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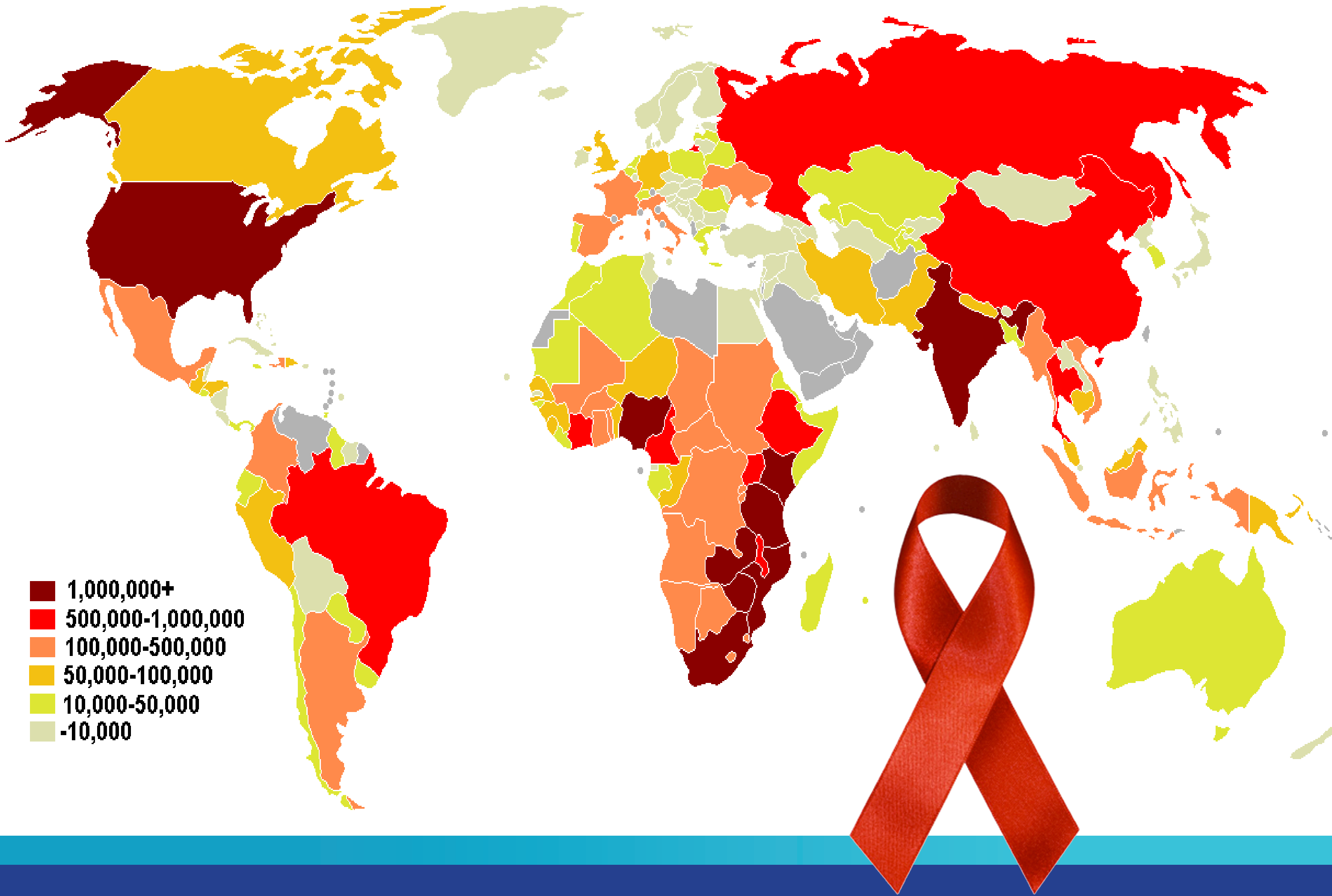
HIV/AIDS SERO-PREVALENCE AND SOCIOECONOMIC STATUS: Evidence from Uganda



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ABSTRACT

Although Uganda reported large reductions in HIV/AIDS prevalence during the 1990s, recent evidence suggests that country's rate of new HIV infections is on the rise. This study explores the factors that are correlated with sexual behavior and the risk of HIV infection using a unique dataset of 19,500 individuals from the 2011 Uganda AIDS Indicator Survey. This survey tested individuals 15-49 years of age for sexually transmitted infections, including the HIV virus. The same survey also collected background information for all tested individuals. This information is similar to what is collected in a typical demographic and health survey (DHS). We estimate probit models for the correlates of risky sexual behaviors that can lead to HIV infection such as: having concurrent sexual partners, no-condom use, and alcohol use during sex. In addition, we examine correlates of having been tested for HIV prior to the survey. Also, we estimate models for correlates of the risk of testing HIV positive as well as the self-assessed risks of contracting HIV. We find that higher education attainment and access to health facilities are important for adopting safe sexual behaviors as well as the reducing the risk of testing HIV positive. Among HIV infected couples, we find that women have a higher rate of discordance which is at odds with the low rates of self-reported extra marital sexual behavior.

1.0 INTRODUCTION/BACKGROUND

HIV/AIDS remains a significant development problem in sub-Sahara Africa (SSA), and understanding the factors that can halt the spread of the disease is both an economic and a public health priority. According to the joint United Nations Programme on AIDS (UNAIDS), at the end of 2011, an estimated 34 million persons were infected with HIV globally, and at least 69% of victims were in SSA—a region with only 12% of the global population (UNAIDS, 2012). Worse still, the region had 70% of the estimated 2.7 million new HIV infections during the same period. Clearly, the HIV/AIDS situation in SSA remains dire despite the increased resources devoted to control of the disease. In the literature, such risky sexual behaviors as having multiple sexual partners and not using a condom are highlighted as the main drivers of HIV infections. Among policymakers and researchers, it is now recognized that without sustained behavioral change, SSA is unlikely to reverse the tide of increasing HIV/AIDS infections. Although some studies have examined whether sexual behaviors are indeed changing due to HIV/AIDS (e.g. Glick and Sahn, 2008; Fortson, 2008), the evidence is still inconclusive, and many of the previous cross-country studies have been plagued by comparability issues.

This paper seeks to add to the existing evidence on this issue by studying the correlates of risk of HIV infection in Uganda, a country that is considered exemplary because of its proactive strategy for combating of the spread of HIV/AIDS. Uganda managed to reduce its HIV/AIDS prevalence rate from 30% in the early 1990s to approximately 6.4% by 2004/05 (Ministry of Health and ORC Macro, 2006); however by 2011, the HIV prevalence rate had increased to 7.3% (Ministry of Health et al, 2012). This reversal is partly attributed to the behavioral change campaign that was code named ABC—Abstinence, Being faithful and using Condoms. This campaign was implemented beginning in the late 1980s (Green *et al*., 2006). Furthermore, spending on new HIV/AIDS care and prevention programs has increased the overall significance of the health sector in Uganda's national budget. Between 1997/98 and 2001/02, health spending in Uganda averaged 7 % of the national budget (Government of Uganda, 2008). In contrast, for the periods 2002/03 and 2005/06, average health spending was more than 12 % of the national budget.[1] Indeed, the recent surge in health spending is attributed to the global initiative to combat the spread of HIV, which includes the Global Fund for AIDS, Malaria and Tuberculosis, the Global Alliance for Vaccines and Immunization (GAVI), and the US President's Emergency Plan for AIDS Relief (PEPFAR).

Although Uganda has achieved some commendable results in combating the spread of HIV/ AIDS, challenges remain. First, despite a significant decrease in the national HIV/AIDS prevalence rates, the country has failed to meet its own HIV targets. For example, the current Health

1 Actual spending on HIV/AIDS intervention programs increased from US$ 38.4 million in 2003/04 to US$ 170 million in 2006/07 (MFPED, UAC, and UNDP, 2008).

Sector Strategic Plan (HSSP) reports that the sero-prevalence among Ugandans has consistently remained above the national target of 5 % (Government of Uganda, 2010b). Second, in the recent past, the country has seen a reversal in the trend in new HIV infections. According to the Uganda AIDS Commission, the new infections rates nearly doubled from 73,000 in 2002 to over 130,000 by 2009 (Uganda AIDS Commission, 2009).[2] Third, only a small proportion of Ugandans know their HIV status. Thus, a substantial proportion of infected individuals have never been tested, and such individuals have an increased risk of spreading the disease. Overall, the increase in new HIV infections may be partly explained by complacency due to the recent availability of antiretroviral therapies (Government of Uganda, 2010b). Nonetheless, such reversals not only highlight internal inefficiency in the health system but also cast doubts on Uganda's ability to attain its HIV control targets. Against the backdrop of increased spending on HIV/AIDS prevention and care, the correlates of HIV status must be examined, and we must consider how these correlates vary within various populations.

1.2 Objectives to the study

In this paper, we investigate the association between individual HIV status, sexual behavior, and socioeconomic status. Specifically, we consider the following questions: (a) What are the socio-economic correlates of sexual behaviors? (b) What factors are correlated with the adoption of the key HIV infection prevention strategies? (c) What are factors are associated with the risk of being HIV positive? The overriding objective is to understand individual sexual behaviors and practices relate to the risk of eventual HIV infection.

Uganda is of special interest in this research given its long history of implementing HIV/AIDS prevention programs. For some time, the country was heralded as a leader in HIV/AIDS prevention programs.[3] Consequently, it would be wise to consider how the country managed to reverse the increase in HIV/AIDS—at least in the 1990s. Second, as earlier mentioned, there is evidence to show that new HIV infections are rising in Uganda. The 2009 modes of HIV/AIDS transmission study for highlighted the major drives of new HIV infection in the country—notably multiple sexual partners, HIV discordance, mother to child transmission and commercial sex work (Uganda AIDS Commission, 2009). In response to the rising new HIV infections and the recognition of the possibility that the HIV/AIDS epidemic in Uganda may have matured, the government has adopted incorporated additional interventions to control the spread of the HIV virus. The current national HIV prevention strategy (2011-2015) considers interventions beyond the ABC to include: prevention of mother to child transmission (PMTCT); roll out of safe male circumcision; and expansion of ARTs to reduce the overall community viral load

2 These recent changes should be interpreted with caution because they are not based on nationally representative surveys/assessments, as mentioned earlier, but are instead based on information from sentinel sites that test for HIV/AIDS among expectant mothers. Thus, they may produce unreliable data that may have been affected by self-selection bias.

3 Previously, Uganda's main HIV prevention strategy hinged on the ABC—Abstinence, Being Faithful and Condom Use.

(Uganda AIDS Commission, 2011). The current study investigates whether the national focus is in line with drivers of sexual behavior.

Although other studies have examined the determinants and impacts of HIV/AIDS prevalence in Uganda, the majority focuses on the medical aspects of the disease (see, e.g., Ciantia *et al*., 2004; Quinn *et al*., 2000; and Serwadda *et al*., 1995). Furthermore, there has been no nationally representative study that combines regular socioeconomic and demographic information with information on HIV testing in the Uganda literature. Indeed, prior to the 2004/05 survey by the Uganda Bureau of Statistics and ORC Macro International, all of the previous estimates of HIV/AIDS prevalence in Uganda were based on sentinel sites and thus may not nationally representative. Furthermore, despite the advent of DHS type surveys, which also test for HIV status, all of the previous cross-country studies examining correlates of HIV status have not involved Uganda (see, e.g., Fortson, 2008; de Walque, 2007b, 2009). Consequently, using the 2011 Uganda AIDS Indicator Survey, which is nationally representative, this paper investigates how individual sexual behaviors relate to the risk of HIV infection.

The paper is organized as follows. In the next section, we present a theoretical framework for analyzing the correlates of HIV infection status and review the recent literature on the likely drivers of HIV status in SSA. Section 3 provides the methodology and data used. Section 4 presents the findings and discussions of the study, and the conclusions are presented in Section 5.

2.0 RESEARCH ISSUE: THEORETICAL FRAMEWORK AND REVIEW OF THE LITERATURE

Given the numerous ways in which an individual can contract HIV/AIDS—which range from sexual intercourse to blood transmissions, mother-to-child blood transmissions and intravenous drug use—there is no single theoretical framework that has been used to explain the determinants of HIV/AIDS status. Rather, a number of authors identify a number of major pathways through which an individual can contract HIV/AIDS (see, e.g., Glick, 2010, 2007; de Walque, 2007a; Oster, 2012, 2005). Using the unique characteristics of SSA—which, as mentioned previously, is the region with the highest HIV infection rates—Glick (2007) identifies two major pathways linking socioeconomic status to HIV prevalence: sexual behavior and knowledge of HIV/AIDS; and the poor state of general reproductive health services, which leads to a large number of sexually transmitted infections (STIs) and the poorly developed health services, because of which a large proportion of the population do not know their HIV status; and.

One of the most highlighted reproductive health characteristics of SSA is the large number of untreated non-HIV STIs. It is argued that untreated diseases, such as syphilis and herpes, increase the susceptibility of an individual to HIV infections. Indeed, such authors as Oster (2005) posit that this increased susceptibility is one of the major explanations for the differences in the HIV/AIDS transmission rates in the United States and SSA.[4] According to the author, SSA has experienced more rapid HIV transmission due to the large number of untreated STIs. Other concerns related to reproductive health include the issues of male circumcision and pregnancy. According to Ferry *et al*. (2001), male circumcision rates may partly explain the differences in the HIV/AIDS prevalence rates within SSA. For instance, HIV/AIDS prevalence rates are much lower in West African countries, which have a large Muslim population, than in East and Central Africa countries, which have much lower rates of male circumcision.[5] In addition, pregnant women have higher rates of HIV/AIDS prevalence compared to other sexually active women, possibly due to reduced immunity during pregnancy. The state of overall health services can also aid the spread of HIV. Glick (2007) notes that the majority of the adult population in SSA has never been tested for HIV/AIDS despite the outbreak of the disease more than 20 years ago. Thus, there is limited knowledge about HIV/AIDS status, which exacerbates the spread of the disease, as mentioned earlier.

According to Glick (2007), sexual behavior (and in particular, sex with multiple partners) is seen as the major reason why the countries in SSA have the highest rates of HIV infection. Although the average lifetime number of sexual partners in SSA is similar to that in other regions, due to the region's history of polygamy, men in SSA normally have a number of concurrent sexual partners, which creates what is known as the "sexual network" in the HIV/AIDS literature.

4 HIV/AIDS was first identified in the gay community in the USA in the early 1980s; however, the spread of disease in the USA has been very limited compared to its spread in SSA (Oster, 2005).

5 Muslim believers practice circumcision on male children as part of their religious rights of passage.

The susceptibility to HIV infections increases with both the number of people in the sexual network and the duration of sexual relationships. Other sexual behaviors noted as key drivers of HIV/AIDS in SSA include the practice of cross-generational sexual relationships, particularly between older men and young girls. This practice explains the large gender differences in HIV infection rates among teenagers. Thus, sexual behavior, coupled with knowledge, attitudes and beliefs about HIV/AIDS, can be a key determinant of infection.

Another important socioeconomic factor in HIV/AIDS prevalence is gender: females have far higher rates of HIV/AIDS infection than men. Even among sero-discordant couples[6], women are more likely to be infected (de Walque, 2007b). No conclusive explanation has been provided for these higher rates of HIV infection; however, the literature points to a number of contextual factors that may increase female susceptibility to HIV infection. First, women become sexually active much earlier than men in SSA, which may increase their lifetime chances of contracting the disease. Second, because of the unequal power relations within most households in developing countries, most women cannot exercise control over their sexuality. Furthermore, because of the lack of empowerment of women in many SSA societies, some are forced to engage in transactional sex. Also, with the exception of expectant mothers, who are regularly tested at sentinel sites, women in SSA are less likely than men to be tested for HIV/AIDS (Gersovitz, 2005).

One of the most examined drivers of HIV infection is the extent of deprivation within a community. Such authors as Oster (2012) postulate that another reason for the higher HIV/AIDS infection rates in SSA is the generally high level of poverty and low expected future incomes. This supposition is based on the premise that sexual behavior in SSA has not changed drastically despite the onset of the HIV/AIDS epidemic more than 20 years ago. According to Oster, because of the lower valuation of life (at least in monetary terms), most Africans engage in risky sexual behavior despite adequate knowledge of the potential consequences. However, empirical support for the higher poverty-higher HIV/AIDS prevalence hypothesis is very limited; most authors do not find a significant impact of poverty on HIV/AIDS prevalence (de Walque, 2009; Lachaud, 2007). In fact, some studies in SSA find that HIV/AIDS prevalence is linked to higher incomes. However, this finding is mainly explained by the higher HIV/AIDS infection rates in urban areas, where most of the well-to-do individuals reside, rather than by incomes per se. In the next subsection, we describe some of the empirical results of the studies that investigate the correlates of HIV positive status.

6 These are sexual relationships in which one partner is HIV positive and the other is HIV negative.

2.1 Empirical evidence of the determinants of HIV/AIDS status.

There is a vast and growing body of literature on the determinants of HIV/AIDS prevalence and associated sexual behaviors in SSA. Examples of empirical studies from the recent past include de Walque and Kline (2010), Fortson (2008), Glick and Sahn (2008), de Walque (2007a, 2007b), Oster (2005), and Gersovitz (2005). The main focus for most of these studies is why SSA has the highest rates of HIV/AIDS infection in the world. The evidence from these (mainly cross-country) studies is mixed. For example, a number of studies show that the expected relationship between poor health status and low income does not hold for HIV infections (see, e.g., Mishra *et al*., 2007; and Fortson, 2008). Fortson (2008) uses 5 DHS surveys that tested individuals for HIV/AIDS status to determine that individuals from well-to-do households and those with higher education levels are more likely to be HIV positive. According to Fortson, highly educated men and women are more likely to engage in pre-marital sex, which may increase their susceptibility to HIV infections. Other studies based on both cross-country analysis and country surveys also point to the positive relation between HIV infection status and both risky sexual behaviors and economic status. For instance, Gregson *et al*. (2001) find a significant relationship between national HIV/AIDS prevalence rates and literacy. Similarly, based on a survey in the Kisumu district in Western Kenya, Luke (2008) finds that wealthier men make proportionally larger monetary or other payments to non-steady sexual partners and that this practice may exacerbate the incidence of unsafe sexual activities, such as unprotected sex, within this population subgroup.

One of the challenges of understanding the causes and impacts of HIV/AIDS using regular surveys has been the identification of HIV-positive individuals. Due to the stigma attached to the disease, only a small proportion of the African population has ever been tested for HIV/AIDS. As such, most of the earlier analysis of HIV/AIDS prevalence relied on sentinel data that were collected mainly from women attending antenatal clinics. Starting in the late 1990s, the DHS surveys pioneered the collection of nationally representative information on HIV knowledge, and more recently, the surveys have tested individuals to more accurately establish sero-prevalence (Mishra *et al.*, 2007).[7] This recent availability of data has spurred research examining an array of issues, and some of the results dispel earlier preconceived notions about the disease. As mentioned earlier, Glick and Sahn (2007) show that the limited testing for HIV among Africans is not due to fear of knowing one's HIV status but rather to constrained access to HIV/AIDS testing facilities. de Walque (2009), based on DHS surveys from Burkina Faso, Cameroon, Ghana, and Kenya, finds that male circumcision has no significant impact on HIV/AIDS status. In a related study, focusing only on couples, de Walque (2007b) finds that at least two thirds of infected couples are sero-discordant. In a more recent study,

7 By 2009, the following countries in SSA had DHS type surveys with an HIV testing component: Burkina Faso, Cameroon, Ghana, Kenya, Malawi, Tanzania, and Uganda.

Fortson (2009) finds no significant impact of HIV prevalence on the fertility of women in 12 African countries.

Gersoritz (2005) uses ten DHS surveys for Kenya, Tanzania, Uganda, and Zambia to identify evidence of behavioral change in response to the pandemic. For example, women in Zambia are having sex later because of the fear of HIV/AIDS. In contrast, Glick and Sahn (2008) examine a much larger sample of 16 DHS surveys from eight countries in SSA[8] and do not find consistent reduction in this regard for women or men. In particular, for women, such results are found only for Benin, Ghana, Mozambique, and Nigeria, while only Uganda and Zambia show a significant increase in the average age of women at their first instance of sexual intercourse. Nonetheless, Glick and Sahn (2008) find consistent favorable changes in at least one indicator of sexual behavior—condom use among unmarried individuals—for both women and men. For women, with the exception of Nigeria, all of the countries studied show significant increases in condom use. For men, the only significant increases in condom use are identified for Benin, Burkina Faso, Ghana, and Mozambique. For the other indicators of non-risky sexual behavior, such as abstinence and fidelity to one sexual partner, the results vary by country.

A key determinant of access to and comprehension of HIV/AIDS knowledge and information is education. De Walque (2007a) posits that education is negatively related to HIV infection rates and identifies various pathways through which education impacts HIV/AIDS infection: the use of condoms, particularly during sex with non-regular partners; the use of HIV/AIDS facilities, particularly voluntary counseling and testing centers; and the empowerment of women to negotiate sex. Based on longitudinal data from a district in Southwestern Uganda, de Walque (2007a) shows that increased education attainment has large payoffs in terms of HIV/AIDS reduction. In particular, after the introduction of HIV/AIDS information campaign in Southwestern Uganda, HIV/AIDS infections decreased by 6 % for individuals with primary education and 12 % for individuals with secondary education.

8 The countries covered are Benin, Burkina Faso, Ghana, Kenya, Mozambique, Nigeria, Uganda, and Zambia.

3.0 METHODOLOGY AND DATA

3.1 Probit estimation for correlates of sexual behavior and the risk of being HIV positive.

Because of the nature of the cross-sectional dataset available and because of econometric concerns, such as omitted variable bias (e.g., preferences in sexual behavior), we do not claim to establish a causal relationship between the risk of HIV infection and socioeconomic status. Instead, we estimate the association between the risk of HIV infection and such factors as educational attainment, spatial location, and marital behavior (i.e., whether a person has ever married or has had multiple marriages). Following previous studies that examined the correlates of HIV infection in Africa (see, e.g., de Walque and Kline 2010; Corno and de Walque, 2007), we estimate a probit model for being HIV positive. The reduced-form equation can be formally represented as

(1) $$\Pr(HIV_i = 1) = \beta_o + \sum_j \beta_{1j} A_{ji} + \sum_m \beta_{4m} D_{mi} + \varepsilon_i$$

where HIV_i represents whether or not an individual i is HIV positive, A_{ji} are individual-level factors, such as age, gender, marital experience, and educational attainment, D_{mi} are household-level and location factors, such as welfare status and residence in an urban area, and $\square_i$ are unobservable factors that may aid the spread of the HIV virus. In the above specification, we do not include variables related to direct sexual behavior (e.g., condom use and extramarital relations), as these would be endogenous. Instead, we estimate similar regressions for the correlates of condom use, extramarital sex and HIV testing. Specifically, we estimate the following additional models:

(2) $$\Pr(Condom_i = 1) = \beta_o + \sum_j \beta_{1j} A_{ji} + \sum_m \beta_{4m} D_{mi} + \varepsilon_i$$

(3) $$\Pr(Extra\_Marital_i = 1) = \beta_o + \sum_j \beta_{1j} A_{ji} + \sum_m \beta_{4m} D_{mi} + \varepsilon_i$$

(4) $$\Pr(HIV\_test_i = 1) = \beta_o + \sum_j \beta_{1j} A_{ji} + \sum_m \beta_{4m} D_{mi} + \varepsilon_i$$

where $Condom_i = 1$ represents the use of condoms during the person's last instance of sexual intercourse, $Extra\_Marital_i = 1$ indicates extramarital sex among individuals who reported being married, and HIV_test_i represents whether an individual has ever been tested. The other behaviours considered include: use of alcohol during sex, undertaking an HIV test, male circumcision, and self-perceived chances of contracting HIV. The various specifications help to show whether the drivers of the risk of HIV infection are similar to the drivers of adoption of preventive or risky sexual behaviors associated with contracting the HIV virus.

If the drivers of HIV infections and sexual behavior are all presented by a vector X, then equations (1)-(4) can be jointly rewritten as

(5) $$\Pr(S_i = 1) = \Phi(\beta' X_i)$$

where $S_i = \{HIV_i, Condom_i, Extra\_Sex_i\}$ and Φ represent a standard normal cumulative distribution and □' represents the parameters to be estimated. To more accurately interpret the results of the probit estimations, we estimate the marginal effects of the specification in Eq. (4). The marginal effects model is specified as

(6) $$\frac{\partial[\Phi(\beta' X_j)]}{\partial X_{ij}} = \phi(\beta' X_i)\beta_j$$

The interpretation of the estimations from Eq. (6) is as follows; for example, it indicates the effect of a change in the regressor at the mean on HIV prevalence in the HIV infection specification.

3.2. Data

As mentioned earlier, this study uses the most recent nationally representative survey of HIV prevalence in Uganda: the 2011 Uganda AIDS Indicator Survey, conducted by the Ministry of Health in Uganda and ICF International (Ministry of Health et al, 2012). The objective of this survey, which was supported by the US government, was to obtain national and regional prevalence estimates of HIV and syphilis infection in Uganda. In addition, the survey sought to capture information on sexual behaviors and program coverage for HIV related services. In particular, the survey tested for the following sexually transmitted infections (STIs): HIV, syphilis, herpes simplex, and hepatitis b. For HIV positive individuals, the survey established the CD4 count in order to understand the HIV treatment needs. This survey was undertaken during a period of 7 months (February –September 2011) and employed a two-stage cluster sampling design. In the first stage, clusters or enumeration areas were the principal sampling unit, and at least 470 clusters were selected across the country. In the second stage, 25 households were randomly selected from each cluster.

Furthermore, the survey coverage was expansive, with 11,340 households selected for analysis. The survey targeted individuals in the sexually active age category: people aged 15-59 years. Within the selected households, at least 12,153 women and 9,983 men were in the reproductive age group and were thus eligible for interview and STI testing. All eligible women and men were asked to voluntarily provide a blood sample for testing STIs. For children ages 15-17 years, consent for testing was sought from parents or guardians. Of all individuals eligible for interview and testing, 96.8 % of the women and 94.1 % of the men could be tested.[9] Of the eligible individuals who could not be tested, approximately half declined to be tested, and the rest were absent at the time of the survey. Overall, 19,570 individuals (11, 028 women and 8,541 men) aged 15-49 years were tested, and this is the sample that was used in our analysis. In addition to determining HIV status, the survey also addressed the regular DHS indicators, including educational attainment, reproductive history, sexual activity, and knowledge and attitudes regarding STIs. Below, we describe the particular variables used in our analysis.

3.3 Variables used.

3.3.1 Dependent variables

HIV Infection status: As noted earlier, the survey tested eligible women and men for HIV and other STIs. The results of the laboratory tests indicate which individuals are HIV positive, and this is our indicator of HIV infection.

Condom Use: For individuals who had had sex in the past 12 months, the survey asked whether they used a condom during their last sexual encounter. We use this information as the dependent variable, condom use.

Concurrent sexual relations: The survey asked questions about number of partners with whom the respondents had had sex in the 12 months preceding the survey, the types of relationships that they had with these partners, and the overall number of sexual partners that they had had in their lives. Within the realm of multiple sexual partners, we focus on concurrent sexual relationships as these are considered more risky than for example polygamous unions (Ministry of Health, *et al*., 2012). Following the UNAIDS classification, concurrent sexual relations are defined as 'overlapping sexual partnerships where intercourse with one partner occurs between two acts of intercourse with another partner' (UNAIDS, 2009). We consider two variants of concurrent sexual relationships: occurring in the past 6 months (point estimate) and occurring in the past 12 months (cumulative estimate).

Alcohol use during sex: For sexually active individuals over the past one year, the survey inquired whether the respondent or their partners drunk alcohol during the last sexual act over the past 12 months. We define alcohol use if at least one sexual partner was drunk.

HIV testing: The respondents were also asked how many times they had ever taken an HIV test and whether they had collected the results and whether they have ever tested as a couple. In addition, women are asked if they had received the test as part of their antenatal services. We

9 The variance between women and men is because men were more likely to be absent from home than women.

define three variables relating to HIV testing: (1) Having ever taken an HIV test; (2) Having ever taken an HIV test as a couple; and (3) Having received an HIV test as part of antenatal visit.

3.3.2 Independent variables

Demographics: To capture each individual's demographic characteristics, we consider the following indicators: age and marital status (married polygamy etc.). The age of the individual is meant to indicate the extent of the person's susceptibility to STIs. We include the following age categories 15-19 years, 20-24 years, 25-29 years, 30-39 years, and 40-49 years. In addition, we undertake separate estimations for the youth (aged 15-24 years) since they have a relatively shorter experience of sexual activities compared to older persons. Other age variables considered include age of the cohabiting partners which may reflect some form of bargaining in sexual relations within the household. We also estimate separate regressions for women and men due to previous evidence showing differences in sexual behaviours between women and men (Dunkle *et al*., 2004; Jewkes *et al*., 2003)—especially in forced sex relations.

The other demographic variables used include marital status. Specifically, for each independent variable, we estimate separate regressions for either married women or men since the Ugandan public health literature highlight the fact that new HIV infections are highest among married couples (Uganda AIDS Commission, 2009). Consequently it is important to understand any differences in sexual behavior among married persons. In addition, the married dummy variable, we also include an indicator for presence of a polygamous union. The consideration of polygamy is guided by the fact it remains pervasive in Uganda—at least 25% of women and 16% of women in our sample are in polygamous union. Secondly, apart from polygamy increasing the risks of one man infecting multiple partners with STIs, there is evidence to show that in other African countries, women in polygamous marriages are more likely to engage in extra marital sexual relationships (de Walque, 2007b).

Socioeconomic characteristics: The major socioeconomic characteristics are related to educational attainment and proxies for wealth status. We include two major variables to capture to capture education attainment: number of completed years for primary and secondary school. Apart from representing the accumulated human capital of the individual, the education variables may also signal an individual's ability to receive and process health information. The survey, similar to the regular DHS surveys, did not solicit information on household income and did not capture information on household consumption, an effective income proxy. Following earlier studies that have utilized DHS-type surveys examining sexual behaviors (e.g. Corno and de Walque, 2012; Ssewanyana and Younger, 2008; Sahn and Stifel, 2003); we use a durable good index as a proxy for household income or wealth. The items considered for the durable goods index are: radio, television, fridge, motor cycle, car, and having electricity.

Interaction terms: In order to account for life cycle effects on education and wealth status and the differential impacts of wealth on certain groups, we also include a number of interaction e.g. (i) between education attainment and wealth status; and (ii) between age categories and wealth status.

Religious affiliation: As demonstrated by previous authors (e.g. Glick and Sahn, 2009 for Madagascar), religious beliefs and influences can be important determinants of sexual behaviours and consequently reduce the risk of HIV infection. We include dummy variables for the majorly religious denomination i.e. Catholics, Anglican, Moslems, and other religious denominations (Pentecostals, Baha'i etc.).

Supply level proxy variables: We include a number of variables to proxy for supply level access to health facilities. In particular, I include: (i) cluster level average to distance to health facilities and (ii) distance to the market. In addition, in some estimation, we include cluster level variables for: (iii) HIV testing and (iv) male circumcision coverage.

Location variables: To capture the environment faced by the individual, we include dummies for urban location. We also include regional dummies to capture location heterogeneity and ethnicity. The means of the key variables, disaggregated by gender, are provided in Table 1.

4.0 RESULTS

4.1 Descriptive results of sexual behavior and HIV program coverage.

Table 2 shows how individual sexual behavior varies by gender and also age category—particularly the youth aged 15-24 years. The average age at first sexual intercourse for women is 16.6 years while their average age at marriage is 17.6. The corresponding statistics for men are 17.8 years and 22.5 years respectively. The above figures suggest that most women marry within one year of their sexual debut while men take on average 5 years from sexual debut to marriage. Table 2 also shows that at least 30% of the young women and 44% of young men aged 15-24 years are yet to initiate sexual activity i.e. are abstaining from sex. Concurrent sexual relationships are predominant among men; among women, it is women resident in urban areas that exhibit concurrent relationships in the past 12 months—3.5%. Also worth noting is that 6.3% of male youth were engaged in concurrent sexual relationships during the past 12 months. Finally, alcohol use during sex is significant in both women and men.

With regard to testing for HIV virus, Table 2 shows that more women than men have tested for HIV. At least 70% of women have tested for HIV compared to 47% for men. The higher testing rates among women may be attributed to receiving tests during the regular antenatal visits. Also, there is significant urban bias towards HIV testing with average rates in urban areas at least 10 percentages higher than average national rates. Furthermore, a large proportion of individuals have tested more than while only about 20% of individuals have tested for HIV as couple—the rates are about similar in both rural and urban areas.

With regard to HIV infection, the average rate among women is 8.3% compared to 6.1% for men. Whereas the HIV infection rates for men are similar across spatial location, for women, HIV infection rates are higher for urban residents by at least 3 percentage points. Among HIV positive individuals, only 31% of women and 20% of men have undertaken a CD4 count test to establish their immunity levels. Based on the CD4 count tests undertaken as part of the survey, at least one in four individuals that tested HIV positive have a CD4 count below 350—a level below which the World Health Organization (WHO) recommends starting antiretroviral therapy (WHO, 2010). On the other hand, Table 2 shows that of HIV positive individuals about 22% of women and 16% of men are accessing ARTs.

4.2 Concurrent sexual relationships

Table 3 shows the correlates for having concurrent sexual relations in the past year for women and men. The table shows the marginal effect as well the corresponding regression coefficient and stand error of the coefficient. For women, it is also indicated that older women (aged 40-49 years) are least likely to engage in concurrent sexual relations compared to women aged 15-

19 years. Furthermore, the results in column one indicates that urban women are significantly more likely to maintain concurrent sexual relationships. However, when only married women are considered in column II, the magnitude and significance of the urban control reduces; however, it remains significant for young women as indicated in column V. This suggests this suggests that it is mainly single young women in urban areas that have multiple sexual partners. Previous research shows that residence in urban areas can increase the supply of potential sexual partners due to wider interaction with outsiders than is the case in rural areas (Glick and Sahn, 2009). Finally, with respect to the interactions, young married women aged 20-24 years from relatively well-do households are significantly more likely to have extra marital sex compared to married women aged 15-19 years.

Turning to the correlates of concurrent sexual partners for men (columns 6-12), Table 3 shows that middle aged men are significantly more likely to maintain concurrent sexual relations. In particular, men aged 30 years and above are about 14% more likely to maintain concurrent sexual relations than men aged 15-19 years, all else held constant. It is also worth noting that among married men, those in polygamous relations are not significantly different from their non-polygamous counterparts with regard to engaging in extra marital sex. Finally, among married men, the variable for age of cohabiting partner is positive and significant suggesting that men are more likely to stray as their spouses become older into cross generation sex relationships.

We do not find any significant influence of education attainment on maintaining concurrent sexual relations over the past year—for both women and men. Similarly, there is no significant impact of wealth as a driver of extra-marital sex for both women and men. The interactions of education and wealth as well as wealth and age are insignificant as well. Finally, we also considered the possibility of community level variables driving sexual behaviour and estimated community fixed effects regressions. The fixed effects results (not indicated in the table) for correlates of concurrent sexual partners remained largely the same as the results reported in Table 3.

4.3 Condom use

The second sexual behaviour we consider is the use of a condom during the last causal sex encounter. Advocacy for the use of condoms has been a major component of Uganda's ABC strategy and current National HIV prevention strategy (2011-2015) proposes to increase the cconsistent use of condoms during risky sexual encounters from 50% to 80% by 2015 (Uganda AIDS Commission, 2011). Given such relatively low condom use during causal sex, it important to understand which groups consistently use condoms—possibly as means of preventing the spread of STIs including the HIV virus. The results for correlates of condom use during risky sex are reported in Table 4 and it is revealed that for women, higher education attainment is associated with increased condom use but the education effect is only significant among single young women. Each additional of post primary schooling increases condom use by 3% among young women compared to counterparts without education. The significance of education for women may be explained by the fact that highly educated women in SSA are not only heavily exposed to safe sex information, but are more likely to engage in premarital sexual relationships (Glick and Sahn, 2007); and maintain concurrent sexual partners (Espetein, 2007). An alternative explanation could be that highly educated women are more assertive, appreciate and understand the costs of risky sexual behavior and as a consequence are more likely to demand the use of a condom with non-regular sexual partners.

For all specifications, married individuals especially men less likely to use condoms. This is consistent with earlier research showing that the surge in use of condoms in SSA has been mainly among the unmarried (Glick and Sahn, 2009). However, among married men, higher wealth status as captured by the durable goods index is positive and highly significantly associated with increased condom use. Assuming that the use of condoms among married is predominantly for casual sex, the above result can be linked to the fact that multiple sexual partners can be considered a normal good (whose consumption increases with wealth)—following the sexual adventure literature (de Walque, 2007a). On the other hand, urban youths are significantly more likely to use condoms. Also, condom use among married men decreases with age and this may be explained by the fact that safe sex information in Uganda has mainly targeted young people.

For the various estimations for correlates of condom use during causal sex we include cluster level variables for access to health services—to proxy supply level variables for access to health services. In particular, we include indicators for cluster level HIV testing—a proxies for use of health services and the log of distance to nearest health facility. The results in Table 4 show that it is only the distance to clinics that is significant and only for women. Each additional kilometer to the nearest health facility reduces condom use by women by as much as 2%. Given that increasing distance can be interpreted as cost, this particular finding suggests that there is limited access to condoms among poorer married women. For men, cluster level testing for HIV is also significantly associated with increased condom use among married men. This latter result suggest that married men who are able to know their HIV status are able to receive information on safe sex practices including condom use and this is in line with the current Uganda National HIV prevention strategy 2011-2015 (Uganda AIDS Commission, 2011).

For the regressions for young women and men (aged 15-24 years), the results for the interaction terms in Table 4 show that wealth may not matter as much for younger than older persons. The results show that wealth is more important for younger women than older women with regard to the use of condoms. On the other hand, the interaction term for higher education and wealth is negative and significant suggesting that higher education does not matter for women in well-to-do households, possibly higher education and wealth status are substitutes in the demand for safe sex practices.

4.4 Alcohol use during sex

The other major sexual behaviour we consider is alcohol use during sex. There are important reasons for considering alcohol use during sex in Uganda. The 2011 UAIS shows that the HIV prevalence for men who used alcohol during sex (11.2%) is about double that for men who do not use alcohol (5.8%). There is also substantial difference between women—10% of women who have used alcohol during sex in the past 12 months were HIV positive compared to rate of 7.6% for women who did not use alcohol (Ministry of Health et al, 2012). Table 5 shows that for women alcohol use increases with age. In addition, higher education attainment is significantly associated with the reduced risk of being drunk during the last sexual encounter. Each additional year of secondary education reduces the risk of alcohol use during sex by as much as 3%. However, the interaction terms between age and wealth as well as between education and wealth are all not significant. When only married women are considered, the age effect disappears suggesting that age controls may be highly correlated with marital status. However, the education effects remain the same regardless of marital status. Overall, the results for women suggest that it is mainly married women who use alcohol prior to sex.

Among men, it is mainly men resident in urban areas that use alcohol during sex. In addition, the negative and significant effect of education on alcohol use is sustained for men; however, it mainly the effect of years of primary education that is most consistent. Furthermore for the married category, the interaction of primary education and wealth status is significant suggesting that for married men, at higher levels of welfare status, increasing primary education is associated with alcohol use.

4.5 Ever tested for HIV

As mentioned previously, the limited knowledge that individuals have about their HIV status is seen as one reason why the HIV virus spread at fast pace in SSA. In Uganda, HIV testing coverage has increased tremendously in the past seven years—from 15% for women and 12% for men aged 15-49 years in 2004/5 (Ministry of Health and ORC Macro, 2006) to over 69% for women and 47% for men by 2011 (Table 1). Notwithstanding the relatively high HIV testing coverage rates, we examine the correlates of ever testing for women and men. The survey asks how many times an individual has tested for HIV prior to the survey; whether tests were undertaken as couple; and whether HIV tests were received as part a routine antenatal visit (for women).

The marginal effects of the correlates of testing for HIV prior to the survey are reported in Table 6. It is indicated that higher education attainment of women is associated with increased testing; each additional year of either primary or secondary education increases the likelihood of HIV testing by about 2%. In addition, age effects as well as the interactions between age and wealth are statistically significant. The age effects may be explained by the fact that HIV testing among women is linked with attendance of antenatal clinics and most of the female child bearing occurs during the ages of 20-29 years. Furthermore, the interaction terms between age and wealth status reveals that it mainly middle aged and older married women from well-to-do households that undertake the HIV tests. Also urban women are about 6% more likely to test for HIV than their rural counterparts, all else held constant.

Education is of also of particular importance to men—each year of secondary education increase the likelihood of HIV testing by about 3%, all else constant. However, the interaction terms between education and wealth are insignificant unlike the case for women above. It is also worth noting that among men there are no significant differences between rural and urban areas with regard to HIV testing. Table 6 also shows that men in polygamous marriages are significantly less likely to be tested for HIV than their single counterparts.

For cluster level variables, an increase in the distance of the clinic significantly reduces HIV testing among women and this suggests that there are some costs involved in accessing HIV related services. These particular results are similar to those obtained regarding condom use among women (reported in Table 4) and this may suggest that women face relatively similar constraints in accessing HIV related services. On the other hand, supply level proxies are insignificant for the male regressions and this also suggests that higher than average female testing may be driven by access to antennal services, an issue we examine below.

As earlier mentioned, the survey inquired from married individuals whether they tested as couple. We undertook separate estimates for couples and the results (not presented in the table) indicate that younger and middle aged individuals are more likely to test as couple. Furthermore, higher education attainment is associated with an increased and significant likelihood of both women and men testing as couple. On the other hand, community level variables appear unimportant for testing as a couple. In addition, we also examined which women are likely to receive an HIV test during routine antennal visits. The results (also not presented in the table) indicated that it mainly women in the prime of child bearing that use antenatal services and receive testing as part of the services. Distance to health facilities is major determinant of whether women receive HIV tests at antennal clinics.

4.6 Male circumcision

As earlier mentioned, scaling up of safe male circumcision (SMC) services is now a key component in Uganda's National HIV Prevention strategy and the Ministry of Health initiated SMC campaigns in 2010. As such, in Table 7, we examine the correlates of male circumcision in 2011 and it is indicated that circumcision generally increases with age and wealth status. This may suggest that circumcision services may only be available in private health facilities frequented by the relatively well-to-do. Overall, most of the policy variables are insignificant. Among married men, with the exception of urban residence—which may also be linked to wealth status mentioned above, there are hardly any significant correlates for male circumcision. This particular result suggests that most men enter marriage when already circumcised. Indeed, male circumcision prior to initiation of sexual behaviour can occur due to religious rites (e.g. among Muslims) or ethnic driven practices (e.g. the *imbalu* male circumcision ritual practiced among the *Bagisu* in Eastern Uganda).

A comparison of the two available sero behavioural surveys in Uganda confirms that there has not been any significant change in male circumcision rates during the six years—only 25% of men aged 15-49 years were circumcised in both 2004/5 and 2011 and more 80% of these were circumcised before the age of 20 years (Ministry of Health et al, 2012). Furthermore, the 2011 UAIS survey also reveals that 50% of the un-circumcised men would be willing to have the operation. This suggests that there has that there has been limited roll out of the SMC campaign despite extensive evidence from African countries showing that male circumcision can reduce the risk of HIV infection by as much as 50% (Weiss *et al*., 2000).

The current National HIV prevention strategy (2011-2015) proposes to increase male circumcision rates to 80% by 2016 through conduction 4.2 million safe male circumcision operations (Uganda AIDS Commission, 2011). However, major health stakeholders such as the World Health Organization (WHO) have also pointed to the fact that Uganda has failed to invest significant resources towards SMC. Part of the reason for the lacklustre male circumcision rates in Uganda is the lack of national champion despite the potential for male circumcision to reduce new HIV infection. The president of Uganda has been one of the main opponents to SMCs—especially as an intervention targeting the youth. Indeed, in December 2012, during both the national celebrations to mark the 2012 World AIDS Day and the end of year national address, the President of Uganda reaffirmed his opposition to SMC as an HIV prevention strategy and accused the Uganda AIDS Commission for allowing such confusing messages to be propagated in Uganda. According to the President,

> *"Circumcision will not make a man "metallic" and therefore immune to HIV infection"*

4.7 The risk of HIV infection and self-perceived chances of contracting HIV.

Table 8 reports the marginal effects and coefficients associated with the risk of testing HIV positive among women and men. The results for women indicate that age is a significant correlate of testing HIV positive—older married women are significantly more likely to test HIV positive and this may be linked to life cycle effects e.g. longer duration in marriage and its associated risk of exposure to HIV infection. Other significant demographic variables include the presence of a polygamous union—women in polygamous marriages are 2% more likely to test HIV positive than their counterparts in non-polygamous unions. For all women, urban residence is associated with a 4% increased risk of testing HIV positive. However, the significance of the urban dummy is eliminated when either the married or young women are considered. This suggests that it may be older single women in urban areas driving the above results. Our earlier findings regarding the correlates of concurrent sexual partners and condom use among women (reported in Tables 3 and 4) partly confirm this hypothesis of higher HIV prevalence among older unmarried women. Given that these are older women, it is possible that such women have had previous sexual relationships and are currently unmarried due either divorce or widowed. Related, there is a possibility that after women lose their husbands to HIV, they move and settle in urban areas.

Also, higher educational attainment is significant and negatively related to risk of testing HIV positive. Each additional year of secondary schooling reduces the likelihood of testing positive for HIV among women by as much as 4%—especially among young women. In addition, the interaction term for secondary education and wealth status is significant suggesting that rich educated young women are more likely to test HIV positive. The particular result may explained by the fact that this category of women is less likely to use condom as highlighted in Table 4. Finally, for women, the community variables that proxy for health supplies are all insignificant.

The education results for men are counter-intuitive—additional years of education of primary and secondary education area not significantly associated with reducing risk of testing HIV positive. However, for married men, the interaction term between years of secondary education and wealth status is negative and significant. This suggests that higher education attainment and wealth may be complements in the HIV infection process as documented in earlier studies (e.g. Glick and Sahn, 2007). Nonetheless, this would be at odds with our sexual adventure hypothesis of increasing sexual partners with increased education and wealth noted earlier and would also be contrary to earlier studies on HIV infection in SSA that showed the risk of HIV infection increasing with increases in wealth status (see, e.g., Corno and De Walque 2007 for Lesotho). Table 8 also shows that unlike the case for women, among men, the urban risk of testing HIV positive is maintained among married men as well as all men combined. Urban residence—which is also associated with higher welfare status—is associated with a 5%

increase in the risk of testing HIV positive for men. Finally, as was the case for women, none of the supply level community variables have a significant impact on the risk of testing HIV positive and among young men, all covariates appear insignificant. The latter result may be explained by the fact that a substantial proportion of young men are yet to make their sexual debut and also the HIV prevalence among this demographic group is very low—2.1% for men aged 15-19 years compared to 6.1 for all men aged 15-49 years (Ministry of Health et al, 2012); consequently, we may be dealing with very few observation of HIV positive young men.

Self-Reported Risk of HIV infection

As earlier mentioned, the survey inquired from individuals about the self-reported chances of contracting HIV. The possible answers were: high chance; low chance; and do not know. These qualitative responses are important since a large proportion of individuals consider themselves to be at a high risk of contracting HIV/AIDS (Table 2 shows that at least 30% of women and 20% of men rate their chances of contracting HIV as high). Furthermore, these qualitative responses allow us to gauge if the correlate of the risk of testing HIV positive and the self-perceived risks of contracting HIV are similar. Table 9 shows the results for the correlates of a high self-perceived risk of contracting HIV for women and men. For women, the results indicate that middle aged when significantly consider their chances of HIV infection as high. Furthermore, the negative and significant interaction terms between age and wealth status indicate that that is it mainly poor women who rate their chances of contracting HIV as high. However, when only married women are considered, most of the age controls become insignificant with the exception for women aged 30-39 years. This may suggest that is mainly women out of marital unions i.e. single, divorced/separated and widowed women—who rate their chances of contracting HIV as high. Such categories of women are usually vulnerable and more deprived than their married counterparts and this main explain the significance of the age and wealth interaction terms mentioned above.

It is also worth noting that for the various categories of women estimations, women in urban areas significantly rate their chances of contracting HIV as low. This is at odds with the observed sexual behavior—especially relating to maintaining multiple sexual partners in Table 3 and also the higher likelihood of urban women testing HIV positive especially older women who are currently not in a marriage (Table 8). Also for all the three different types of estimations for women, those in a polygamous union have a significantly chance of reporting a higher self-perceived risk of contracting HIV/AIDS. Furthermore, among married women, the variable for age of cohabiting partner is negative and significant suggesting that women expect male risky sexual behavior to reduce with age whereas our earlier results for concurrent sexual partners (Table 3) showed that multiple sexual partners increase with a woman's aging.

The results for men contrast sharply to that of women. For instance, younger and older married men significantly report that their chances of contracting HIV are low; indeed, it is only young men aged 20-24 years who rate their chances of contracting HIV as significantly high. Also whereas urban married women significantly rate their chances of contracting HIV as low, urban residence for married men is associated with 4.5% chance of reporting that an individual's chance of contracting HIV are high. We do not find similar effects of polygamy on the risk of reporting high chances of contracting HIV for men. This suggests that men do not consider polygamous unions are risky conduits for spreading STIs like the HIV virus, as women do. It is conceivable that men consider their polygamous sexual partners as faithful whereas women have a less favorable perception about fidelity in a polygamous setting. The above results qualitatively show that individuals in Uganda understand that risky sexual behavior can lead to HIV infection. Why they continue to behavior this way despite the know risks, is not very clear from the data.

4.8 Sero-Discordance among infected couples

The Ugandan AIDS literature highlights sero-discordance (i.e. where one partner is HIV positive and another negative) as another major driver of HIV infection (Gray *et al*, 2001; Mermin *et al.,* 2008; Uganda AIDS Commission, 2009). According to the modes of transmission analysis for Uganda, at least 35% of new HIV infections in Uganda are attributed to discordant couples (Uganda AIDS Commission, 2009)—discordant couples are only second to multiple sexual partners (37%). In order to further explain the HIV infection environment in Uganda, we also examine the nature of sero-discordance in Uganda and how it relates to overall sexual behaviour in Uganda using the 2011 UAIS. Following de Walque (2007b) who examined the pattern of sero-discordance in five African countries (Burkina Faso, Cameroon, Ghana, Kenya, and Tanzania), we define four possible states of concordance i.e. (i) concordant negative—when both partners are HIV negative; (ii) concordant positive—when both partners are HIV positive; (iii) discordant male—when the male partner is HIV positive and female partner HIV negative; and finally (iv) discordant female—when the male partner is HIV negative and female partner HIV positive.

Table 10 shows the estimates for discordance in 2011 and it is indicated that 26% of the infected couples are discordant. The means in column II show that female discordance accounts for 60% of the overall discordance and this rate is in line with earlier studies e.g. de Walque (2007b) which showed a higher presence of females among discordant couples. Column III which considers infected persons who have only been married once shows that female discordance is not driven by re-marriages. Specifically, women who have been married only once have a slightly higher rate of female discordance than all infected women (18.8% vs. 15.4%).

Given that discordance is the route to actual concordance and the fact that HIV infection transmission rates are very slow (Gray *et al*., 2001; Quinn *et al*., 2000), it is possible that persons who are discordant have only been married for a shorter duration. We consider couples who have been cohabiting for at least 10 years—which was considered be the median duration from infection to HIV/AIDS deaths prior to the advent of ARVs (de Walque, 2007b). Column IV shows that the rate of both male and female discordance among couples cohabiting for at least 10 years is nearly similar to the rate for all couples. Finally, we consider whether the higher female discordance rates are due to polygamy—one male partner infecting a number of female partners. Column V shows a surprising result—female discordance is substantially higher among females in non-polygamous unions who have only been married once; however, this is line with studies in other African countries such as de Walque (2007b) which point to the possibility of higher than the self- reported rates of extra-marital sex among women. The above result suggests that married women in Uganda may be engaging in extra marital sex which is at odds with self-reported low rates of female infidelity. Indeed, in 2011, 3% of married women reported having concurrent partners in the past 12 months compared to 8.2% for single women (Ministry of Health *et al*., 2012). However, only 7% of married women having concurrent sexual relationships reported using condom compared to 38% for single women. To the extent that women in such environments do not use protection, this may be driving the observed HIV/AIDS infection rates—especially female discordance.

In African communities, it is a culturally abominable for a woman to engage in extra-marital sex and such cultural expectations may bias self-reported responses. Indeed, instances of miss-reported sexual behaviour are not uncommon in African settings. Studies such as Gersovitz (2005) as well as Glick and Sahn (2008) show evidence of miss-reporting of age at first intercourse in African countries. The presence of other persons during the interview has been documented to result in biased responses during behaviour related surveys (Aquilino *et al*., 2000). Consequently, misreporting on extra-marital sexual behaviours may explain the very low self-reported rates of concurrent sexual relationships in Uganda but a high rate of female discordance among non-polygamous persons who have only been married once. The 2011 UAIS also documents evidence of inconsistence in self-reported sexual health status. Specifically, the self-reported HIV prevalence among women and men who had previously undertaken an HIV test prior to the survey was only about half that established through the laboratory HIV tests conducted as part of the survey (Ministry of Health *et al*., 2012). On the other hand, one can not entirely rule out non-sexual transmission of HIV infections, for Uganda as well as other African countries. A previous study by Deuchert (2011) shows a large proportion of self-reported virgins that are HIV positive in Lesotho, Swaziland, and Zimbabwe.

5.0 CONCLUSIONS AND IMPLICATIONS

This paper examines the factors associated with different sexual behaviors as well as the risk of HIV infection in Uganda, which is a country that has been heralded as exemplary in the fight against HIV/AIDS but that has recently seen an increase in the rate of new HIV infections. We use a nationally representative survey that tested individuals aged 15-49 years for HIV virus and other STIs. In order to the current HIV story for Uganda, we examine the correlates of a number of sexual behaviours including: maintaining concurrent sexual partners, condom use during risky sex, and alcohol use during sex. In addition, we also examine correlates for the use of HIV related services such as testing for HIV, CD-4 testing among HIV positive individuals and safe male circumcision. Finally, we examine directly the factors associated with the risk of testing HIV positive, the self-perceived risk of a high chance of contracting HIV, and the nature of discordance among HIV infected couples. Overall, we find significant gender differences in terms of sexual behavior. Young women resident in urban areas are more likely to maintain multiple sexual partners than young men. Proximity to health facilities significantly affects women's adoption of safe sex practices.

Our results in section 4 have implications for the current national HIV prevention strategy for Uganda. First, access to and the cost of health services can be a major hindrance in adopting safe sex practices. For instance, individuals from well-to-do households are more likely to be tested for HIV than poorer individuals. Furthermore, there has been a surge in HIV testing among women and men in Uganda in the past 6 years. Although the majority of HIV testing services remains free, these facilities are mainly located in urban centers and major hospitals patronized by richer individuals. Similarly, the use of condoms during sex with casual partners is most common in urban areas, whose residents can afford the cost of condoms. Consequently, it is important for the Ministry of Health to continue to subsidize HIV/AIDS services to to encourage testing" or "to increase the use of these services.

Second, our results point to the importance of education—especially for women—both as a possible driver for reducing risky sexual behavior and use of key health services. For instance, higher education attainment is associated with increased use of condoms during risky sex and the reduced risk of using alcohol during sex. Similarly highly educated women and men are more likely to have ever undertaken an HIV test compared to their counterparts with no or poor education. Also highly educated and rich men are less likely to test HIV positive. Our education results suggest that Uganda's investment in primary and secondary education through the UPE and USE programs is a step in the right direction as a long term means of controlling risky sexual behaviours.

Third, our results show that Uganda has failed to fully operationalize its safe male circumcision campaign—partly due to high level political opposition. Nonetheless, it is important to emphasize to both to the public and political leadership that SMC is not vaccine and the interventions is part of a multi-faceted approach to prevent the spread of HIV. Without a change in the types of messages used to promote SMC and attitudes by the political leadership regarding SMC, this very important intervention may continue to be neglected in the public health budget.

Finally, our results regarding the nature of HIV discordance in Uganda point to the possibility that married women may be engaging more in extra marital sex that what is reported the demographic and health surveys. At the same time, married women are least likely to use condoms when engaging in risky sex. To the extent that married women are not targeted with safe sex information—due to the assumption that it mainly married men affected by infidelity—implies that this is an important demographic category that is not currently a focus of attention. The discordance results also points to need emphasize testing HIV as couple so that appropriate precautions can be undertaken in case one of the partners is sero-discordant.

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7.0 APPENDIX: TABLES

Table 1:Descriptive statistics for variables used , 15-49 years

	Women	Men
Sexual behaviour		
Age at first intercourse (years)	16.7	18.2
Age at first marriage/Cohabitation (years)	17.8	22.5
Concurrent sexual relationship in past 6 months	0.005	0.068
Concurrent sexual relationship in past 12 months	0.022	0.207
Used a condom with sexual partner	0.036	0.098
Engaged in sex when one of partners is drunk	0.195	0.243
Never had sex: Abstinence	0.128	0.178
Self-Reported STI in past 12 months	0.204	0.113
HIV Testing and Status		
Ever tested for HIV	0.698	0.469
Ever tested for HIV more than once	0.529	0.331
Tested for HIV as part of antenatal visit	0.556	-
Male circumcision	-	0.2673
HIV Infection: Positive	0.084	0.061
Self-reported chance of contracting HIV: High	0.332	0.223
Self-reported chance of contracting HIV: Low	0.490	0.639
CD4 count below 350	0.026	0.023
Receiving Anti-retroviral therapies	0.021	0.015
Age category		
15-19 years	0.067	0.010
20-24 years	0.232	0.109
25-29 years	0.231	0.205
30-39 years	0.308	0.395
40-49 years	0.161	0.281
Years of primary education	5.29	5.74
Years of secondary education	0.88	1.57
Log of asset index	0.462	0.447
Marital status		
Single	0.236	0.368
Married	0.656	0.771
Living with partner	0.183	0.137
Widowed	0.040	0.008
Divorced/Separated	0.121	0.083
In a polygamous marriage	0.197	-
Religious affiliation		
Roman Catholic	0.39	0.43
Anglican	0.34	0.35
Moslem	0.14	0.13
Other religious denominations	0.13	0.10
urban	0.20	0.18
Regional location		
Central 1	0.122	0.122

Central 2	0.108	0.104
Kampala	0.075	0.063
East Central	0.111	0.104
Mid-Eastern	0.105	0.099
North East	0.080	0.085
West Nile	0.063	0.071
Mid Northern	0.091	0.122
South Western	0.127	0.102
Mid-Western	0.118	0.128
Community level variables		
Share of men in the community circumcised	0.27	0.25
Distance to market (kms)	3.27	3.43
Distance to health facility (kms)	3.47	3.66
Share of individuals tested for HIV in the community	0.604	0.600
Number of observations	*8,990*	*7,915*

Source: Author's calculations from the 2011 Uganda AIDS Indicator Survey

Table 2: Sexual behaviours, HIV testing and infection status by gender (individuals aged 15-49 years), 2011

	Women				Men			
	All women	Location		Young women	All Men	Location		Young Men
		Urban	Rural	15-24 years		Urban	Rural	15-24 years
Marital status								
Currently married=1	50.9	34.1	55.4	31.5	48.4	34.9	51.7	12.5
Living with partner=1	12.7	17.1	11.4	10.3	8.8	13.3	7.7	3.4
Women in a polygamous marriage=1	25.1	20.8	25.9	15.9	-	-	-	-
Sexual relations								
Age at first intercourse (years)	16.6	16.9	16.5	16.3	17.8	17.8	17.8	16.3
Age at first marriage/Cohabitation (years)	17.6	18.6	17.4	17.1	22.5	24.3	22.2	19.8
Abstinence: Never had sex=1	12.8	15.2	12.2	30.3	17.9	17.1	18.1	44.4
Concurrent sexual partners in past 6 months	0.4	0.4	0.4	0.1	4.6	2.8	4.8	0.2
Concurrent sexual partners in past 12 months	2	3.5	1.6	2.1	14.8	14	15	6.3
Used a condom during the last sex=1	5.2	10.4	3.8	6.9	11.2	20.3	8.9	12.5
Used alcohol during sex=1	17	10.7	18.7	8.2	16.9	12.6	17.9	4.9
Had STI in past 12 months=1	16.1	17.4	15.8	11	8.6	8.1	8.7	4.7
Use of sexual reproductive services								
Circumcised	-	-	-	-	26.5	37.4	23.8	26.5
Ever tested for HIV	69.9	78.1	67.6	61.7	46.9	59.1	44	32.9
Ever tested for HIV more than once	52.9	63	50.1	43.9	31.3	42.2	28.6	18.2
Tested for HIV as a couple	21.4	22.7	21	18.9	19.7	20.3	19.5	6.5
Tested as part of antenatal visit	43.1	42.6	43.2	36.8	-	-	-	-
HIV Infection status: HIV Positive	8.3	10.7	7.7	5.1	6.1	6.1	6.1	2.2
Among infected individuals								
Ever undertaken CD4 count test	31.8	35.6	30.4	12.3	20.9	24.5	20.1	3.4
CD4 count below 350 (Based on the 2011 UAIS)	25.4	27.1	24.6	16.5	25.6	39.3	22.2	5.9
Accessing ARVs	21.5	27.3	19.4	7.6	15.7	19.1	14.9	1.9
Self-Perceived HIV Risk: (What are the chances that you can get HIV: High or Low?)								
High	29.8	26.5	30.6	27.1	20	21.2	19.8	17
Low	52.5	56.7	51.4	57.9	66.2	67.5	65.9	69.8
Do not know	17.7	16.8	18	15	13.8	11.3	14.3	13.2
Sub Total	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*

Source: Author's calculations from the 2011 Uganda AIDS Indicator Survey

Table 3: Correlates of concurrent sexual relations within past 12 months-Probit Model Results

	Women 15-49 years						Men 15-49 years					
	All		Married		Youth (15-24 years)		All		Married		Youth (15-24 years)	
	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Age category												
20-24 years	0.013	0.236	-0.214***	-4.011*	0.014	0.303	0.045	0.208	0.466	1.427	0.032	0.293
		(0.337)		(1.929)		(0.333)		(0.259)		(0.948)		(0.277)
25-29 years	0.045	0.616	-0.212**	-3.465			0.112	0.485	0.578***	2.127*		
		(0.352)		(1.893)				(0.261)		(0.939)		
30-39 years	0.012	0.227	-0.303**	-3.629			0.143*	0.630**	0.504***	2.127*		
		(0.333)		(1.907)				(0.226)		(0.942)		
40-49 years	0.058	0.700	-0.158	-3.209			0.142*	0.604*	0.525***	1.990*		
		(0.431)		(1.900)				(0.250)		(0.932)		
Years of primary education	0.001	0.031	0.002	0.050	-0.001	-0.014	0.008	0.041	0.006	0.020	0.012	0.110
		(0.047)		(0.058)		(0.102)		(0.035)		(0.036)		(0.092)
Years of secondary education	0.003	0.069	0.005	0.110	0.002	0.043	-0.000	-0.000	-0.005	-0.017	-0.001	-0.006
		(0.055)		(0.076)		(0.088)		(0.038)		(0.047)		(0.077)
Durable Goods Index	0.005	0.106	-0.147	-3.221	-0.010	-0.207	-0.003	-0.014	0.373	1.346	-0.007	-0.062
		(0.228)		(1.800)		(0.401)		(0.228)		(0.785)		(0.362)
Interaction terms												
[20-24 years X Durable goods]	0.006	0.122	0.263*	5.767*	0.004	0.082	0.083	0.410	-0.410	-1.479	0.048	0.435
		(0.360)		(2.723)		(0.356)		(0.303)		(1.200)		(0.327)
[25-29 years X Durable goods]	-0.017	-0.366	0.233	5.114			0.039	0.192	-0.559	-2.018		
		(0.372)		(2.691)				(0.326)		(1.180)		
[30-39 years X Durable goods]	-0.001	-0.015	0.238	5.233			0.037	0.182	-0.539	-1.947		
		(0.342)		(2.699)				(0.271)		(1.185)		
[40-49 years X Durable goods]	-0.036	-0.771	0.214	4.699			0.037	0.184	-0.527	-1.902		
		(0.515)		(2.671)				(0.304)		(1.168)		
Years of primary education X Durable goods	-0.004	-0.076	-0.004	-0.093	0.009	0.194	-0.011	-0.052	0.003	0.010	-0.018	-0.167
		(0.148)		(0.179)		(0.406)		(0.125)		(0.131)		(0.311)
Years of secondary education X Durable goods	-0.012*	-0.250*	-0.017*	-0.373*	-0.008	-0.174	-0.010	-0.051	-0.003	-0.010	-0.008	-0.075
		(0.114)		(0.166)		(0.184)		(0.088)		(0.111)		(0.177)
Married =1	-0.002	-0.051			-0.003	-0.068					0.029*	0.243*
		(0.079)				(0.111)						(0.107)
Polygamous Union=1	-0.003	-0.071	-0.003	-0.069	-0.004	-0.098	0.092***	0.484***	-0.073	-0.243		
		(0.097)		(0.100)		(0.214)		(0.054)		(0.888)		
Urban	0.016**	0.299**	0.012	0.226	0.025**	0.450***	0.018	0.086	0.021	0.073	0.012	0.108
		(0.092)		(0.133)		(0.125)		(0.073)		(0.084)		(0.111)
Age of cohabiting partner (years)			-0.000	-0.001					0.003**	0.012**		
				(0.004)						(0.005)		
Constant		-2.080***		-2.173***		-2.504***		-2.419***		-2.206*		-2.256***
		(0.175)		(0.262)		(0.340)		(0.149)		(0.942)		(0.292)
Number of Observations	11,028	11,028	7,016	7,016	4,556	4,556	8,541	8,541	4,842	4,842	3,415	3,415

Standard errors in parentheses *** p<0.001, ** p<0.01, * p<0.05

Table 4: Correlates of condom use during past 12 months

	Women 15-49 years						Men 15-49 years					
	All		Married		Youth (15-24 years)		All		Married		Youth (15-24 years)	
	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Age category												
20-24 years	-0.027	-0.318	-0.037	-0.910	-0.037	-0.333	0.139***	0.648***	0.723**	2.731*	0.052	0.275
		(0.234)		(0.521)		(0.241)		(0.066)		(1.305)		(0.202)
25-29 years	0.008	0.078	-0.002	-0.045			0.124***	0.591***	0.670***	2.870*		
		(0.244)		(0.509)				(0.085)		(1.283)		
30-39 years	-0.006	-0.069	-0.020	-0.390			0.115***	0.582***	0.521***	2.798*		
		(0.214)		(0.453)				(0.079)		(1.276)		
40-49 years	0.027	0.253	0.019	0.287			0.051**	0.272**	0.504*	2.238		
		(0.280)		(0.522)				(0.094)		(1.275)		
Years of primary education	0.004	0.041	0.003	0.049	0.007	0.061	0.008**	0.047***	0.006	0.042	0.023	0.127
		(0.042)		(0.062)		(0.085)		(0.014)		(0.049)		(0.079)
Years of secondary education	0.018***	0.194***	0.007	0.133	0.031***	0.272***	0.007***	0.040***	0.006	0.040	0.007	0.040
		(0.044)		(0.072)		(0.056)		(0.010)		(0.053)		(0.048)
Durable Goods Index	-0.011	-0.120	-0.007	-0.133	-0.015	-0.133	0.008	0.047	0.318*	2.281*	-0.015	-0.079
		(0.163)		(0.394)		(0.323)		(0.065)		(0.913)		(0.329)
Interactions												
[20-24 years X Durable goods]	0.040*	0.426*	0.029	0.549	0.049*	0.425*	0.060	0.355	-0.419*	-3.009*	0.077*	0.418
		(0.212)		(0.614)		(0.216)		(0.205)		(1.415)		(0.213)
[25-29 years X Durable goods]	0.006	0.067	-0.010	-0.186			0.070*	0.413*	-0.458*	-3.287*		
		(0.230)		(0.611)				(0.188)		(1.392)		
[30-39 years X Durable goods]	0.026	0.275	0.019	0.362			0.074*	0.432*	-0.447*	-3.212*		
		(0.199)		(0.563)				(0.213)		(1.386)		
[40-49 years X Durable goods]	-0.033	-0.357	-0.030	-0.559			0.100*	0.590*	-0.401*	-2.877*		
		(0.299)		(0.629)				(0.260)		(1.379)		
Years of primary education X Durable goods	0.002	0.016	0.002	0.041	0.003	0.029	-0.023	-0.134	-0.007	-0.054	-0.048	-0.258
		(0.139)		(0.197)		(0.334)		(0.138)		(0.185)		(0.306)
Years of secondary education X Durable goods	-0.029***	-0.313***	-0.017*	-0.313*	-0.047**	-0.412**	-0.008	-0.044	-0.004	-0.027	0.001	0.008
		(0.093)		(0.150)		(0.129)		(0.083)	(0.017)	(0.123)		(0.109)
Married =1	-0.061***	-0.608***			-0.068***	-0.685***	-0.583***	-5.098***			-0.074***	-0.471***
		(0.067)				(0.111)		(0.061)				(0.114)
Polygamous Union=1	-0.012	-0.141	-0.008	-0.153	-0.007	-0.064	0.416***	4.630				
		(0.092)		(0.095)		(0.203)		(0.000)				
Urban	0.011	0.113	-0.007	-0.136	0.039*	0.313**	0.025	0.140	0.012	0.081	0.053*	0.267*
		(0.089)		(0.138)		(0.118)		(0.093)		(0.124)		(0.133)
Age of cohabiting partner (years)			-0.000	-0.001					0.001	0.004		
				(0.003)						(0.006)		
Community level variables												
Cluster level testing for HIV/AIDS	0.017	0.181	-0.001	-0.025	0.016	0.138	0.060	0.349	0.075*	0.536*	0.015	0.083
		(0.209)		(0.307)		(0.265)		(0.185)		(0.249)		(0.248)
Log of distance to health facility	-0.017**	-0.176**	-0.015**	-0.284***	-0.010	-0.086	0.001	0.008	-0.003	-0.021	0.002	0.010
		(0.055)		(0.079)		(0.078)		(0.050)		(0.073)		(0.072)
Constant		-1.381***		-1.252***		-1.874***		-1.868***		-2.573***		-1.594***
		(0.195)		(0.304)		(0.344)		(0.189)		(0.586)		(0.338)
Number of Observations	11,028	11,028	7,016	7,016	4,556	4,556	8,541	8,541	4,840	4,840	3,415	3,415

Standard errors in parentheses *** p<0.001, ** p<0.01, * p<0.05

Table 6: Having ever taken an HIV test -Probit Model Results

	Women 15-49 years						Men 15-49 years					
	All		Married		Youth (15-24 years)		All		Married		Youth (15-24 years)	
	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Age category												
20-24 years	0.197***	0.736***	0.213**	1.007*	0.148**	0.457**	0.245***	0.752***	0.422***	2.058*	0.226***	0.673***
		(0.145)		(0.482)		(0.149)		(0.188)		(0.986)		(0.197)
25-29 years	0.156***	0.574**	0.224**	1.068*			0.154**	0.447**	0.384*	1.395		
		(0.174)		(0.486)				(0.169)		(1.061)		
30-39 years	0.156***	0.557***	0.211*	0.924*			0.232***	0.684***	0.452***	1.840		
		(0.142)		(0.463)				(0.150)		(1.036)		
40-49 years	0.048	0.169	0.115	0.511			0.238***	0.719***	0.425***	1.972		
		(0.154)		(0.495)				(0.169)		(1.063)		
Years of primary education	0.016*	0.054*	0.010	0.039	0.033*	0.109*	0.024**	0.070**	0.021	0.058	0.033	0.104
		(0.024)		(0.030)		(0.046)		(0.027)		(0.034)		(0.057)
Years of secondary education	0.021*	0.070*	0.025	0.095	0.024	0.081	0.030**	0.089**	0.038**	0.106**	0.030*	0.095*
		(0.034)		(0.057)		(0.044)		(0.027)		(0.036)		(0.047)
Durable Goods Index	-0.058	-0.196	0.178	0.672	0.004	0.014	0.056	0.162	0.508	1.416	0.094	0.298
		(0.119)		(0.427)		(0.187)		(0.116)		(0.919)		(0.219)
Interactions												
[20-24 years X Durable goods]	0.060	0.203	-0.224	-0.845	0.094	0.314	-0.104	-0.305	-0.844	-2.350	-0.092	-0.293
		(0.162)		(0.651)		(0.161)		(0.213)		(1.318)		(0.221)
[25-29 years X Durable goods]	0.159**	0.538**	-0.242	-0.910			0.108	0.315	-0.480	-1.336		
		(0.196)		(0.651)				(0.180)		(1.436)		
[30-39 years X Durable goods]	0.084	0.283	-0.263	-0.992			0.014	0.040	-0.658	-1.833		
		(0.150)		(0.630)				(0.151)		(1.396)		
[40-49 years X Durable goods]	0.132*	0.445*	-0.238	-0.897			-0.043	-0.126	-0.729	-2.030		
		(0.179)		(0.665)				(0.194)		(1.424)		
Years of primary education X Durable goods	-0.001	-0.002	0.009	0.034	-0.054	-0.179	-0.025	-0.072	-0.010	-0.027	-0.082	-0.258
		(0.075)		(0.095)		(0.168)		(0.100)		(0.125)		(0.221)
Years of secondary education X Durable goods	-0.010	-0.033	-0.020	-0.074	-0.017	-0.056	0.011	0.033	-0.012	-0.034	0.020	0.063
		(0.075)		(0.123)		(0.092)		(0.066)		(0.088)		(0.111)
Married =1	0.150***	0.474***			0.285***	0.883***	0.600***	5.344**			0.145***	0.431***
		(0.038)				(0.055)		(0.000)				(0.095)
Polygamous Union=1	-0.012	-0.041	0.010	0.038	0.021	0.069	-0.400**'	-5.075***				
		(0.051)		(0.055)		(0.116)		(0.056)				
Urban	0.060*	0.207*	0.053*	0.209*	0.067*	0.227*	0.041	0.119	0.021	0.059	0.027	0.084
		(0.085)		(0.094)		(0.112)		(0.079)		(0.105)		(0.110)
Age of cohabiting partner (years)			-0.001	-0.003					-0.004*	-0.010*		
				(0.002)						(0.004)		
Community level variables												
Cluster level male circumcision	-0.068*	-0.231*	-0.089**	-0.334**	-0.056	-0.187	-0.048	-0.141	-0.034	-0.094	-0.074	-0.236
		(0.104)		(0.118)		(0.140)		(0.109)		(0.134)		(0.145)
Log of distance to health facility	-0.061***	-0.205***	-0.069***	-0.260***	-0.057**	-0.190**	-0.011	-0.032	-0.008	-0.023	-0.021	-0.067
		(0.053)		(0.065)		(0.070)		(0.049)		(0.064)		(0.068)
Constant		-0.444**		0.812***		-0.664**		-1.222***		-0.510		-0.915***
		(0.164)		(0.234)		(0.231)		(0.142)		(0.285)		(0.223)
Number of Observations	11,028	11,028	7,016	7,016	4,556	4,556	8,541	8,541	4,840	4,840	3,415	3,415

Standard errors in parentheses *** p<0.001, ** p<0.01, * p<0.05

Table 7: Correlates of male circumcision -Probit Model Results

VARIABLES	Women 15-49 years					
	All		Married		Youth (15-24 years)	
	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient
	I	II	III	IV	V	VI
Age category						
20-24 years	0.126*	0.601*	0.050	0.264	0.091*	0.489*
		(0.234)		(1.337)		(0.218)
25-29 years	0.224***	1.007***	0.134	0.671		
		(0.261)		(1.457)		
30-39 years	0.162***	0.786***	0.107	0.583		
		(0.216)		(1.347)		
40-49 years	0.163**	0.769**	0.058	0.313		
		(0.233)		(1.425)		
Years of primary education	0.011	0.060	0.002	0.009	0.022*	0.121*
		(0.037)		(0.047)		(0.066)
Years of secondary education	0.005	0.028	0.003	0.019	0.001	0.007
		(0.037)		(0.050)		(0.064)
Durable Goods Index	0.099**	0.540**	0.048	0.275	0.115*	0.638*
		(0.169)		(1.130)		(0.273)
Interactions						
[20-24 years X Durable goods]	-0.056	-0.306	-0.019	-0.108	-0.045	-0.251
		(0.235)		(1.697)		(0.222)
[25-29 years X Durable goods]	-0.124*	-0.673*	-0.086	-0.488		
		(0.263)		(1.867)		
[30-39 years X Durable goods]	-0.096*	-0.522*	-0.098	-0.560		
		(0.209)		(1.714)		
[40-49 years X Durable goods]	-0.118**	-0.643**	-0.083	-0.474		
		(0.241)		(1.824)		
Years of primary education X Durable goods	-0.022	-0.119	0.014	0.078	-0.057	-0.315
		(0.127)		(0.169)		(0.251)
Years of secondary education X Durable goods	-0.002	-0.013	-0.004	-0.023	0.006	0.035
		(0.086)		(0.115)		(0.149)
Married =1	0.244*	1.419*			0.015	0.083
		(0.803)				(0.096)
Polygamous Union=1	-0.269*	-1.399*	-0.331	-1.361		
		(0.798)		(0.794)		
Urban	0.069	0.350*	0.086*	0.448**	0.054	0.283
		(0.170)		(0.173)		(0.218)
Age of cohabiting partner (years)			0.001	0.006		
				(0.005)		
Community level variables						
Log of distance to the market	0.023	0.125	0.035*	0.198*	0.005	0.028
		(0.096)	(0.020)	(0.111)	(0.023)	(0.125)
Log of distance to health facility	-0.027	-0.145	-0.038*	-0.214*	-0.014	-0.077
		(0.106)	(0.020)	(0.112)	(0.024)	(0.131)
Cluster level testing for HIV/AIDS	-0.183**	-0.995**	-0.260***	-1.482***	-0.082	-0.451
		(0.315)	(0.059)	(0.350)	(0.072)	(0.399)
Constant		-1.387***		0.389		-1.684***
		(0.305)		(0.943)		(0.432)
Number of Observations	8,541	8,541	4,842	4,842	3,415	3,415

Standard errors in parentheses *** p<0.001, ** p<0.01, * p<0.05

Table 8: Correlates of HIV Infection -Probit Model Results

	Women 15-49 years						Men 15-49 years					
	All		Married		Youth (15-24 years)		All		Married		Youth (15-24 years)	
	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Age category												
20-24 years	0.161**	0.832***	0.142	0.776	0.058	0.626	0.068	0.480	0.682*	2.470	0.005	0.108
		(0.218)		(0.472)		(0.510)		(0.342)		(1.330)		(0.383)
25-29 years	0.138*	0.734**	0.134	0.745			0.045	0.348	0.426	1.720		
		(0.226)		(0.471)				(0.324)		(1.228)		
30-39 years	0.159***	0.865***	0.123*	0.751*			0.120*	0.842**	0.441*	2.259*		
		(0.208)		(0.455)				(0.282)		(1.205)		
40-49 years	0.158**	0.810***	0.157*	0.816*			0.096*	0.670*	0.425	1.925		
		(0.238)		(0.482)				(0.294)		(1.208)		
Years of primary education	0.004	0.027	0.008	0.064	-0.017	-0.147	0.002	0.014	0.001	0.010	-0.006	-0.131
		(0.034)		(0.039)		(0.095)		(0.038)		(0.045)		(0.144)
Years of secondary education	-0.013*	-0.091*	-0.007	-0.057	-0.037*	-0.319*	0.001	0.009	0.006	0.049	0.000	0.009
		(0.044)		(0.061)		(0.132)		(0.044)		(0.054)		(0.107)
Durable Goods Index	-0.013	-0.093	0.043	0.329	-0.092	-0.782	-0.019	-0.178	0.167	1.261	-0.036	-0.767
		(0.166)		(0.342)		(0.508)		(0.238)		(0.888)		(0.702)
Interactions												
[20-24 years X Durable goods]	-0.018	-0.127	-0.084	-0.642	-0.052	-0.447	-0.013	-0.120	-0.372*	-2.804*	0.008	0.177
		(0.245)		(0.553)		(0.618)		(0.403)		(1.542)		(0.451)
[25-29 years X Durable goods]	0.023	0.164	-0.078	-0.598			0.035	0.322	-0.249	-1.872		
		(0.249)		(0.555)				(0.375)		(1.385)		
[30-39 years X Durable goods]	0.023	0.165	-0.058	-0.439			0.031	0.288	-0.276	-2.080		
		(0.217)		(0.528)				(0.330)		(1.357)		
[40-49 years X Durable goods]	0.018	0.130	-0.086	-0.657			0.059	0.546	-0.221	-1.666		
		(0.262)		(0.553)				(0.346)		(1.358)		
Years of primary education X Durable goods	-0.008	-0.056	-0.021	-0.162	0.063	0.540	-0.000	-0.002	0.000	0.002	0.037	0.790
		(0.105)		(0.123)		(0.357)		(0.133)		(0.157)		(0.700)
Years of secondary education X Durable goods	0.004	0.032	0.006	0.043	0.079*	0.670*	-0.017	-0.154	-0.031*	-0.235*	-0.004	-0.093
		(0.089)		(0.124)		(0.261)		(0.103)		(0.128)		(0.249)
Married =1	-0.076***	-0.488***					-0.542	-4.766			0.010	0.199
		(0.050)						(0.000)				(0.142)
Polygamous Union=1	0.012	0.081	0.017*	0.124*	0.031	0.238	0.454	4.527				
		(0.064)		(0.064)		(0.150)		(0.062)				
Urban	0.044**	0.286**	0.020	0.145	0.002	0.018	0.035**	0.282**	0.052**	0.334**	-0.002	-0.048
		(0.087)		(0.118)		(0.219)		(0.088)		(0.107)		(0.227)
Age of cohabiting partner (years)			-0.000	-0.002					0.001	0.006		
				(0.002)						(0.005)		
Community level variables												
Log of distance to the market	0.002	0.013	0.000	0.001	-0.014	-0.116	-0.001	-0.007	-0.003	-0.022	0.002	0.039
		(0.048)		(0.056)		(0.125)		(0.047)		(0.057)		(0.107)
Constant		-1.877***		-1.456***		-1.291**		-2.296***		-2.396***		-3.460***
		(0.166)		(0.227)		(0.405)		(0.176)		(0.520)		(0.727)
Number of Observations	11,028	11,028	7,016	7,016	1,915	1,915	8,560	8,560	4,849	4,849	3,425	3,425

Standard errors in parentheses *** p<0.001, ** p<0.01, * p<0.05

Table 9: Correlates of high risk of HIV Infection (self reported) -Probit Model Results

	Women 15-49 years						Men 15-49 years					
	All		Married		Youth (15-24 years)		All		Married		Youth (15-24 years)	
	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Age category												
20-24 years	0.153**	0.441**	0.182	0.511	0.159***	0.500***	0.114*	0.391*	-0.242**	-1.640	0.093*	0.375*
		(0.134)		(0.322)		(0.136)		(0.162)		(1.555)		(0.167)
25-29 years	0.122**	0.352**	0.149	0.417			0.053	0.189	-0.290**	-1.799		
		(0.128)		(0.320)				(0.199)		(1.549)		
30-39 years	0.127**	0.371**	0.195*	0.558*			0.080	0.284	-0.324	-1.485		
		(0.135)		(0.319)				(0.177)		(1.513)		
40-49 years	0.011	0.034	0.101	0.284			0.069	0.246	-0.323*	-1.705		
		(0.184)		(0.358)				(0.209)		(1.527)		
Years of primary education	0.002	0.005	0.004	0.011	0.005	0.014	0.001	0.005	-0.011	-0.040	0.017	0.069
		(0.023)		(0.029)		(0.044)		(0.030)		(0.040)		(0.057)
Years of secondary education	0.004	0.012	-0.003	-0.008	-0.004	-0.011	0.002	0.009	0.008	0.030	-0.003	-0.012
		(0.033)		(0.045)		(0.040)		(0.030)		(0.041)		(0.053)
Durable Goods Index	0.036	0.109	0.066	0.189	0.005	0.014	-0.021	-0.077	-0.591	-2.111	0.017	0.071
		(0.104)		(0.274)		(0.177)		(0.157)		(1.374)		(0.229)
Interactions												
[20-24 years X Durable goods]	-0.099*	-0.298*	-0.133	-0.382	-0.096*	-0.303*	-0.008	-0.032	0.892	3.188	-0.008	-0.031
		(0.135)		(0.402)		(0.137)		(0.171)		(2.151)		(0.176)
[25-29 years X Durable goods]	-0.054	-0.163	-0.047	-0.134			0.045	0.168	0.940	3.360		
		(0.137)		(0.402)				(0.234)		(2.149)		
[30-39 years X Durable goods]	-0.088*	-0.267'*	-0.107	-0.309			0.030	0.112	0.831	2.971		
		(0.149)		(0.396)				(0.201)		(2.090)		
[40-49 years X Durable goods]	-0.013	-0.039	-0.020	-0.057			0.016	0.061	0.867	3.099		
		(0.210)		(0.447)				(0.245)		(2.110)		
Years of primary education X Durable goods	0.014	0.042	0.001	0.002	0.037	0.117	0.003	0.011	0.047	0.169	-0.055	-0.231
		(0.075)		(0.092)		(0.164)		(0.110)		(0.141)		(0.215)
Years of secondary education X Durable goods	-0.022	-0.065	-0.019	-0.053	-0.009	-0.027	-0.012	-0.046	-0.029	-0.102	0.009	0.039
		(0.069)		(0.093)		(0.085)		(0.071)		(0.098)		(0.126)
Married =1	0.060***	0.182***			0.026	0.083	0.306*	1.313			-0.001	-0.005
		(0.037)				(0.055)		(0.758)				(0.090)
Polygamous Union=1	0.123***	0.352***	0.135***	0.375***	0.130***	0.377***	-0.331*	-1.300	-0.464	-1.314		
		(0.041)		(0.042)		(0.088)		(0.753)		(0.746)		
Urban	-0.075**	-0.237*	-0.071*	-0.211*	-0.082*	-0.270*	0.052	0.187	0.086*	0.288*	0.011	0.043
		(0.096)		(0.099)		(0.125)		(0.098)		(0.130)		(0.131)
Age of cohabiting partner (years)			-0.003***	-0.009***					0.001	0.004		
				(0.002)						(0.004)		
Community level variables												
Cluster level testing for HIV/AIDS	0.018	0.053	0.065	0.186	0.007	0.021	0.056	0.210	0.057	0.205	0.106	0.439
		(0.200)		(0.222)		(0.238)		(0.171)		(0.195)		(0.253)
Log of distance to the market	-0.048**	-0.145**	-0.048**	-0.137*	-0.044*	-0.138*	0.022	0.083	0.045**	0.160**	-0.004	-0.016
		(0.051)		(0.053)		(0.058)		(0.050)		(0.055)		(0.074)
Constant		-0.744***		-0.416*		-0.886***		-1.556***		-0.771		-1.470***
		(0.183)		(0.205)		(0.253)		(0.197)		(0.805)		(0.328)
Number of Observations	11,028	11,028	7,016	7,016	4,556	4,556	8,541	8,541	4,842	4,842	3,415	3,415

Standard errors in parentheses *** p<0.001, ** p<0.01, * p<0.05

Table 10: Discordance in HIV status among couples, 2011

	All married couples	Infected Couples			
		All	Couples who have been in only one union	Couples who have been married for at least 10 years	Couples who are not in a polygamous union and married only once
	I	II	III	IV	V
Concordant negative	0.916	n.a	n.a	n.a	n.a
	[0.005]				
Concordant positive	0.041	0.481	0.491	0.542	0.439
	[0.003]	[0.024]	[0.032]	[0.033]	[0.036]
Discordant male	0.009	0.102	0.097	0.106	0.024
	[0.001]	[0.011]	[0.015]	[0.015]	[0.009]
Discordant female	0.013	0.154	0.188	0.142	0.283
	[0.001]	[0.013]	[0.021]	[0.018]	[0.032]

Notes: n.a. = not applicable. The table reports the sample means with standard errors in brackets. The sample comprises all couples for which an HIV test was available for both partners.

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