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**Predictors of Dual Contraception among HIV Discordant Relationships in Zambia**

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By

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Bachelor of Science

Spelman College

2013

Thesis Committee Chair: Kristin Wall, PhD

An abstract of
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## ABSTRACT

### Predictors of Dual Contraception among HIV Discordant Relationships in Zambia

**By Andrea D. Brown**

### Abstract

**Background:** Mother to child transmission and unintended pregnancy are major concerns among HIV discordant couples. Dual contraception use is proposed as way to increase pregnancy prevention and contraception effectiveness for such high risk couples. Investigation on predictors of dual contraception use among HIV discordant couples is not well documented.

**Methods:** To further examine dual contraception trends, this study utilized a longitudinal cohort of married and cohabitating Zambian couples recruited from 1994 to 2012 to participate in HIV counseling and testing (CVCT) services. Demographic, family planning, sexual history, and clinical measures were collected as possible predictors of dual contraception use.

**Results:** Overall increasing number of male lifetime sex partners, male reporting having a STI in the previous year, female being post-partum, and the male wanting a child within the next year best predicted dual use among HIV positive female discordant couples. For HIV positive male discordant couples, decreasing number of female lifetime sex partners, increasing number of male lifetime sex partners, female being post-partum, and decreasing fertility intentions of both male and female best predicted dual use.

**Conclusions:** Final models suggest males and post-partum female populations are particularly important groups to advocate increased dual contraception use. Increasing fertility desires across HIV discordant couples require expanded family planning outreach.

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**TABLE OF CONTENTS**

## Background

### *HIV & Fertility in Sub-Saharan Africa*

Despite growing access to prevention and treatment efforts, geographic disparities continue to exist in diagnosis of human immune-deficiency virus (HIV) and acquired immunodeficiency syndrome (AIDS). For decades, sub-Saharan Africa has been disproportionately affected by HIV/AIDS. Though it inhabits only 13% of the global population this region is home to about 68% of the total global prevalent HIV cases and nearly 70% of all incident HIV cases (1). Large infected child populations further amplify modern sub-Saharan HIV needs for more innovative HIV prevention efforts and monetary resources to treat vertical transmission. In 2012 more than 250,000 sub-Saharan children contracted HIV of which an estimated 90% became infected during pregnancy, at birth, through breastfeeding, or because of their mother's positive HIV status (1). High rates of total fertility (TFR), unintended pregnancy (UIP), HIV-related infant mortality, and HIV-caused death among women of reproductive age further underline the need for expanded fertility services for people living with HIV/AIDS (PLWA) (2). The United Nations has emphasized effective family planning as critical for economic recovery and development in Africa. Particularly interventions like the Prevention of Mother-to-Child Transmission (PMTCT) show promise for such recommendations. PMTCT major aims are: 1) Primary prevention of HIV infection among women of reproductive age; 2) Prevention of UIP among women living with HIV; 3) Prevention of HIV transmission from women living with HIV to their children; 4) Provision of care, treatment, and support to mothers living with HIV, their children and families. PMTCT has also recently recommended lifelong antiretroviral treatment (ART) or 'Option B+' to all HIV women

who are pregnant or breastfeeding. Currently PMTCT covers nearly 65% of Sub-Saharan Africa. African countries should further expand upon such family planning interventions in order to advance maternal and child health, prevent HIV transmission, and moderate demographic trends (1).

*Health, Social, and Economic Consequences of Unintended Pregnancy*

As indicated by PMTCT recommendations, the decrease of UIP rates is critical to improving the overall reproductive health of sub-Saharan Africa populations, especially among PLWA. The short and long-term effects of UIP can be detrimental to both mother and child and the community at large. Previous studies show that women who have an UIP are more likely to newly acquire HIV (3, 4), not obtain timely prenatal care and to engage in risky behaviors (i.e. poor physical exercise, alcoholic drinking, smoking, and eating habits) which compromise the health of their child (5). Low birth weight or premature birth thus can result from such poor prenatal or perinatal care habits and can lead to early child death or later developmental and educational learning problems (5). Negative health consequences of UIP can limit the child's opportunities for mobility in school, within their career, and future socioeconomic status. Moreover the stress of UIP can have harmful mental health effects on the mother, increase the likeliness of abortion, and could possibly cause strains in the future relationship between mother and child (5). High rates of UIP in South Africa can ultimately drive increased maternal and child mortality, increase medical costs or need within communities, promote more rapid population growth and poverty across regions (6).

*Health, Social, and Economic Consequences of Mother-to-Child Transmission*

When adhered to PMTCT interventions can reduce HIV mother-to-child transmission (MTCT) risk to about 5%. (1). Such findings are important to high HIV prevalent regions like Sub-Saharan Africa considering the negative health consequences of MTCT. MTCT can greatly influence the quality of life of children who are infected, especially when intersecting with living in high poverty regions. Malnutrition and infectious disease are already a major concern for several sub-Saharan African children (7). However scientists show when a HIV infected child is malnourished this can heighten the progression of their disease and increase their likeliness of acquiring other infections. HIV MTCT can further impact the child's school attendance, increase their likeliness of losing a parent, and limit their life expectancy. Likewise the costs to treat and care for an HIV infected child and mother is an avoidable burden to sub-Saharan African countries. Shortage in resources to treat (i.e. hospital equipment, workers, medicine, funding etc.), lack of mental health services, and limited medical space make it difficult to control HIV and the overall health of infected populations. Like UIP, MTCT can thus also impact sub-Saharan Africa's development of households, population education status, productivity, maternal and child mortality rates and promote increased poverty within the region (7).

*Cost Effectiveness of PMTCT Prong 2*

From 2001 to 2010 PMTCT expansion has helped facilitate a 30% decrease in new HIV diagnoses seen among sub-Saharan African children (2). By focusing on HIV and UIP prevention in women of child bearing age PEPFAR predicts that PMTCT aims provide the most cost-effective solution to child HIV prevention (2). The cost

effectiveness of implementing PMTCT interventions within sub-Saharan Africa has been documented by many analysts (8). Within this region PMTCT spends an average of $64 per HIV mother to child transmission (MTCT) averted (8). HIV MTCT averted by PMTCT planning for UIP are largely driven by a countries ability to meet family planning needs including contraception (9). Moreover at $61 per birth averted and $359 per HIV MTCT averted about 423,000 UIP cases can be prevented when all family planning needs are met for HIV positive women (10). However the UNAIDS notes that approximately 25% of sub-Saharan women have unmet family planning needs of which many are predicted to be HIV positive (9).

*HIV & Fertility Prevention Needs in Zambia*

Zambia, a country within the Sub-Saharan region, is an important site for further HIV research and intervention in UIP and MTCT within HIV infected populations. Zambia currently has over 1 million prevalent HIV cases for a country-wide prevalence of 13% (11). Within this region urban HIV prevalence is about 23.1% (vs 10.8% in rural areas) (12). Across genders, when compared to men HIV prevalence is higher among Zambian women (12.3% vs 16.1%, respectively), especially for women in the 15-24 age group (8.9% vs 4.2%) (12) (13). HIV diagnoses in persons of reproductive age are also particularly high (11). The lowest Zambia TFR of 5.2 was recorded from 2003-2009. However, the TFR has increased in recent years to 6.1 in 2010 and 6.0 in 2011 (14). Even more about 27% of married Zambian women report having unmet family planning needs (13) and UIP (40%). Although recently Zambia's adopted PMTCT Option B+ to support the health of pregnant women, large orphan AIDs populations (about 600,000) and current HIV MTCT transmission figures (12%) emphasize areas for improved family

planning efforts and PMTCT implementation within HIV infected Zambian populations (12, 13).

*The Importance of Discordant Couples*

About 70-90% of incident sub-Saharan Africa adult HIV infections occur among married or co-inhabiting couples (15). Within this proportion an estimated 55-92% of new HIV cases are predicted to have transpired in discordant relationships (16). Although PLWA are increasingly involved in committed relationships (17, 18), few studies focus on improving contraceptive methods (i.e. use of modern forms, continuation, uptake, and access) across couples, and in particular discordant couples (19). WHO defines a discordant couple as "two persons in an ongoing sexual relationship" in which "one partner is HIV infected and the other is not" (20). Such populations have increased risk for partner HIV transmission, unintended pregnancy, and mother-to-child HIV acquisition. Studying trends in contraceptive use, rate of uptake across different forms, reasons for uptake and discontinuation among serodiscordant relationships may thus be important to strengthening UIP and MTCT interventions within sub-Saharan HIV populations.

*Contraception Review*

Previous studies have identified several possible predictors of contraception use among couples. Specifically among couples contraception engagement has been found to be influenced by cultural norms, gender power imbalances, monogamy agreements, fertility desires and consequent low risk perception due to intimacy (18, 21). Although in comparison predictors have not been frequently investigated, contraception use among discordant HIV couples have been found to be associated with having at least 1 child,

family home location, family planning counseling attendance, and access to contraception (22, 23).

Short-term effectiveness and inconsistent use are key drawbacks to the sole use of condoms for pregnancy prevention (24-26) especially within high risk populations such as couples (21). In general barriers to consistent condom use and overall contraceptive trends within sub-Saharan Africa populations have been largely impacted by unpredictable changes in employment, living in rural areas, transportation limitations, and several other social and infrastructural factors (27-31). Moreover study cohorts with HIV positive women have also shown that low desire for children within discordant partnerships is not necessarily associated with more frequent condom use and reduced pregnancy rates (32, 33). For example Wall's et al study among a cohort of HIV positive couples receiving a family planning intervention in Zambia showed that rates (in couple years (CY)) of UIP were highest for couples who used condoms only (26.4/100CY) or oral contraceptive pills (20.7/100CY) and lowest among those using injectables (0.7/100CY) and intrauterine device (IUD) (1.6/100CY) users. No pregnancies occurred among contraceptive implant users or after tubal ligation (34). Such findings highlight that expansion of modern contraceptive (i.e. IUDs, injectables, sterilization etc.) or long-acting reversible contraceptive (LARC) practices can encourage greater contraception effectiveness in pregnancy prevention for HIV discordant couples who wish to delay or limit fertility. Increased use of long-term contraception methods can also help to combat issues with condom use consistency.

Modern contraceptive practices have increasingly been promoted within reproductive healthcare, especially among adolescents (35). However despite increased

advocacy and its noted benefits to pregnancy prevention among women, in 2012 it was found that although 42% of sub-Saharan women of reproductive age wanted to avoid pregnancy only 17% were actively using modern contraceptives (6). Large sub-Saharan HIV child and discordant couple populations within poverty stricken, high HIV prevalent regions suggest a need for more modern contraception use and interventions which focus on reproductive health in conjunction with STI prevention.

### *Cost-Effectiveness of Unintended Pregnancy Prevention via the Different Contraceptive Methods*

HIV MTCT and UIP can greatly be reduced by solely meeting unmet contraception needs of sub-Saharan couples (6). Contraception effectiveness and unmet need for modern contraception play a major role in estimating the overall cost effectiveness of PMTCT prevention efforts and for meeting PMTCT aims. In 2012 it was predicted that modern contraceptives could have prevented 12 million UIPs, 4 million abortions, 2 million miscarriages, about 7 million unplanned births and 35,000 maternal deaths in sub-Saharan Africa. Moreover By addressing the over 53 million sub-Saharan Africans with unmet contraceptive family planning needs an estimated $1.30 would be saved for every dollar invested (6).

# JOURNAL ARTICLE

## Introduction

Considering economical/societal consequences of UIP, HIV transmission, and MTCT, dual contraceptive methods have been recommended as a more reliable form of protection for simultaneous prevention of UIP and HIV transmission among women with and at-risk of HIV (36). Dual contraceptive use includes the use of condoms for HIV prevention in addition to a modern method (36). Considering the high transmission risk associated with HIV discordant couples and the high rate of UIP among couples, promotion of dual contraception use could be key to prevent both vertical and horizontal transmission.

Although dual contraception is cost-effective and highly recommended among high risk STI populations, previous studies show that there is a gap in promoting its use (37). Primarily few behavioral interventions integrate reproductive health needs within prevention campaigns to high risk HIV populations (38). Despite condom use being frequently reported as a common means of STI protection among HIV positive women (37, 39-42) across high risk populations dual contraception use is considerably low (<25%) (37, 41, 43-49) especially within long-term partnerships (44). However compared to HIV negative females, interventions have had greater success in influencing dual contraception or contraceptive use among HIV positive females (22, 39, 42, 50, 51). Studies have found that predictors of dual contraception among HIV positive women use include: being on ART treatment (52), being female (37, 43, 46) , comfortable asking a partner to use a condom (37), having more intercourse in the past month (46), awareness (35, 44), lower SES (46), having concurrent partners (46) and communication with a

health care provider about family planning (37, 50, 53). Continuing efforts to meet and expand PMTCT aims within sub-Saharan Africa warrant further exploration and research aimed at finding associations and trends related to dual contraception use among PLWA (54).

Besides the primary use of condoms (40.8%), about 20-32.7% of Zambia couples report use modern contraceptives (23, 32, 48). Specifically about 12% of married Zambian women reported using the pill, 19 % used injectables, 6% used implants, 1% used IUDs, 4% used condoms, and 51% weren't using any form of contraception (55). Being that few studies have investigated contraceptive use among HIV discordant couples (22) and that Zambia is disproportionately affect by both UIP and HIV further investigation of predictors associated with dual-contraceptive methods among discordant couples can thus inform targeted development and promotion of this strategy for HIV and unintended pregnancy prevention.

## Methods

### *Ethics*

Written informed consent was obtained from all participants and the study was approved by the IRBs at Emory University and the University of Zambia.

### *Participants*

Community promoters in Lusaka, Zambia invited married or cohabiting couples to attend couples' voluntary HIV counseling and testing (CVCT) services (56-58)which include group counseling, rapid HIV testing, and post-test couples counseling (59, 60).

HIV serodiscordant couples (in which the man is HIV-positive and the woman HIV-negative (M+F-) or the man is HIV-negative and the woman HIV-positive (M-F+)) were invited into a longitudinal cohort study with open enrollment between 1994-2012.

### *Exposures*

For this analysis, the following demographic variables included as potential predictors of dual contraception use were collected at baseline: man and woman age; number of years the couple has been living together; monthly income; literacy in Nyanja (the primary language of the region); alcohol use; number of previous pregnancies, pregnancy status, fertility intentions, number of previous sexual partners, STI history, HSV-2 status and whether the male partner was circumcised. HIV clinical stage and viral load data were collected from all HIV positive participants. Post-partum pregnancy status was measured as a time-varying variable (at each study visit) and was defined as periods up to 6 months after the end of a pregnancy.

*Outcome of interest*

Dual contraception use was defined as having no indication of unprotected sex (as indicated by having no sperm on a wet prep during a study visit, no seroconversion detected during a study visit, no incident pregnancy since the last study visit, no self-reported unprotected sex since the last study visit, and no incident STI detected during the study visit) and use of one of the following contraceptive methods during the study interval: OCPs, implant, IUD, injectables, permanent method). Contraceptive methods were provided at the research site. Incident STIs included gonorrhea, trich, chlamydia, herpes, syphilis.

*Data analysis*

We described the outcome of interest stratified by the gender of the HIV-positive partner using counts and percentages for the outcome itself, and the variables comprising the outcome, across all study intervals. P-values were determined using Pearson chi-square tests (Table 1). Univariate analyses were then used to find means, counts and percentages of all predictor variables (Table 2). The crude association with the exposures of interest and the dual-method use outcome were evaluated using Andersen-Gill models using a counting process approach with robust estimation to account for recurrent outcomes and for correlated observations (61) stratified by the gender of the HIV-positive partner.

Regression analysis based on the Cox model was used to measure associations between time-independent predictor variables and dual contraception across strata. The extended Cox model was used to find associations between time varying predictor

variables and dual contraception. Wald chi-square statistic p-values were used to test the significance of all calculations (Table 2).

Using forward selection and backward elimination techniques, across genders interaction was assessed between the following predictor variables: age, alcohol use, history of STI and lifetime sex partners; pregnancy status, pregnancy history and partner fertility intentions; male circumcision status and STI history; and monthly income and HIV clinical stage.

Multivariate models were built using exposures that were significant in the univariate analyses, and model variables were assessed for multi-collinearity (condition indices >30 and variance decomposition proportions >0.5) (Table 3a and Table 3b). The proportional hazards assumption was confirmed for time-independent model variables using graphical methods and statistical tests. Crude hazards ratios (cHRs) and adjusted hazards ratios (aHRs) are presented for univariate and multivariate associations, respectively. Data analysis was conducted with SAS v9.3 (Cary, NC).

## Results

*Outcome of interest*

Descriptive statistics revealed that among all couples (N=1393 M+F- and N = 1656 M-F+ couples), 13% of study participants reported dual contraception use since the last study visit. The majority (62%) of study participants either used condoms alone or no form of contraception during sexual intercourse. Accordingly about 62% of participants reported having unprotected sex since the last study visit. Injectables and OCPs were the second most common forms of protection used by couples (14% each). Implants (6%), IUDs (2%) and permanent contraception methods (1%) were reported the least by couples.

Contraception methods were significantly different across HIV positive male and HIV positive female discordant couples ($p<.0001$). HIV positive female couples reported lower uses of implants, IUDs, and permanent contraception methods and higher uses of condoms alone or no contraception method. Frequency of unprotected sex was also higher among HIV positive female couples ($p= .0205$) (See Table 1).

*Univariate results*

Among fixed continuous covariates and predictor variables the average age was 35.22 years (sd=8.11) among men, 28.48 years (sd= 6.76) among women, average number of years couples had cohabited was 7.13 (sd= 6.24) and the average family income was $79.53 (sd= 98.57). Most women could not easily read Nyanja, the primary language of the region (76.20%) and most did not drink alcohol in the past year (79.80%). Contrastingly more men reported reading Nyanja (43.80%) and engaging in alcohol consumption (70.30%) .

Within HIV positive female discordant couples increasing number of previous pregnancies (p=.0035), greater numbers of male (p=.0041) sex partners, fewer female (p=.0064) lifetime sex partners, having a male partner who had no STI within the last year (p=.0448), and not being post-partum (p=.0240) versus post-partum and were significantly associated with dual methods use. Also compared to those who wanted children within the next year, having a male (p=.0046) or female (p=.0046) partner who was not sure of or who had no fertility desires predicted dual contraceptive use. No demographic or clinical variables were associated with dual contraception among this group. Female baseline pregnancy status and number of male and female last year sex partners were also not associated with the outcome (See Table 2a).

Results show that among HIV positive male discordant couples male alcohol consumption within the last year (p=.0267), increased number of previous pregnancies (p=.0358), decreased female fertility intentions (p=.0118), and not being of post-partum status (p=.0004) versus post-partum were associated with dual contraception use. All other demographic and clinical variables were not associated dual contraception use for such couples. Baseline pregnancy, male fertility intentions, number of sex partners, and STI history were also not associated with dual contraception for HIV positive male discordant couples (See Table 2b).

*Multivariate results*

In a third phase of data analysis, forward selection methods found 3 possible 'best' models for prediction of dual contraception use among female HIV positive couples. Model 1 includes increasing number of previous female pregnancies, decreasing number of female lifetime sex partners, increasing number of male lifetime sex partners,

male partner not having a STI within the last year and female being post-partum (vs not post-partum) as predictors for dual contraception. Model 2 includes increasing number of male lifetime sex partners, male reporting having a STI in the previous year, female being post-partum, and the male wanting a child within the next year.

Similarly among male HIV positive couples 3 possible ‘best’ models were found to predict dual contraception use: Model 1included male alcohol consumption within the last year, decreasing number of female lifetime sex partners, increasing number of male lifetime sex partners, decreasing female fertility intentions, and female being of post-partum status; and Model 2 included decreasing number of female lifetime sex partners, increasing number of male lifetime sex partners, female being post-partum, and decreasing fertility intentions of both male and female. All final parameter estimates for the ‘best’ model can be seen in Table 4.

Overall model 2 was chosen as the ‘best’ models, respectively, for predicting dual contraception use among both HIV positive female and HIV positive male discordant couples. Model 2 in both discordant scenarios had the lowest AICs compared to other possible models for dual contraception (See Table 3a and Table 3b).

**Discussion**

Overall dual contraception was low among this cohort. Coinciding with previous literature there was a high use of condoms and low use of LARCs across participants (37, 42, 47). Results from this study indicate that predictor's of dual contraception use among HIV discordant couples slightly differ depending upon whether the male or female counterpart is positive. Specifically higher number of male lifetime partners, lower female lifetime partners, male not having a STI in the last year, and male fertility intentions only predicted dual contraception use among HIV female positive couples. Moreover male alcohol consumption predicted dual contraception use among HIV positive male couples. These results indicate that outside of PMTCT goals, there is a need for greater Zambia HIV prevention and family planning efforts which target and reach men. Females who reported having a desire to have a child within the next year, who had lower number of previous pregnancies, and who were post-partum for up to six months were less likely to engage in dual contraception across both strata. Such findings indicate that in order to avoid HIV transmission to partner, MTCT, and UIP there is a need for greater family planning with emphasis on the importance of condom use immediately after pregnancy. As PMTCT goals indicate expanded antiviral treatment for high risk HIV or HIV infected women of childbearing age is also needed. With further research, HIV interventions targeting both HIV and UIP could potentially consider such similarities and differences of dual contraception use within discordant couples in future efforts. Final best models chosen in this study for both HIV positive female and HIV positive male discordant couples again highlight the possible importance of aforementioned factors.

Although this study had a large sample size many limitations still exist. Primarily there may be discrepancies in self-reported and actual condom/dual contraception use among couples. In Table 1 it can be seen that although many couples reported using condoms alone or no methods of contraception with their partner fewer couples admitted to having unprotected sex. Greater feelings of trust needs to be established between couples and intervention workers in order to encourage them to report risky sexual behaviors. Findings still however highlight the need for sustainable contraception methods. Many couples when asked separately about their fertility intentions reported that they did not want children, however they falsely assumed that their partner wanted more children. As seen in previous research, such false assumptions about their partner could have impacted their response to other study questions and also could influence their willingness to engage in dual contraception and other risky behaviors (37). Findings thus indicate a need for family planning to facilitate greater communication within couples about fertility intentions.

## Conclusions

Results of this study highlight high risk behaviors among Zambian discordant couples which warrant increased dual contraception promotion. Findings suggest that UIP and HIV prevention needs should be prioritized and incorporated within family planning and STI interventions, especially among risk populations such as discordant couples. Final 'best' model selection show that males and post-partum female populations are particularly important groups to advocate increased dual contraception use. Final models also show that increasing fertility desires across HIV discordant couples require expanded family planning outreach. More research into predictors of dual contraception use among this cohort is planned.

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Tables 1. Outcome of Interest

| Measures of dual method use | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | All couples | | M-F+ | | | M+F- | | | p-value |
| | N intervals | % | N intervals | row % | col % | N intervals | row % | col % | |
| OUTCOME | | | | | | | | | |
| **DUAL METHOD USE#** | | | | | | | | | 0.2957 |
| Yes | 2220 | 13% | 1134 | 51% | 12% | 1086 | 49% | 13% | |
| No | 15417 | 87% | 8058 | 52% | 88% | 7359 | 48% | 87% | |
| COMPONENT VARIABLES | | | | | | | | | |
| **Contraceptive method use** | | | | | | | | | **<.0001** |
| None/condoms alone | **17246** | **62%** | 8695 | 50% | 64% | 8551 | 50% | 61% | |
| Implant | 1735 | 6% | 726 | 42% | 5% | 1009 | 58% | 7% | |
| Injectables | 3813 | 14% | 1873 | 49% | 14% | 1940 | 50% | 14% | |
| IUD | 647 | 2% | 207 | 32% | 2% | 440 | 68% | 3% | |
| OCP | 3890 | 14% | 1920 | 49% | 14% | 1970 | 51% | 14% | |
| Permanent method | 398 | 1% | 176 | 44% | 1% | 222 | 56% | 2% | |
| **Unprotected sex*** | | | | | | | | | |
| Yes | **11025** | **62%** | 5859 | 53% | 62% | 5166 | 47% | 61% | **0.0205** |
| No | **6753** | **38%** | 3468 | 51% | 38% | 3285 | 49% | 39% | |

#Defined as having no indication of unprotected sex* (as indicated by no sperm on a wet prep, no seroconversion, no incident pregnancy, no self-reported unprotected sex, and no incident STI during the study intervals) and any contraceptive method used duing the study interval except none/condoms (OCPs, implant, IUD, injectables, permanent method)

STIs: gonorrhea, trich, chlamydia, herpes, syphilis

Table 2a. Univaritate and Multivariate Analysis (M-F+)

| Unadjusted associations between fixed covariates and predcitors of any dual method use | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | All couples | | M-F+ | | | | | |
| Variables | N intervals | % | N intervals | % | HR | 95%CI | | p-value (2- |
| **Demographics** | | | | | | | | |
| Man age (mean, SD) | 35.22 | 8.11 | 35. 27 | 8.6 | 0.997 | 0.983 | 1.011 | 0.6886 |
| Woman age (mean, SD) | 28.48 | 6.76 | 28.58 | 6.68 | 0.992 | 0.975 | 1.009 | 0.3672 |
| Age disparity (mean, SD) | 6.995 | 4.77 | 6.98 | 5.07 | 1.006 | 0.984 | 1.028 | 0.5915 |
| Years cohabiting (mean, SD) | 7.13 | 6.24 | 6.11 | 5.77 | 1.016 | 0.997 | 1.035 | 0.0934 |
| Monthly family income (USD) (mean, SD) | 79.58 | 98.57 | 75.58 | 91.97 | 0.999 | 0.998 | 1.001 | 0.2562 |
| Woman reads Nyanja | | | | | | | | |
| Yes, easily | 6641 | 23.80% | 3368 | 12.07% | 1.043 | 0.797 | 1.365 | 0.7596 |
| With difficulty/not at all | 21263 | 76.20% | 10491 | 37.60% | ref | ref | ref | ref |
| Man reads Nyanja | | | | | | | | |
| Yes, easily | 12210 | 43.80% | 5797 | 20.80% | 1.069 | 0.828 | 1.381 | 0.6075 |
| With difficulty/not at all | 15666 | 56.20% | 8052 | 28.89% | ref | ref | ref | ref |
| Woman alcohol use last year | | | | | | | | |
| Yes | 5605 | 20.20% | 3269 | 11.78% | 0.912 | 0.698 | 1.192 | 0.501 |
| No | 22139 | 79.80% | 10530 | 37.95% | ref | ref | ref | ref |
| Man alcohol use last year | | | | | | | | |
| Yes | 19453 | 70.30% | 10146 | 36.67% | 0.913 | 0.69 | 1.209 | 0.4016 |
| No | 8217 | 29.70% | 3603 | 13.02% | ref | ref | ref | ref |
| Family planning and sexual history | | | | | | | | |
| Number of previous pregnancies (mean, SD) | 3.6 | 2.38 | 3.48 | 2.26 | 1.07 | 1.022 | 1.119 | **0.0035** |
| Pregnant at baseline (N, %) | | | | | | | | |
| Yes | 4397 | 15.51% | 2254 | 15.93% | 0.866 | 0.664 | 1.129 | 0.2865 |
| No | 23955 | 84.49% | 11899 | 84.07% | ref | ref | ref | ref |
| Fertility intentions of man (N, %) | | | | | | | | |
| Yes, next year | 1654 | 15.37% | 1045 | 17.47% | 0.444 | 0.253 | 0.779 | **0.0046** |
| Yes, but not next year | 3867 | 35.95% | 2350 | 39.28% | 0.893 | 0.596 | 1.338 | 0.5824 |
| Don't know/No | 5237 | 48.68% | 2587 | 43.25% | ref | ref | ref | ref |
| Fertility intentions of woman (N, %) | | | | | | | | |
| Yes, next year | 2413 | 20.35% | 1466 | 22.60% | 0.537 | 0.35 | 0.826 | **0.0046** |
| Yes, but not next year | 2716 | 22.91% | 1609 | 24.80% | 1.056 | 0.722 | 1545 | 0.7797 |
| Don't know/No | 6728 | 56.74% | 3412 | 52.60% | ref | ref | ref | |
| Woman lifetime sex partners (mean, SD) | 3.29 | 7.04 | 3.94 | 9.53 | 0.92 | 0.867 | 0.977 | **0.0064** |
| Woman last year sex partners (mean, SD) | 1.09 | 0.54 | 1.13 | 0.66 | 0.912 | 0.712 | 1.167 | 0.537 |
| Woman history of STI last year | | | | | | | | |
| Yes | 9806 | 34.59% | 6007 | 42.44% | 0.84 | 0.644 | 1.096 | 0.198 |
| No | 18542 | 65.41% | 8146 | 57.56% | ref | ref | ref | ref |
| Man lifetime sex partners (mean, SD) | 11.05 | 15.34 | 11.01 | 17.04 | 1.005 | 1.002 | 1.008 | **0.0041** |
| Man last year sex partners (mean, SD) | 1.71 | 1.75 | 1.64 | 1.76 | 0.955 | 0.87 | 1.049 | 0.3347 |
| Man history of STI last year | | | | | | | | |
| Yes | 9921 | 35.00% | 4101 | 28.98% | 0.756 | 0.575 | 0.993 | **0.0448** |
| No | 18426 | 65.00% | 10051 | 71.02% | ref | ref | ref | ref |
| **Clinical** | | | | | | | | |
| HIV stage of positive partner | | | | | | | | |
| Stage I | 9674 | 34.12% | 5746 | 40.60% | 1.016 | 0.45 | 2.294 | 0.9692 |
| Stage II | 9686 | 34.16% | 4469 | 31.58% | 1.052 | 0.465 | 2.379 | 0.9032 |
| Stage III | 7101 | 25.05% | 3274 | 23.13% | 0.8 | 0.346 | 1.888 | 0.6011 |
| Stage IV | 1891 | 6.67% | 664 | 4.69% | ref | ref | ref | ref |
| Log viral load of positive partner, log10 copies/ml (mean, SD) | 4.5 | 0.9 | 4.28 | 0.9 | 0.985 | 0.782 | 1.241 | 0.8974 |
| Circumcised male partner | | | | | | | | |
| Yes | 3766 | 13.31% | 2352 | 16.65% | 1.219 | 0.914 | 1.625 | 0.1777 |
| No | 24539 | 86.69% | 11777 | 83.35% | ref | ref | ref | ref |
| HSV-2 status (woman) | | | | | | | | |
| Positive | 15659 | 81.29% | 8535 | 87.02% | 1.636 | 0.413 | 6.485 | 0.4836 |
| Negative | 2155 | 11.19% | 797 | 8.13% | 1.654 | 0.401 | 6.82 | 0.4848 |
| Discrepant | 1355 | 7.03% | 476 | 4.85% | ref | ref | ref | ref |
| HSV-2 status (man) | | | | | | | | |
| Positive | 11203 | 58.67% | 4156 | 44.62% | 0.817 | 0.376 | 1.77 | 0.6102 |
| Negative | 5120 | 26.81% | 3538 | 37.98% | 0.698 | 0.321 | 1.52 | 0.3651 |
| Discrepant | 2642 | 13.84% | 1621 | 17.40% | ref | ref | ref | ref |
| **Time-Varying Variables** | | | | | | | | |
| Post-partum (up to 6 months post-delivery) | | | | | | | | |
| Yes | 932 | 3% | 368 | 2.60% | 0.588 | 0.371 | 0.932 | **0.0239** |
| No | 27420 | 97% | 13785 | 97.40% | ref | ref | ref | ref |
| USD: United States Dollar; OCP: oral contraceptive pill; IUD: copper intrauterine device; STI: sexually transmitted infection | | | | | | | | |
| Fertility intentions collected from 2002-2011 | | | | | | | | |
| VL collected from 1999 | | | | | | | | |

Table 2b. Univaritate and Multivariate Analysis (M+F-)

| Unadjusted associations between fixed covariates and predcitors of any dual method use | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | All couples | | M+F- | | | | | |
| Variables | N intervals | % | N intervals | % | HR | 95%CI | | p-value (2- |
| **Demographics** | | | | | | | | |
| **Man age (mean, SD)** | 35.22 | 8.11 | 35. 16 | 7.6 | 1.001 | 0.986 | 1.017 | 0.8687 |
| **Woman age (mean, SD)** | 28.48 | 6.76 | 28.38 | 6.83 | 0.994 | 0.976 | 1.012 | 0.5129 |
| **Age disparity (mean, SD)** | 6.995 | 4.77 | 6.92 | 4.45 | 1.017 | 0.994 | 1.04 | 0.1448 |
| **Years cohabiting (mean, SD)** | 7.13 | 6.24 | 8.13 | 6.51 | 1.012 | 0.994 | 1.031 | 0.2016 |
| **Monthly family income (USD) (mean, SD)** | 79.58 | 98.57 | 83.54 | 104.55 | 0.999 | 0.998 | 1 | 0.2864 |
| **Woman reads Nyanja** | | | | | | | | |
| Yes, easily | 6641 | 23.80% | 3273 | 49.28% | 0.989 | 0.742 | 1.319 | 0.9423 |
| With difficulty/not at all | 21263 | 76.20% | 10772 | 50.66% | ref | ref | ref | ref |
| **Man reads Nyanja** | | | | | | | | |
| Yes, easily | 12210 | 43.80% | 6413 | 52.51% | 0.942 | 0.744 | 1.192 | 0.6174 |
| With difficulty/not at all | 15666 | 56.20% | 7614 | 48.60% | ref | ref | ref | ref |
| **Woman alcohol use last year** | | | | | | | | |
| Yes | 5605 | 20.20% | 2336 | 52.44% | 0.895 | 0.647 | 1.238 | 0.5029 |
| No | 22139 | 79.80% | 11609 | 41.68% | ref | ref | ref | ref |
| **Man alcohol use last year** | | | | | | | | |
| Yes | 19453 | 70.30% | 9307 | 47.84% | 1.326 | 1.033 | 1.702 | **0.0267** |
| No | 8217 | 29.70% | 4614 | 56.16% | ref | ref | ref | ref |
| **Family planning and sexual history** | | | | | | | | |
| **Number of previous pregnancies (mean, SD)** | 3.6 | 2.38 | 3.7 | 2.48 | 1.053 | 1.003 | 1.105 | **0.0358** |
| **Pregnant at baseline (N, %)** | | | | | | | | |
| Yes | 4397 | 15.51% | 2143 | 15.09% | 1.21 | 0.908 | 1.612 | 0.1925 |
| No | 23955 | 84.49% | 12056 | 84.91% | ref | ref | ref | ref |
| **Fertility intentions of man (N, %)** | | | | | | | | |
| Yes, next year | 1654 | 15.37% | 609 | 12.75% | 0.453 | 0.202 | 1.017 | 0.055 |
| Yes, but not next year | 3867 | 35.95% | 1517 | 31.76% | 0.688 | 0.423 | 1.12 | 0.133 |
| Don't know/No | 5237 | 48.68% | 2650 | 55.49% | ref | ref | ref | ref |
| **Fertility intentions of woman (N, %)** | | | | | | | | |
| Yes, next year | 2413 | 20.35% | 947 | 17.64% | 0.392 | 0.189 | 0.813 | **0.0118** |
| Yes, but not next year | 2716 | 22.91% | 1107 | 20.61% | 0.565 | 0.358 | 0.892 | **0.0142** |
| Don't know/No | 6728 | 56.74% | 3316 | 61.75% | ref | ref | ref | ref |
| **Woman lifetime sex partners (mean, SD)** | 3.29 | 7.04 | 2.64 | 2.77 | 0.982 | 0.93 | 1.036 | 0.5037 |
| **Woman last year sex partners (mean, SD)** | 1.09 | 0.54 | 1.04 | 0.39 | 1.006 | 0.844 | 1.2 | 0.9444 |
| **Woman history of STI last year** | | | | | | | | |
| Yes | 9806 | 34.59% | 3799 | 26.76% | 1.219 | 0.912 | 1.63 | 0.1806 |
| No | 18542 | 65.41% | 10396 | 73.24% | ref | ref | ref | ref |
| **Man lifetime sex partners (mean, SD)** | 11.05 | 15.34 | 11.1 | 13.4 | 1.005 | 0.995 | 1.015 | 0.3596 |
| **Man last year sex partners (mean, SD)** | 1.71 | 1.75 | 1.78 | 1.74 | 0.941 | 0.868 | 1.02 | 0.1385 |
| **Man history of STI last year** | | | | | | | | |
| Yes | 9921 | 35.00% | 5820 | 41.00% | 1.009 | 0.784 | 1.299 | 0.9419 |
| No | 18426 | 65.00% | 8375 | 59.00% | ref | ref | ref | ref |
| **Clinical** | | | | | | | | |
| **HIV stage of positive partner** | | | | | | | | |
| Stage I | 9674 | 34.12% | 3928 | 27.66% | 0.749 | 0.429 | 1.308 | 0.3101 |
| Stage II | 9686 | 34.16% | 5217 | 36.74% | 0.865 | 0.5 | 1.498 | 0.6055 |
| Stage III | 7101 | 25.05% | 3827 | 26.95% | 0.741 | 0.424 | 1.296 | 0.2937 |
| Stage IV | 1891 | 6.67% | 1227 | 8.64% | ref | ref | ref | ref |
| **Log viral load of positive partner, log10 copies/ml (mean, SD)** | 4.5 | 0.9 | 4.73 | 0.84 | 0.954 | 0.792 | 1.149 | 0.6181 |
| **Circumcised male partner** | | | | | | | | |
| Yes | 3766 | 13.31% | 1414 | 9.97% | 0.758 | 0.54 | 1.064 | 0.1096 |
| No | 24539 | 86.69% | 12762 | 90.03% | ref | ref | ref | ref |
| **HSV-2 status (woman)** | | | | | | | | |
| Positive | 15659 | 81.29% | 7124 | 76.10% | 0.864 | 0.338 | 2.209 | 0.7595 |
| Negative | 2155 | 11.19% | 1358 | 14.51% | 1 | 0.372 | 2.687 | 0.9998 |
| Discrepant | 1355 | 7.03% | 879 | 9.39% | ref | ref | ref | ref |
| **HSV-2 status (man)** | | | | | | | | |
| Positive | 11203 | 58.67% | 7047 | 73.03% | 1.532 | 0.343 | 6.84 | 0.5765 |
| Negative | 5120 | 26.81% | 1582 | 16.39% | 1.955 | 0.433 | 8.83 | 0.3836 |
| Discrepant | 2642 | 13.84% | 1021 | 10.58% | ref | ref | ref | ref |
| **Time-Varying Variables** | | | | | | | | |
| **Post-partum (up to 6 months post-delivery)** | | | | | | | | |
| Yes | 932 | 3% | 564 | 3.97% | 0.496 | 0.335 | 0.734 | **0.0004** |
| No | 27420 | 97% | 13635 | 96.03% | ref | ref | ref | ref |
| USD: United States Dollar; OCP: oral contraceptive pill; IUD: copper intrauterine device; STI: sexually transmitted infection | | | | | | | | |
| Fertility intentions collected from 2002-2011 | | | | | | | | |
| VL collected from 1999 | | | | | | | | |

Table 3a. Best Model Predictions (M-F+)

| Multivariate model of predictors of time to dual method use | | | | | |
|---|---|---|---|---|---|
| | **M-F+** | | | | |
| **No. events:** | | | | | |
| **AIC fit statistic:** | | | | | |
| | **aHR** | **95%CI** | | **p-value** | **AIC** |
| **Model 1** | | | | | 9160.7 |
| **Variables** | | | | | |
| **Number of previous pregnancies** | 1.063 | 1.039 | 1.087 | <.0001 | |
| **Woman lifetime sex partners** | 0.922 | 0.893 | 0.953 | <.0001 | |
| **Man lifetime sex partners** | 1.004 | 1.003 | 1.006 | <.0001 | |
| **Man history of STI last year** | | | | | |
| Yes | 0.74 | 0.633 | 0.864 | 0.0001 | |
| No | ref | ref | ref | ref | |
| **Post-partum (up to 6 months post-delivery)** | | | | | |
| Yes | 1.525 | 1.018 | 2.284 | 0.0407 | |
| No | ref | ref | ref | ref | |
| | | | | | |
| | | | | | |
| **Model 2** | | | | | 3580.64 |
| **Variables** | | | | | |
| **Fertility intentions of man (N, %)** | | | | | |
| Yes, next year | 0.467 | 0.325 | 0.672 | <.0001 | |
| Yes, but not next year | 0.854 | 0.704 | 1.036 | 0.1102 | |
| Don't know/No | ref | ref | ref | ref | |
| **Man lifetime sex partners** | 1.006 | 1.004 | 1.007 | <.0001 | |
| **Man history of STI last year** | | | | | |
| Yes | 1.317 | 1.052 | 1.648 | 0.0163 | |
| No | ref | ref | ref | ref | |
| **Post-partum (up to 6 months post-delivery)** | | | | | |
| Yes | 2.063 | 1.124 | 3.785 | 0.0194 | |
| No | ref | ref | ref | ref | |

Table 3b. Best Model Predictions (M+F-)

| Multivariate model of predictors of time to dual method use | | | | | |
|---|---|---|---|---|---|
| | **M+F-** | | | | |
| **No. events:** | | | | | |
| **AIC fit statistic:** | | | | | |
| | **aHR** | **95%CI** | | **p-value** | **AIC** |
| **Model 1** | | | | | 3359.27 |
| **Variables** | | | | | |
| **Man alcohol use last year** | | | | | |
| Yes | 0.756 | 0.623 | 0.918 | 0.0048 | |
| No | ref | ref | ref | ref | |
| **Fertility intentions of woman (N, %)** | | | | | |
| Yes, next year | 0.362 | 0.266 | 0.494 | <.0001 | |
| Yes, but not next year | 0.597 | 0.464 | 0.768 | <.0001 | |
| Don't know/No | ref | ref | ref | ref | |
| **Man lifetime sex partners** | 1.01 | 1.004 | 1.015 | 0.0007 | |
| **Woman lifetime sex partners** | 0.892 | 0.835 | 0.952 | 0.0006 | |
| **Post-partum (up to 6 months post-delivery)** | | | | | |
| Yes | 5.506 | 2.019 | 15.013 | 0.0009 | |
| No | ref | ref | ref | ref | |
| | | | | | |
| | | | | | |
| **Model 2** | | | | | 2956.31 |
| **Fertility intentions of man (N, %)** | | | | | |
| Yes, next year | 0.662 | 0.442 | 0.992 | 0.0456 | |
| Yes, but not next year | 0.82 | 0.659 | 1.021 | 0.0762 | |
| Don't know/No | ref | ref | ref | ref | |
| **Fertility intentions of woman (N, %)** | | | | | |
| Yes, next year | 0.459 | 0.32 | 0.657 | <.0002 | |
| Yes, but not next year | 0.627 | 0.472 | 0.833 | 0.0013 | |
| Don't know/No | ref | ref | ref | ref | |
| **Man lifetime sex partners** | 1.01 | 1.005 | 1.015 | 0.0002 | |
| **Woman lifetime sex partners** | 0.918 | 0.862 | 0.976 | 0.0066 | |
| **Post-partum (up to 6 months post-delivery)** | | | | | |
| Yes | 5.316 | 1.961 | 14.412 | 0.001 | |
| No | ref | ref | ref | ref | |