (aOR)=0.97 per each year increase, 95% CI: 0.94, 0.99), being married (aOR=11.28, 95% CI: 7.48, 17.02), unknown partner HIV status (aOR=0.58, 95% CI: 0.44, 0.78), HIV-positive partner status (aOR=0.06, 95% CI: 0.01, 0.29), lifetime number of sexual partners (aOR=1.25, 95% CI: 1.12, 1.40), and forced sex (aOR=13.80, 95% CI: 2.89, 66.00) were independently associated with unprotected sex during pregnancy.

Correlates of unprotected sex during postpartum

At 36 weeks postpartum, cofactors for unprotected sex during postpartum were largely similar to those identified during pregnancy. However, there was no difference in unprotected sex at 36 weeks postpartum between women who were HIV negative and those with partners of unknown HIV status, no difference by age of sexual debut, and no difference for those reporting anal sex versus not reporting anal sex.

Correlates of vaginal washing and drying during pregnancy

Older age (OR=1.02, 95%CI: 1.00, 1.05 for each additional year) and number of live births (OR=1.07, 95% CI: 1.00, 1.15 for each additional child) were associated with increased odds of vaginal washing (Table 3). There was a trend for married women to be more likely to report vaginal washing when compared to unmarried women (OR=1.23, 95% CI: 0.94, 1.62). Women who reported forced sex were more likely to engage in vaginal washing (OR=10.72, 95% CI: 2.55, 45.00). Education level, employment status, age at sexual debut, lifetime number of sexual partners, partner HIV status, partner circumcision, age difference with partner, relationship duration, unprotected sex, trading sex, anal sex, history of sexual transmitted infections, and history of abnormal discharge were not associated with vaginal washing.

In a multivariable model including age and forced sex in the past month (number of live births was excluded due to collinearity with age) both older age (aOR=1.02, 95% CI: 1.00, 1.04) and forced sex in the past month (aOR=10.56, 95% CI: 2.52, 44.36) remained independently associated with reported vaginal washing during pregnancy.

There was a trend for older women (OR=1.02 for each additional year, 95% CI: 0.99, 1.05) to report vaginal drying. Married women were significantly more likely to report vaginal drying than unmarried women (OR=1.49, 95% CI: 1.02, 2.18) (Table 3). Women with partners of unknown status were less likely to report vaginal drying than women with HIV-uninfected partners (OR=0.59, 95% CI: 0.41, 0.85). Vaginal drying was more commonly reported by women who had unprotected sex (OR=1.62, 95% CI: 1.20, 2.19), forced sex (OR=10.12, 95% CI: 4.83, 21.20), had a history of sexually transmitted infections (OR=2.14, 95% CI: 1.31, 3.51) or abnormal discharge (OR=3.18, 95% CI: 1.82, 5.56).

Education level, employment status, age at sexual debut, lifetime number of sexual partners,

partner circumcision status, relationship duration, and trading sex were not associated with vaginal drying during pregnancy.

Having a partner of unknown HIV status (aOR=0.56, 95% CI: 0.39, 0.81), forced sex (aOR=8.88, 95% CI: 4.16, 18.98) and history of abnormal discharge (aOR=3.18, 95% CI: 1.78, 5.66) remained significantly associated with vaginal drying in a multivariable model that also included unprotected sex and marital status (history of an STI was excluded due to collinearity with history of abnormal discharge).

Correlates of vaginal washing and drying during postpartum

At 36 weeks postpartum, women with partners of unknown HIV status (OR=0.62, 95% CI: 0.48, 0.81), who were housewives (OR=0.55, 95% CI: 0.41, 0.74), or who had a longer duration of relationship (OR=0.97, 95% CI: 0.95, 1.00) were less likely to report vaginal washing. Women with history of abnormal discharge (OR=2.35, 95% CI: 1.27, 4.35) and women with an older age of sexual debut (OR=1.06, 95% CI: 1.01, 1.11 per additional year) were more likely to report vaginal washing at 36 weeks postpartum. Age and number of live births were not associated with vaginal washing.

Older women (OR=1.04, 95% CI: 1.01, 1.08 for each additional year) were more likely to report vaginal drying. Unlike during pregnancy, being married, having a partner unknown HIV status, forced sex, history of sexually transmitted infections, history of abnormal discharge, and history of unprotected sex in last month were not associated with vaginal drying during postpartum. Other cofactors for vaginal washing and drying were similar to those identified during pregnancy.

Resumption of sex after delivery

The majority (n=1,079, 86.2%) of women reported resuming sex by 36 weeks postpartum: 42.1% 5 weeks and 9.2% as early as 2 weeks. Among these women, the median time of resumption of sex was 7 weeks (IQR 4, 12). Older age (Hazard ratio [HR] =1.48 for every 10 year increment, 95% CI: 1.34, 1.63), higher lifetime number of sexual partners (HR=1.08, 95% CI: 1.04, 1.11), older partners (HR=1.02 for each additional year older, 95% CI: 1.01, 1.03) and anal sex (HR=1.93, 95% CI: 1.07, 3.50) were associated with faster time to resumption of sex after delivery (Table 4). Higher number of live births and longer duration of relationship were also associated with time to resumption of sex, however these variables were highly collinear with age. Women who were married (HR=4.21, 95% CI: 3.49, 5.08) resumed sex at a faster rate than unmarried women (Figure 2). Unemployed women resumed sex at a slower rate compared to employed women and housewives, but this was due to unemployment being highly related to being unmarried (collinear).

Women who completed at least primary education (HR=0.86, 95% CI: 0.75, 0.97), who had a caesarean delivery (HR=0.69, 95% CI: 0.51, 0.95), with partners of unknown HIV status (HR=0.85, 95% CI: 0.73, 0.98) or who were circumcised (HR=0.78, 95% CI: 0.68, 0.90) were less likely to have resumed sex. History of trading sex, forced sex, and age at sexual debut were not associated with time to resumption of sex.

In a multivariable model including age, education, marital status, anal sex, lifetime number of sex partners, partner HIV status, partner circumcision status, caesarean delivery, and age difference between partners, only marital status (aHR=2.69, 95% CI: 2.10, 3.43), partner being circumcised (aHR=0.86, 95% CI: 0.74, 1.00), and caesarean delivery (HR=0.57, 95% CI: 0.40, 0.80) were independently associated with resumption of sex.

Discussion

Among HIV-uninfected pregnant and postpartum women, we found sexual activity decreased during pregnancy with a gradual increase after delivery; we also noted high rates of unprotected sex, and appreciable prevalence of vaginal washing and drying. Reduced frequency of sexual activity with increasing gestation observed in our study is consistent with findings from studies in Portugal, China, Nigeria, and South Africa^{6-8,16,24}. Hormonal changes, growing abdominal girth, cultural and psychological factors that include concerns about harming the infant, inducing miscarriage and precipitating labor or rupture of membranes have been cited as contributing to reduced sexuality during pregnancy^{7,24-26}. A potential risk of the decreased sexual activity in women is that their male partner may respond by seeking concurrent sex partners. In Nigeria, 28-43.7% of men report concurrent sex partners during their wives pregnancy^{8,9,27}. Concurrent sexual partnerships put men, and subsequently their female partner and infants, at risk of HIV^{8,9,27}.

Sexual health discussions at ANC and MCH clinics could address concerns about sex during pregnancy, including allaying fears of harm to the fetus and provide a forum to promote safer sex practices. However, sexual health, though a common concern during pregnancy, is infrequently discussed either during prenatal or postnatal care⁷. Women may be uncomfortable bringing up issues they consider private and providers fail to explore sexual health problems even during discussions on contraceptive use²⁸. To optimize sexual health, it is critical for providers to engage women and their partners in an open discussion about sex during pregnancy.

We found very high rates of unprotected sex similar to a study in Uganda which found less frequent condom use in pregnant women (4%) than in breastfeeding women (9%, $p<0.0001$) or among non-pregnant and non-lactating women (10%; 9%, $p<0.0001$)². We found that married women were likely to report unprotected sex during pregnancy. Women in stable relationships may fear asking their partners to use condoms as this may be implied as an expression of distrust^{29,30}. Strategies to promote condom use among couples in stable partnerships are needed, particularly for women in HIV discordant relationships and those who do not know the HIV status of their partners. It was encouraging that women who did not know the HIV status of their partners or who had a HIV-infected partner were less likely to report unprotected sex during pregnancy.

Alternative strategies for HIV-uninfected women unable to negotiate condom use include antiretroviral pre-exposure prophylaxis (PrEP) and microbicides. Use of oral PrEP among couples in HIV discordant relationship can substantially reduce the risk of incident HIV infection³¹. Currently, WHO recommends oral PrEP as an HIV prevention choice for individuals at substantial risk of HIV infection such as HIV discordant couples³².

Microbicides are products that uninfected women apply vaginally to protect themselves from acquiring HIV. Similar to PrEP, microbicides offer another female-initiated method for primary HIV prevention and have potential to empower women to protect themselves as they do not require cooperation, consent or knowledge of the male partner for use. In the CAPRISA trial, use of tenofovir vaginal gel reduced HIV acquisition by 39% among all women and by 54% among women with high gel adherence³³, however, other randomized trials have not shown similar protective benefit^{34,35}

Rates of new partnerships among women were low similar to other reports from sub-Saharan Africa². A prospective study in Uganda found that pregnant women reported significantly lower proportion of multiple sexual partners (1%) than breastfeeding women (2%) or non-pregnant and non-lactating women (3%)². We found lower prevalence of anal intercourse than has been reported in studies from Portugal and Canada, (~7%)^{6,26}. A study in Nigeria reported increased anal intercourse during pregnancy (2%) compared to period before pregnancy (1%)²⁴. Increasing abdominal girth as pregnancy progresses leading to physical awkwardness during vaginal sex may make some couples opt for anal intercourse. Risk of HIV transmission is higher with receptive anal intercourse than with vaginal sex^{12,36,37}. This risk may be compounded by lower rates of condom use with anal compared to vaginal sex³⁸⁻⁴⁰.

In our study, the median time of resumption sexual activity after delivery was 7 weeks, similar with other studies (5 to 8 weeks)⁴¹⁻⁴⁴. Resumption of sex before perineal healing may increase risk of HIV acquisition if the woman has sex with a HIV-infected partner. Previous studies from West Africa reported prolonged sexual abstinence after childbirth due to cultural norms^{27,45}. However, with changing cultural practices that discourage polygamy, long periods of sexual abstinence may increase risk of male partners seeking concurrent sex partners⁴⁵. Recent studies from Nigeria report earlier resumption of coitus after delivery^{15,24}. We found that older married women reported earlier resumption of sex, consistent with other studies^{15,46-48}. In our study, women with caesarean deliveries resumed sex earlier compared to those delivered vaginally. Caesarean delivery spares the pelvic floor from mechanical damage thereby preventing perineal discomfort or pain. However, in previous studies, associations of mode of delivery with timing of resumption have been inconsistent^{15,44,46,49,50}. Other studies have reported association of breastfeeding with late resumption of sexual activity attributed to reduced interest in sex from psychological and physiological factors⁴⁶.

Similar to findings from non-pregnant African cohorts, vaginal washing and drying were common^{19,51-53}. This prevalence remained consistent throughout the follow up period; the majority of women using soap and water for vaginal washing. Previous studies have postulated that need to maintain hygiene, prior to or following sex, or during pregnancy, or cultural preference as reasons for vaginal washing^{54,55}. Vaginal washing could reduce levels of microbicides potentially limiting effectiveness in preventing incident HIV infection.

We have previously reported that we did not find association between vaginal washing or vaginal drying and incident HIV infections⁵. However, several studies from sub-Saharan Africa have reported increased risk of HIV acquisition with vaginal washing^{18,19,21,53,56},

although not consistently^{53,57-59}. A recent meta-analysis of individual participant data from 13 prospective cohort studies from sub-Saharan Africa reported that use of cloth or paper and intravaginal cleaning with soap were each associated with HIV acquisition¹⁸. The mechanism for increased HIV risk is speculated to be via injury to vaginal epithelium, mucosal inflammation leading to recruitment of HIV target cells or by disruption of vaginal flora^{18,60}. In contrast, a prospective study in South Africa found that vaginal washing was associated with prevalent HIV but not incident HIV infection suggesting that vaginal washing may be undertaken in response to vaginal infections that occur more commonly among HIV-infected women⁵³.

Rates of vaginal drying were lower than those reported from studies in Southern Africa where 2 in 3 women report vaginal drying²². Vaginal drying during pregnancy was also associated with forced sex, history of sexually transmitted infections, history of abnormal discharge and reporting unprotected sex in last month. It is possible that women, who have been forced into sex, may undertake vaginal washing and drying as a physical way to deal with feeling of sexual violation. In a recent meta-analysis vaginal drying was associated with HIV acquisition¹⁸. Vaginal drying could mop up the microbicides thereby reducing levels and potentially limiting effectiveness in preventing HIV infection.

Our study had several strengths. Prospectively following up the women allowed for determination of vaginal and sexual practices during pregnancy and postpartum period. Due to the large sample size, the study had power to assess covariates of vaginal and sexual practices. The study also had some limitations. Data was collected through interviewer-administered questionnaires and this may have introduced social desirability bias in assessment of sexual frequency, timing of resumption of sex after delivery, number of new partnerships, use of condoms and anal sex. In addition, responses were not corroborated by their sexual partners.

In conclusion, our study found extremely low rates of condom use, new sexual partnerships, or anal intercourse and high rates of vaginal washing and vaginal drying. The high rates of unknown partner HIV status, polygamy, and low condom use underscores need for better HIV prevention strategies for women during pregnancy and postpartum, including promotion of condom use in women during this period and other female-controlled interventions including microbicides. However, high prevalence of vaginal washing and drying may limit effectiveness of microbicides.

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References

1. Drake AL, Wagner A, Richardson B, G JS. Incident HIV during Pregnancy and Postpartum and Risk of Mother-to-Child HIV Transmission: A Systematic Review and Meta-Analysis. *PLoS Med.*

Feb.2014 2511(2):e1001608. 2014. doi:1001610.1001371/journal.pmed.1001608.eCollection1002014.

2. Gray R, Li X, Kigozi G, et al. Increased risk of incident HIV during pregnancy in Rakai, Uganda: a prospective study. *Lancet*. 2005; 366(9492):1182–1188. [PubMed: 16198767]
3. Moodley D, Esterhuizen TM, Pather T, Chetty V, Ngaleka L. High HIV incidence during pregnancy: compelling reason for repeat HIV testing. *AIDS*. 2009; 23(10):1255–1259. [PubMed: 19455017]
4. Kinuthia J, Kiarie JN, C F, et al. Cofactors for HIV-1 Incidence during Pregnancy and Postpartum Period. *Curr HIV Res*. 2010; 8(7):510–514. [PubMed: 20946093]
5. Kinuthia J, Drake AL, Matemo D, et al. HIV acquisition during pregnancy and postpartum is associated with genital infections and partnership characteristics. *AIDS*. 2015; 29(15):2025–2033. [PubMed: 26352880]
6. Pauleta JR, Pereira NM, Graça LM. Sexuality During Pregnancy. *The Journal of Sexual Medicine*. 7(1pt1):136–142.
7. Fok WY, Chan LYS, Yuen PM. Sexual behavior and activity in Chinese pregnant women. *Acta Obstetrica et Gynecologica Scandinavica*. 2005; 84(10):934–938. [PubMed: 16167907]
8. Onah HE, Iloabachie GC, Obi SN, Ezugwu FO, Eze JN. Nigerian male sexual activity during pregnancy. *International journal of gynaecology and obstetrics: the official organ of the International Federation of Gynaecology and Obstetrics*. 2002; 76(2):219–223.
9. Lawoyin TO, Larsen U. Male sexual behaviour during wife's pregnancy and postpartum abstinence period in Oyo state, Nigeria. *Journal of Biosocial Science*. 2002; 34(1):51–63. [PubMed: 11814213]
10. Mullick S, Watson-Jones D, Beksinska M, Mabey D. Sexually transmitted infections in pregnancy: prevalence, impact on pregnancy outcomes, and approach to treatment in developing countries. *Sexually Transmitted Infections*. Aug 1; 2005 81(4):294–302. 2005. [PubMed: 16061534]
11. 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. *Sexually Transmitted Infections*. 1999; 75(1):3–17. [PubMed: 10448335]
12. Baggaley RF, White RG, Boily M. HIV transmission risk through anal intercourse: systematic review, meta-analysis and implications for HIV prevention. *Int J Epidemiol*. 2010; 39(4):1048–1063. [PubMed: 20406794]
13. Pinkerton SD, Abramson PR. Effectiveness of condoms in preventing HIV transmission. *Social Science & Medicine*. 1997; 44(9):1303–1312. [PubMed: 9141163]
14. Weller S, Davis K. Condom effectiveness in reducing heterosexual HIV transmission. *Cochrane Database Syst Rev*. 2002; 1:CD003255. 2002.
15. Ezebialu IU, Eke AC. Resumption of vaginal intercourse in the early postpartum period: Determinants and considerations for child spacing in a Nigerian population. *Journal of Obstetrics & Gynaecology*. 2012; 32(4):353–356. [PubMed: 22519480]
16. Keating MA, Hamela G, Miller WC, Moses A, Hoffman IF, Hosseinipour MC. High HIV Incidence and Sexual Behavior Change among Pregnant Women in Lilongwe, Malawi: Implications for the Risk of HIV Acquisition. *PLoS ONE*. 7(6):e39109. [PubMed: 22768063]
17. Gray RH, Li X, Kigozi G, et al. Increased risk of incident HIV during pregnancy in Rakai, Uganda: a prospective study. *The Lancet*. Oct 7; 2005 366(9492):1182–1188. 2005.
18. Low N, Chersich MF, Schmidlin K, et al. Intravaginal Practices, Bacterial Vaginosis, and HIV Infection in Women: Individual Participant Data Meta-analysis. *PLoS Med*. 2011; 8(2):e1000416. [PubMed: 21358808]
19. Myer L, Denny L, De Souza M, Barone MA, Wright TC Jr, Kuhn L. Intravaginal Practices, HIV and Other Sexually Transmitted Diseases Among South African Women. *Sexually Transmitted Diseases*. 2004; 31(3):174–179. [PubMed: 15076931]
20. Francis SC, Baisley K, Lees SS, et al. Vaginal Practices among Women at High Risk of HIV Infection in Uganda and Tanzania: Recorded Behaviour from a Daily Pictorial Diary. *PLoS ONE*. 8(3):e59085. [PubMed: 23555618]
21. McClelland RS, Lavreys L, Hassan WM, Mandaliya K, Ndinya-Achola JO, Baeten JM. Vaginal washing and increased risk of HIV-1 acquisition among African women: a 10-year prospective study. *AIDS*. 2006; 20(2):269–273. 210.1097/1001.aids.0000196165.0000148518.0000196167b. [PubMed: 16511421]

22. Turner AN, Morrison CS, Munjoma MW, Moyo P, Chipato T, van de Wijert JH. Vaginal Practices of HIV-Negative Zimbabwean Women. *Infectious Diseases in Obstetrics and Gynecology*. 2010; 2010:387671. [PubMed: 20871844]
23. Alcaide M, Mumbi M, Chitalu N, Jones D. Vaginal Cleansing Practices in HIV Infected Zambian Women. *AIDS and Behavior*. 17(3):872–878.
24. Bello FA, O O, Aimakhu CO, Adekunle AO. Effect of Pregnancy and Childbirth on Sexuality of Women in Ibadan, Nigeria. *ISRN Obstet Gynecol*. 2011; 856586
25. Orji EO, Ogunlola IO, Fasubaa OB. Sexuality among pregnant women in South West Nigeria. *Journal of Obstetrics & Gynaecology*. 2002; 22(2):166–168. [PubMed: 12521698]
26. Bartellas E, Crane JMG, Daley M, Bennett KA, Hutchens D. Sexuality and sexual activity in pregnancy. *BJOG: An International Journal of Obstetrics & Gynaecology*. 2000; 107(8):964–968. [PubMed: 10955426]
27. Cleland JG, Ali MM, Capo-Chichi V. Post-partum sexual abstinence in West Africa: implications for AIDS-control and family planning programmes. *AIDS*. 1999; 13(1):125–131. [PubMed: 10207554]
28. Leeman LM, Rogers RG. Sex After Childbirth: Postpartum Sexual Function. *Obstetrics & Gynecology*. 2012; 119(3):647–655. [PubMed: 22353966]
29. Chimhiri AM. The condom is an ‘intruder’ in marriage: Evidence from rural Malawi. *Social Science & Medicine*. 2007; 64(5):1102–1115. [PubMed: 17240504]
30. Bauni EK, Jarabi BO. The Low Acceptability and Use of Condoms within Marriage: Evidence from Nakuru District. Kenya. *African Population Studies*. 2003; 18:51–65.
31. Baeten JM, Donnell D, Ndase P, et al. Antiretroviral Prophylaxis for HIV Prevention in Heterosexual Men and Women. *New England Journal of Medicine*. 2012; 367(5):399–410. [PubMed: 22784037]
32. WHO. Consolidated guidelines on the use of antiretroviral drugs for treating and preventing HIV infection: recommendations for a public health approach. 2nd. 2016.
33. Abdool Karim Q, Abdool Karim SS, Frohlich JA, et al. Effectiveness and Safety of Tenofovir Gel, an Antiretroviral Microbicide, for the Prevention of HIV Infection in Women. *Science*. Sep 3; 2010 329(5996):1168–1174. 2010. [PubMed: 20643915]
34. Marrazzo JM, Ramjee G, Richardson BA, et al. Tenofovir-Based Preexposure Prophylaxis for HIV Infection among African Women. *New England Journal of Medicine*. 2015; 372(6):509–518. [PubMed: 25651245]
35. Van Damme L, Corneli A, Ahmed K, et al. Preexposure Prophylaxis for HIV Infection among African Women. *New England Journal of Medicine*. 2012; 367(5):411–422. [PubMed: 22784040]
36. Levy JA. The transmission of HIV and factors influencing progression to AIDS. *The American Journal of Medicine*. 1993; 95(1):86–100. [PubMed: 8328502]
37. Bélec L, Dupré T, Prazuck T, et al. Cervicovaginal Overproduction of Specific IgG to Human Immunodeficiency Virus (HIV) Contrasts with Normal or Impaired IgA Local Response in HIV Infection. *Journal of Infectious Diseases*. Sep 1; 1995 172(3):691–697. 1995. [PubMed: 7658060]
38. Priddy FH, Wakasiaka S, Hoang TD, et al. Anal Sex, Vaginal Practices, and HIV Incidence in Female Sex Workers in Urban Kenya: Implications for the Development of Intravaginal HIV Prevention Methods. *AIDS Research and Human Retroviruses*. 2011; 27(10):1067–1072. [PubMed: 21406032]
39. Halperin D. Heterosexual anal intercourse: prevalence, cultural factors, and HIV infection and other health risks, Part I. *AIDS Patient Care STDS*. 1999; 13:717–730. [PubMed: 10743535]
40. Leichliter JS, Chandra A, Liddon N, Fenton KA, Aral SO. Prevalence and Correlates of Heterosexual Anal and Oral Sex in Adolescents and Adults in the United States. *Journal of Infectious Diseases*. Dec 15; 2007 196(12):1852–1859. 2007. [PubMed: 18190267]
41. Anzaku A, Mikah S. Postpartum resumption of sexual activity, sexual morbidity and use of modern contraceptives among Nigerian women in Jos. 42014
42. Byrd JE, Hyde JS, DeLamater JD, EA P. Sexuality during pregnancy and the year postpartum. *J Fam Pract*. 1998; 47(4):305–308. [PubMed: 9789517]
43. Acele EÖ, Karaçam Z. Sexual problems in women during the first postpartum year and related conditions. *Journal of Clinical Nursing*. 2012; 21(7-8):929–937. [PubMed: 22008061]

44. Odar E, Wandabwa J, Kiondo P. Sexual practices of women within six months of childbirth in Mulago hospital, Uganda. *African Health Sciences*. 2003; 3(3):117–123. [PubMed: 14676716]
45. Desgrées-du-Loû A, Brou H. Resumption of Sexual Relations Following Childbirth: Norms, Practices and Reproductive Health Issues in Abidjan, Côte d'Ivoire. *Reproductive Health Matters*. 2005; 13(25):155–163.
46. Rowland M, Foxcroft L, Hopman WM, Patel R. Breastfeeding and sexuality immediately post partum. *Canadian Family Physician*. Oct 1; 2005 51(10):1366–1367. 2005. [PubMed: 16926969]
47. Rådestad I, Olsson A, Nissen E, Rubertsson C. Tears in the Vagina, Perineum, Sphincter Ani, and Rectum and First Sexual Intercourse after Childbirth: A Nationwide Follow-up. *Birth*. 2008; 35(2): 98–106. [PubMed: 18507580]
48. Makanani B, Kumwenda J, Kumwenda N, Chen S, Tsui A, Taha TE. Resumption of sexual activity and regular menses after childbirth among women infected with HIV in Malawi. *International Journal of Gynecology & Obstetrics*. 2010; 108(1):26–30. [PubMed: 19782980]
49. Buhling KJ, Schmidt S, Robinson JN, Klapp C, Siebert G, Dudenhausen JW. Rate of dyspareunia after delivery in primiparae according to mode of delivery. *European Journal of Obstetrics & Gynecology and Reproductive Biology*. 2006; 124(1):42–46. [PubMed: 16024160]
50. Dabiri F, Yabandeh AP, Shahi A, Kamjoo A, SH T6. The effect of mode of delivery on postpartum sexual functioning in primiparous women. *Oman Med J*. 2014; 29(4):276–279. [PubMed: 25170409]
51. La Ruche G, Messou N, Ali-Napo L, et al. Vaginal Douching: Association With Lower Genital Tract Infections in African Pregnant Women. *Sexually Transmitted Diseases*. 1999; 26(4):191–196. [PubMed: 10225584]
52. Mbizvo ME, Musya SE, Stray-Pedersen B, Chirenje Z, H A. Bacterial vaginosis and intravaginal practices: association with HIV. *Cent Afr J Med*. 2004; 50(5-6):41–46. [PubMed: 15881309]
53. Myer L, Denny L, de Souza M, Wright TC, Kuhn L. Distinguishing the Temporal Association between Women's Intravaginal Practices and Risk of Human Immunodeficiency Virus Infection: A Prospective Study of South African Women. *American Journal of Epidemiology*. Mar 15; 2006 163(6):552–560. 2006. [PubMed: 16443804]
54. Martin Hilber A, Hull TH, Preston-Whyte E, et al. A cross cultural study of vaginal practices and sexuality: Implications for sexual health. *Social Science & Medicine*. 2010; 70(3):392–400. [PubMed: 19906477]
55. Scorgie F, Kunene B, Smit JA, Manzini N, Chersich MF, Preston-Whyte EM. In search of sexual pleasure and fidelity: vaginal practices in KwaZulu-Natal, South Africa. *Culture, Health & Sexuality*. 2009; 11(3):267–283.
56. Hilber AM, Francis SC, Chersich M, et al. Intravaginal Practices, Vaginal Infections and HIV Acquisition: Systematic Review and Meta-Analysis. *PLoS ONE*. 5(2):e9119. [PubMed: 20161749]
57. van de Wijgert JHHM, Chirenje ZM, Iliff V, et al. Effect of Intravaginal Practices on the Vaginal and Cervical Mucosa of Zimbabwean Women. *JAIDS Journal of Acquired Immune Deficiency Syndromes*. 2000; 24(1):62–67. [PubMed: 10877497]
58. van de Wijgert J, Morrison C, Salata R, Padian N. Is vaginal washing associated with increased risk of HIV-1 acquisition? *AIDS*. 2006; 20(9):1347–1348. 1310.1097/1301.aids.0000232252.0000274157.f0000232259. [PubMed: 16816573]
59. van de Wijgert JHHM, Morrison CS, Cornelisse PGA, et al. Bacterial Vaginosis and Vaginal Yeast, But Not Vaginal Cleansing, Increase HIV-1 Acquisition in African Women. *JAIDS Journal of Acquired Immune Deficiency Syndromes*. 2008; 48(2):203–210. 210.1097/QAI.1090b1013e3181743936. [PubMed: 18520679]
60. Taha TE, Hoover DR, Dallabetta GA, et al. Bacterial vaginosis and disturbances of vaginal flora: association with increased acquisition of HIV. *AIDS*. 1998; 12(13):1699–1706. [PubMed: 9764791]

Figure 1.

Figure 2.
Dashed line is unmarried, solid line is married.

Table 1
Demographic characteristics, sexual behaviors, and vaginal practices at enrollment

Characteristic	n (%) or Mean (95% CI) n=1252
Age (years)	23.3 (23.0, 23.6)
Married	981 (78.4%)
Polygamous	148 (15.1%)
Greater than primary education *	447 (35.7%)
Employment status	
Unemployed	324 (25.9%)
Housewife	383 (30.6%)
Self-employed	462 (36.9%)
Salaried	83 (6.6%)
Number of live births	1.6 (1.5, 1.7)
Gestational Age	26.2 (25.8, 26.6)
Age at sexual debut (years)	16.1 (16.0, 16.3)
Lifetime sexual partners	2.3 (2.2, 2.4)
Has current partner	1153 (92.1%)
Known HIV positive **	17 (1.5%)
HIV status unknown **	421 (36.5%)
Circumcised **	346 (30.0%)
Age difference with partner (years older) **	6.4 (6.1, 6.7)
Duration of relationship (years) **	5.1 (4.8, 5.4)
History of trading sex	128 (10.2%)
Sexual behavior (past month)	
Any sexual activity	733 (58.5%)
New sexual partner	11 (0.9%)
During pregnancy (at enrollment)	17 (1.4%)
During postpartum (24 weeks postpartum)	
Any sex without a condom (unprotected sex) ***	691 (94.3%)
Proportion of sex acts with a condom ***	7.8% (5.9%, 9.8%)
Any anal sex ***	11 (1.5%)
Any forced sex ***	33 (4.5%)
Vaginal practices (past month)	
Any vaginal washing	752 (60.1%)
Water only	117 (9.3%)
Antiseptic	4 (<1%)
Soap and water	627 (50.1%)
Detergent	2 (<1%)

Characteristic	n (%) or Mean (95% CI) n=1252
Any vaginal drying	224 (17.9%)

*
>8 years.

**
Among women with a current partner.

Among women who were sexually

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Table 2
Correlates of unprotected sex in the past month at enrollment (logistic regression models)

Characteristic	Unprotected sex (n=691)	Protected sex/no sex (n=561)	OR	95% CI	p-value
	% (n) or mean (95% CI)				
Age (years)	23.89 (23.50, 24.27)	22.62 (22.12, 23.12)	1.04	(1.02, 1.06)	<0.001
Education > Primary	36.03% (249)	35.29% (198)	1.03	(0.82, 1.30)	0.8
Married	94.21% (651)	58.82% (330)	11.39	(7.94, 16.34)	<0.001
Employment status:					
Unemployed	15.20% (105)	39.04% (219)	1.0		
Housewife	33.29% (230)	27.27% (153)	3.14	(2.30, 4.27)	<0.001
Self-employed	43.42% (300)	28.88% (162)	3.86	(2.86, 5.22)	<0.001
Salaried	8.10% (56)	4.81% (27)	4.33	(2.59, 7.24)	<0.001
Number of live births	1.78 (1.65, 1.90)	1.44 (1.30, 1.59)	1.12	(1.05, 1.20)	0.001
History of sex trade	9.26% (64)	11.41% (64)	0.79	(0.55, 1.14)	0.2
Forced sex in the past month	4.49% (31)	0.36% (2)	13.15	(3.13, 55.18)	<0.001
Anal sex in the past month	1.45% (10)	0.18% (1)	8.24	(1.05, 64.56)	0.05
Age at sexual debut (years)	16.27 (16.07, 16.46)	15.91 (15.70, 16.12)	1.06	(1.01, 1.11)	0.02
Lifetime sexual partners	2.48 (2.37, 2.58)	2.09 (2.00, 2.18)	1.30	(1.18, 1.44)	<0.001
Women with a current partner:	(n=687)	(n=466)			
HIV negative	74.82% (514)	64.38% (300)	1.0		
Partner unknown HIV status	24.75% (170)	32.62% (152)	0.65	(0.50, 0.85)	0.001
Partner HIV positive	0.44% (3)	3.00% (14)	0.13	(0.04, 0.44)	0.001
Partner circumcised	28.53% (196)	32.19% (150)	0.81	(0.63, 1.05)	0.1
Age difference with partner (years)	6.60 (6.22, 6.99)	6.14 (5.64, 6.64)	1.02	0.99, 1.05)	0.2
Duration of relationship (years)	4.91 (4.55, 5.28)	5.34 (4.82, 5.85)	0.98	(0.96, 1.01)	0.2

Table 3
Correlates of vaginal washing and drying at enrollment (logistic regression models)

Characteristic	Vaginal washing			Vaginal drying		
	OR	95% CI	p-value	OR	95% CI	p-value
Age (years)	1.02	(1.00, 1.05)	0.03	1.02	(0.99, 1.05)	0.1
Education > Primary	1.07	(0.84, 1.35)	0.6	1.26	(0.94, 1.70)	0.1
Married	1.23	(0.94, 1.62)	0.1	1.49	(1.02, 2.18)	0.04
Employment status:						
Unemployed	1.0			1.0		
Housewife	0.90	(0.67, 1.22)	0.9	0.95	(0.64, 1.41)	0.8
Self-employed	1.13	(0.85, 1.52)	0.4	1.17	(0.81, 1.69)	0.4
Salaried	0.64	(0.39, 1.04)	0.07	1.35	(0.75, 2.46)	0.3
Number of live births	1.07	(1.00, 1.15)	0.04	1.03	(0.95, 1.12)	0.5
Age at sexual debut (years)	1.02	(0.97, 1.07)	0.4	1.05	(0.99, 1.11)	0.1
Lifetime sexual partners	1.05	(0.96, 1.15)	0.3	1.08	(0.98, 1.20)	0.1
Women with a current partner:						
Partner HIV negative	1.0			1.0		
Partner unknown HIV status	0.86	(0.66, 1.12)	0.3	0.59	(0.41, 0.85)	0.005
Partner HIV positive	0.42	(0.16, 1.14)	0.09	1.18	(0.38, 3.68)	0.8
Partner circumcised	0.95	(0.73, 1.23)	0.7	1.17	(0.50, 1.62)	0.3
Age difference with partner (years)	0.99	(0.97, 1.02)	0.6	1.00	(0.97, 1.03)	0.9
Duration of relationship (years)	1.01	(0.99, 1.04)	0.3	0.99	(0.96, 1.02)	0.5
Unprotected sex in last month	1.06	(0.84, 1.32)	0.6	1.62	(1.20, 2.19)	0.002
History of sex trade	1.12	(0.77, 1.64)	0.5	0.89	(0.54, 1.46)	0.6
Forced sex in the past month	10.72	(2.55, 45.00)	0.001	10.12	(4.83, 21.20)	<0.001
Anal sex in the past month	0.55	(0.17, 1.80)	0.3	NA *		
History of STI	0.89	(0.56, 1.39)	0.6	2.14	(1.31, 3.51)	0.003
History of abnormal discharge	0.95	(0.55, 1.64)	0.9	3.18	(1.82, 5.56)	<0.001

Table 4
Correlates of time to resumption of sex after delivery

Characteristic	HR	95% CI	p-value
Age in 10 year increments	1.48	1.34, 1.63	<0.001
Education > Primary	0.86	0.75, 0.97	0.02
Married	4.21	3.49, 5.08	<0.001
Employment status:			
Unemployed	1.0		
Housewife	2.47	2.07, 2.94	<0.001
Self-employed	2.63	2.22, 3.12	<0.001
Salaried	1.69	1.27, 2.24	<0.001
Number of live births	1.17	1.13, 1.20	<0.001
History of sex trade	1.03	0.84, 1.26	0.8
History of forced sex	1.05	0.91, 1.20	0.5
History of anal sex	1.93	1.07, 3.50	0.03
Age at sexual debut (years)	1.01	0.98, 1.04	0.7
Lifetime sexual partners	1.08	1.04, 1.11	<0.001
Women with a current partner:			
Partner HIV negative	1.0		
Partner unknown HIV status	0.85	0.73, 0.98	0.02
Partner HIV positive	0.80	0.47, 1.36	0.4
Partner circumcised	0.78	0.68, 0.90	0.001
Age difference with partner (years)	1.02	1.01, 1.03	0.008
Duration of relationship (years)	1.02	1.01, 1.03	0.001
Mode of delivery			
Vaginal	1.0		
Caesarean Section	0.69	0.51, 0.95	0.02