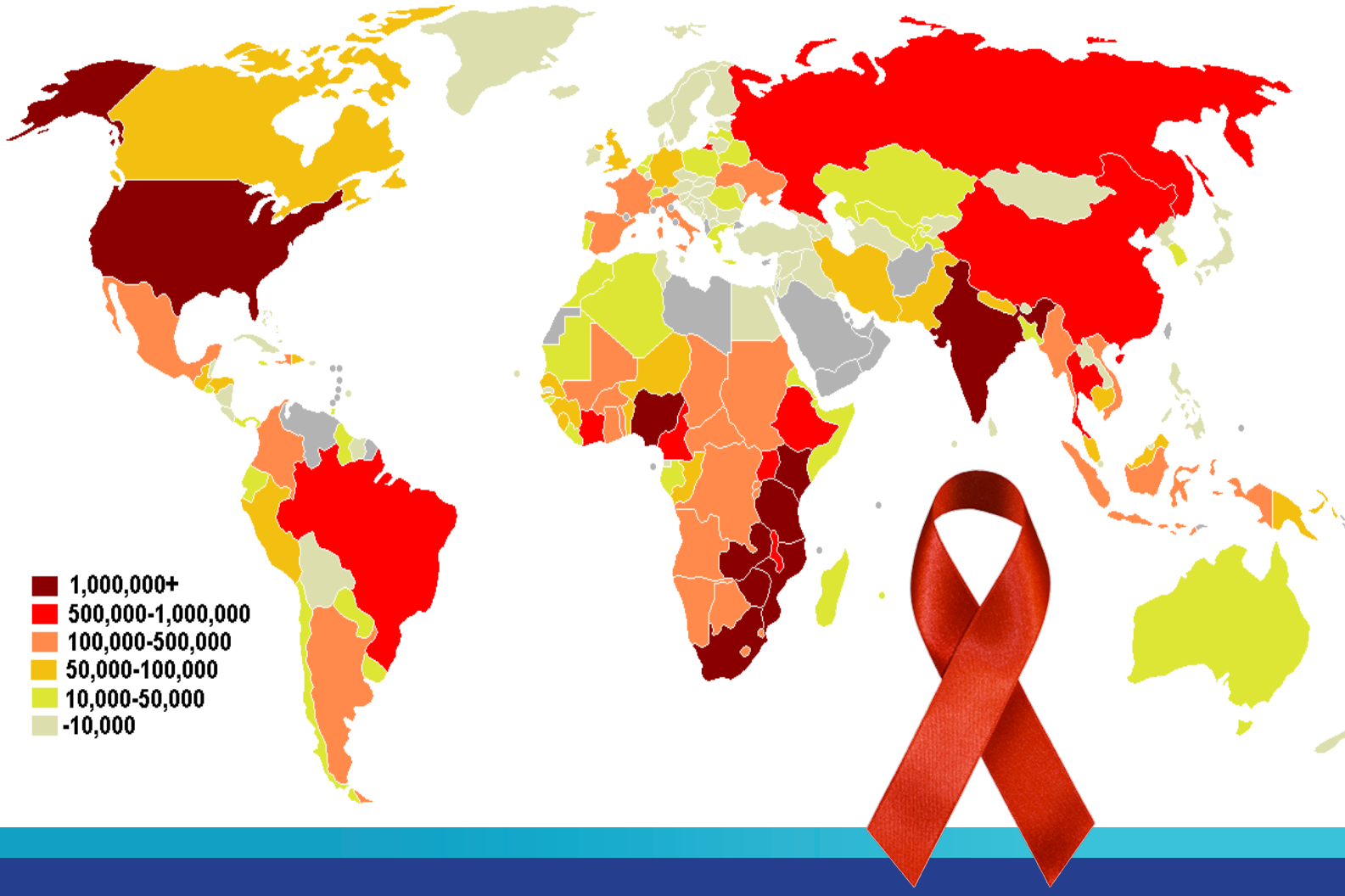
RESEARCH SERIES No. 95

HIV/AIDS Sero-prevalence and Socioeconomic Status: Evidence from Uganda.



IBRAHIM KASIRYE

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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 17,000 individuals from the 2011 Uganda AIDS Indicator Survey. This survey tested individuals 15-49 years of age for sexually transmitted infections, including HIV/AIDS. 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 determinants of sexual behaviors such as: having concurrent sexual partners, condom use, and alcohol use during sex, and having been tested for HIV prior to the survey. In addition, we estimate model for determinants of the risk of HIV infections as well as self-assessed risks of contracting HIV. We find that education and access to health facilities are important determinants of sexual behaviors as well as the risk of HIV infections.

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 2010, an estimated 34 million persons were infected with HIV globally, and at least 68 % of victims were in SSA—a region with only 12% of the global population (UNAIDS, 2011). Worse still, the region had 70 percent 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/AIDS infections. Among policy makers 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 determinants of HIV/AIDS status 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 6.3 % by 2004/05 (Government of Uganda, 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/AIDS, 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 Sector

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).

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/AIDS infections. According to the Uganda AIDS Commission, the new infections rates nearly doubled from 73,000 in 2002 to over 130,000 by 2009 (UAC, 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 (GoU, 2010). 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/AIDS status, sexual behavior, and socioeconomic status. Specifically, we consider the following questions: (a) What are the socio-economic determinants of sexual behaviors? (b) What factors are correlated with the adoption of the key HIV/AIDS prevention strategies ?; (c) What are the determinants of the risk of HIV infection? The overriding objective is to understand individual behaviors relative to the risk of 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. Consequently, it would be wise to consider how the country managed to reverse the increase in HIV/AIDS—at least in the 1990s. Second, anecdotal evidence suggests the increase in new infections could be due to the complacency generated by the new availability of antiretroviral (ARV) drugs. The current study indicates some of the potential reasons for the recent changes.

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

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.

representative. Furthermore, despite the advent of DHS type surveys, which also test for HIV/AIDS status, all of the previous cross-country studies examining correlates of HIV/AIDS status have not involved Uganda (see, e.g., Fortson, 2008; de Walque, 2006, 2007b). 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 current debates on the effectiveness of Uganda's HIV/AIDS prevention programs (highlighted below) provide another reason for undertaking this research.

The paper is organized as follows. In the next section, we present a theoretical framework for analyzing the determinants of HIV/AIDS status and review the recent literature on the determinants of HIV status in SSA. Section 3 provides the methodology and data used. Section 4 presents the findings of the study, and the discussions and 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/AIDS 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.[3] 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.[4] 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

3 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).

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

partners, which creates what is known as the "sexual network" in the HIV/AIDS literature. 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/AIDS infection rates among teenagers. Thus, sexual behavior, coupled with knowledge, attitudes and beliefs about HIV/AIDS, can be a key determinant of infection.

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 an 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.

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[5], women are more likely to be infected (de Walque, 2007b). No conclusive explanation has been provided for these higher rates of HIV/AIDS infection; however, the literature points to a number of contextual factors that may increase female susceptibility to HIV/AIDS 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 determinants of HIV/AIDS is poverty. 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

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

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 determinants of HIV/AIDS status.

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).[6] This recent availability of data has spurred

6 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.

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/AIDS 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, 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[7] 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.

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

3.0 METHODOLOGY AND DATA

3.1 Probit estimation of determinants of risk of HIV infection and sexual behavior

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 determinants of HIV infection in Africa (see, e.g., de Walque and Kline 2010; Corno and de Walque, 2007), we estimate a probit model for HIV/AIDS positive status. The reduced-form equation can be formally represented as

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

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 ε_i are unobservable determinants of HIV/AIDS. 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 determinants of condom use, extramarital sex and HIV testing. Specifically, we estimate the following additional models:

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

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

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

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 above estimations are undertaken separately for women and men. The above four specifications help to show whether the determinants of the risk of HIV infection are similar to the determinants of preventive or risky sexual behaviors associated with contracting the HIV virus.

If the determinants of HIV/AIDS 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 β' 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/AIDS infection specification.

3.2 Bivariate probit models for extramarital sex and condom use

In addition to the probit analysis of the factors in extramarital relations and condom use, we conduct a joint estimation of extramarital affairs and condom use. As highlighted by previous authors, such Kazianga (2005) and Djemai (2009), there are important reasons why extramarital sex and condom use may be jointly determined. First, condom use is heavily determined by the nature of one's sexual partners: the desire for procreation may limit the use of condoms with regular partners. Secondly, the traditional probit model for condom use may not adequately account for the degree of HIV-related risk taking.

In its most generic form, the bivariate probit model assumes that the "treatment"—in our case, condom use—has a direct causal effect on the "outcome": i.e., extramarital relations. The model also assumes that both behaviors are influenced by similar unobservable factors. Formally, these concepts can be represented as

(7) $$\begin{aligned} y_1^* &= \beta_1 X_1 + \varepsilon_1 & y_1 &= 1 \text{ if } y_1^* > 0, \ 0 \ otherwise \\ y_2^* &= \alpha y_1^* + \beta_2 X_2 + \varepsilon_2 & y_2 &= 1 \text{ if } y_2^* > 0, 0 \ otherwise \end{aligned}$$

where y_1^* and y_2^* represent the latent variables for extramarital relations and condom use, respectively. X_1 and X_2 refer to individuals and household factors relating to sexual behaviors, respectively. Finally, the error terms follow a bivariate normal distribution and can be approximated by $(\varepsilon_1, \varepsilon_2) \approx BVN[0,0,\sigma_1^2,\sigma_2^2,\delta]$, where σ_1^2 and σ_2^2 are standard deviations and δ is the correlation coefficient. As indicated in the formulation (Eq. 7), the dummy variable for extramarital relations appears in the regression equation for condom use. Following Green (2003), the bivariate probit model is estimated using full information maximum likelihood (FIML) estimation, and the results are presented in Tables 6 and 7.

3.3. 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.[8] 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, 17,000 individuals (8,990 women and 7,915 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.

3.4 Variables used.

3.4.1 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

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

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 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.
Abstinence: One of the major hallmarks for Uganda's HIV prevention strategy has been abstinence. We include a variable for "Never had sex" as one of indicators for sexual behaviours.

STI infecction: For all individuals sexually active during the past year, the survey inquired whether they had an STI or symptoms of STI. Self reported STI infection is included as another sexual activity indicator.

3.4.2 Independent variables

Demographics: To capture each individual's demographic characteristics, we consider the following indicators: age and marital status (widowed, divorced, separated, and so on). The age of the individual is meant to indicate the extent of the person's susceptibility to STIs. The other demographic variable, marital status, is meant to reflect polygamy, which increases the number of regular sexual partners. In addition, we include variables related to reproductive health, such male circumcision. As noted in the literature review, some studies suggest that individuals who are circumcised will be less likely to contract HIV.

Socioeconomic characteristics: The major socioeconomic characteristics are related to educational attainment and 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 without income information (e.g., Ssewanyana and Younger, 2008; Sahn and Stifel, 2003), we use an asset index as a proxy for household income or wealth.

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 the risk of HIV infection. We include dummy variables for the majorly religious denomination i.e. Catholics, Anglican, Moslems, and other religious denominations (Pentecostals, bahai etc).

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.

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

	Women	Men
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

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. With regard to marital status, at least 25% of all women aged 15-49 years are in a polygamous relationship. 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.

Table 2: Sexual behaviors, 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

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. Furthermore, there is significant urban in testing with average rates in urban areas at least 10 percentages higher than average national rates. 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 test results from the survey, at least one in four individuals 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 only about 20% of individuals are accessing ARTs—with a higher proportion of HIV positive women than men accessing ARVs.

4.2 Determinants of sexual behaviors

Table 3 shows the determinants of key sexual behaviors that increase the risk of HIV infection. The first dependent variable equal one if an individuals has had concurrent sexual relations in the past year and the estimations are undertaken separately for women and men. It is indicated that older women (aged 40-49 years) are least likely to engage in concurrent sexual relations compared to women aged 15-19 years; the few women who engage in concurrent sexual relations are resident in urban areas. On the other hand, middle aged men are significantly more likely to maintain concurrent sexual relations. In particular, men aged 20-29 years are about 7% more likely to maintain concurrent sexual relations than men aged 15-19 years, all else held constant. It is also worth noting that many in polygamous marriage are significantly less likely to engage in such extra marital sex.

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. Furthermore, the interactions of education and wealth as well as wealth and age are insignificant. Men who subscribe to smaller religious denominations (about 10% of the male sample, see Table 1) are more faithful compared to men that subscribe to the other major religious denominations. Finally, we also experimented with a fixed effects specification (not indicated in the table) for determinants of concurrent sexual partners and the results remained largely the same.

The second sexual behaviour we consider is the use of a condom during the last sexual encounter. Advocacy for the use of condoms has been a major component of Uganda's ABC strategy and it important to understand which groups consistently use condoms—possibly as means of preventing the spread of STIs including the HIV virus. The results in Table 3 reveal that condoms are mainly used by young women aged 20-25 years while older women are 10% less likely to use condoms. In addition, higher education attainment of women is significantly associated with condom use—each additional year of secondary education increases condom use by about 10% compared to individuals without education. The education impacts are absent for men with regard to condom use. It is also worth noting that the interaction terms for education, age, and wealth are all significant unlike the case for men.

For determinants of condom use, 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 of male circumcision and HIV testing—both proxies for use of health services and the log of distance to nearest health facility. The results in Table 3 show that only the distance to clinic that is significant and for women. Each additional kilometer reduces condom use by women by as much as 20%. Given that increasing distance can be interpreted as cost, this particular finding suggests that there is limited access to condoms among poorer individuals located in rural areas.

We also estimated separate regressions for young women and men (aged 15-4 years) due to possible life cycle effects and the fact that wealth may not matter as much for younger than older persons. The results (presented in Table A1 in the appendix), show that education is more important for younger women than older women with regard to the use of condoms. In addition, wealth effects do not matter for young persons and urban young women are more likely to use condom—a situation similar to the practice of concurrent partners. Turning to young men, Table A1 shows that there are important wealth, education, and age impacts with regard to using condoms and this suggests that condoms may be costly for young men to acquire. However, the supply level variables are insignificant.

The other major sexual behaviour we consider is alcohol use during sex. Table 3 shows that young women are significantly more likely to be drunk during the last sexual encounter. On the other hand, it is mainly men aged 20-29 years who were more likely to be drunk during the last sex episode. Among men, it is mainly widowed and men in polygamous unions who use alcohol during sex. With regard to young men (aged 15-24 years), it mainly those in urban areas that use alcohol (Table A1).

Table 3: Determinants of sexual behaviors - probit model results

	Concurrent sexual relations with past 12 months				Condom use during past 12 months				Alcohol use during sex			
		[0.28]		[1.91]*		[0.01]		[0.93]		[2.51]**		[2.03]**
30-39 years	-0.013	-0.315	0.046	0.222	-0.007	-0.065	-0.02	-0.119	0.1	0.445	0.048	0.237
		[0.92]		[1.03]		[0.23]		[0.54]		[2.23]**		[1.04]
40-49 years	-0.023	-0.768	-0.009	-0.044	-0.034	-0.411	-0.091	-0.666	0.072	0.319	0.01	0.053
		[1.83]*		[0.16]		[1.08]		[2.25]**		[1.26]		[0.18]
Years of primary education	0.004	0.074	0.016	0.08	0.011	0.106	0.006	0.037	-0.001	-0.004	-0.021	-0.105
		[0.72]		[1.06]		[1.18]		[0.46]		[0.07]		[1.23]
Years of secondary education	0	0.001	0.001	0.004	0.01	0.093	0.006	0.035	-0.003	-0.014	-0.011	-0.058
		[0.02]		[0.12]		[2.13]**		[0.94]		[0.53]		[1.63]
Log (Age X Education years)	-0.984	-20.583	1.114	5.582	-4.406	-42.662	-2.664	-15.377	-0.164	-0.802	0.807	4.139
		[1.18]		[0.42]		[1.80]*		[0.96]		[0.08]		[0.26]
Log of asset index	-1.98	-41.403	2.092	10.486	-8.774	-84.961	-5.453	-31.472	-0.502	-2.454	1.285	6.59
		[1.21]		[0.40]		[1.82]*		[1.00]		[0.12]		[0.21]
Log (Age X Asset Index)	1.015	21.219	-0.921	-4.619	4.434	42.936	2.829	16.329	0.296	1.446	-0.537	-2.754
		[1.23]		[0.35]		[1.83]*		[1.04]		[0.14]		[0.18]
Log (Education X Asset Index)	0.961	20.096	-1.154	-5.784	4.331	41.935	2.643	15.253	0.149	0.73	-0.75	-3.847
		[1.18]		[0.45]		[1.80]*		[0.98]		[0.07]		[0.25]
Marital status												
Married	-0.003	-0.069	0.574	6.945	-0.081	-0.813	-0.519	-4.801	0.087	0.43	-0.409	-4.91
		[0.58]		[102.87]***		[8.93]***		[62.76]***		[5.40]***		[48.64]***
Living with partner	0.003	0.063	0.821	7.16	-0.051	-0.664	-0.172	-4.704	0.1	0.432	-0.207	-4.87
		[0.48]		[.]		[6.62]***		[.]		[4.98]***		[.]
Widowed	-0.017	-0.662	-0.091	-0.627	-0.018	-0.194	-0.041	-0.279	-0.033	-0.174	-0.05	-0.284
		[1.84]*		[1.90]*		[1.21]		[0.95]		[1.32]		[0.93]
Divorced/separated	0.007	0.128	-0.02	-0.106	-0.028	-0.319	-0.005	-0.026	0.03	0.139	0.114	0.511
		[0.98]		[0.78]		[3.54]***		[0.20]		[1.47]		[4.48]***
In polygamous union	-0.002	-0.04	-0.463	-6.586	-0.011	-0.112	0.422	4.246	0.017	0.083	0.546	5.323

	Concurrent sexual relations with past 12 months				Condom use during past 12 months				Alcohol use during sex			
		[0.37]		[72.33]***		[1.16]		[45.07]***		[1.48]		[47.60]***
Religious affiliation												
Anglican	-0.002	-0.039	-0.009	-0.045	0.004	0.034	0.002	0.014	-0.021	-0.104	-0.022	-0.116
		[0.43]		[0.98]		[0.51]		[0.28]		[2.24]*		[2.18]*
Moslem	0	-0.003	0.02	0.095	-0.003	-0.032	0.017	0.093	-0.133	-0.919	-0.159	-1.222
		[0.03]		[1.51]		[0.39]		[1.17]		[7.97]***		[10.84]***
Other Denominations	-0.002	-0.047	-0.074	-0.439	-0.016	-0.173	-0.072	-0.53	-0.073	-0.412	-0.14	-1.016
		[0.39]		[5.66]***		[1.88]		[5.96]***		[6.42]***		[10.21]***
Urban	0.018	0.333	0.017	0.086	0.009	0.085	0.028	0.151	0.03	0.144	0.045	0.222
		[2.99]***		[1.07]		[0.93]		[1.52]		[1.62]		[1.44]
Regional Location		YES				YES				YES		
Cluster level for male circumcision					-0.005	-0.053	-0.016	-0.091				
						[0.46]		[0.74]				
Cluster level testing for HIV/ AIDS					0.016	0.153	0.062	0.357				
						[0.73]		[1.92]				
Log of distance to clinic					-0.023	-0.22	0.006	0.034				
						[3.81]**		[0.65]				
Constant		-3.221		-5.276		-0.692		-4.202		-3.452		-6.231
		[1.98]*		[5.28]***		[0.43]		[3.20]***		[3.84]***		[5.28]***
Observations	8990	8990	7915	7915	8990	8990	7915	7915	8990	8990	7915	7915

4.3 HIV/AIDS testing behavior and male circumcision

As mentioned previously, the limited knowledge that individuals have about their HIV/AIDS 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 to over 69 for women and 47% for men by 2011 (Table 1). Notwithstanding the relatively high HIV testing coverage rates, we examine the determinants of ever testing for women and men. The survey asks how many times an individual has tested for HIV/AIDS 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 determinants of HIV/AIDS testing are reported in first part of Table 4. It is indicated that higher education attainment of women is associated with increased testing; each additional year of secondary education increases the likelihood of HIV testing by about 2.6%. Education is of also of particular importance to men—each year of secondary education increase the likelihood of HIV testing by 3.6%, all else constant. However, the interaction terms between education and wealth are insignificant for both women and men. It is also worth noting that there are no significant differences in the drivers of HIV testing between rural and urban areas. Table 4 also shows that men in polygamous marriages are significantly less likely to be tested for HIV than individuals who are single men. 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. On the other hand, supply level proxies are insignificant for the male regressions and this 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 inquiries from married individuals whether they tested as couple. Columns 5-8 of Table show the results for testing as couple and the results 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. Finally, Table 4 also examines which women are likely to receive an HIV test during routine antennal visits. The results presented in columns 9 and 10 indicates 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 when receive HIV tests at antennal clinics.

Table 4: Determinants of HIV Testing and Male circumcision-Probit model estimates

	Ever taken an HIV test				Taken HIV test as a couple							
	Women		Men		Women		Men		Women Test part of Antenatal visit		Men: Ever circumcised	
	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient
Age category												
20-24 years	0.142	0.54	0.1	0.295	0.127	0.446	0.146	0.603	0.231	0.761	0.006	0.032
		[7.17]***		[3.32]***		[5.01]***		[4.03]***		[9.67]***		[0.30]
25-29 years	0.119	0.453	0.14	0.409	0.106	0.373	0.186	0.752	0.255	0.826	-0.019	-0.105
		[3.86]***		[3.41]***		[2.79]***		[4.10]***		[6.97]***		[0.72]
30-39 years	0.001	0.004	0.098	0.285	0.055	0.2	0.174	0.73	0.131	0.437	-0.074	-0.434
		[0.02]		[1.72]		[1.14]		[3.02]***		[2.67]***		[2.08]*
40-49 years	-0.132	-0.447	0.027	0.079	0.017	0.065	0.142	0.588	-0.102	-0.337	-0.12	-0.78
		[2.08]**		[0.35]		[0.27]		[1.85]*		[1.49]		[2.83]**
Years of primary education	0.028	0.1	0.03	0.088	0.017	0.066	0.014	0.062	0.024	0.079	0.031	0.168
		[2.14]**		[1.36]		[1.22]		[0.76]		[1.50]		[2.18]**
Years of secondary education	0.026	0.094	0.036	0.105	0.027	0.104	0.017	0.075	0.012	0.04	0.013	0.072
		[4.06]***		[3.46]***		[4.02]***		[1.92]*		[1.65]		[2.19]**
Log (Age X Education years)	-3.937	-14.142	-5.061	-14.837	-4.682	-17.711	-5.154	-23.045	-7.807	-26.132	-4.559	-24.983
		[1.48]		[1.10]		[1.59]		[1.09]		[2.51]**		[1.83]*
Log of asset index	-7.928	-28.482	-10.083	-29.558	-9.204	-34.819	-10.228	-45.731	-15.319	-51.277	-9.059	-49.64
		[1.51]		[1.11]		[1.59]		[1.09]		[2.51]**		[1.85]*
Log (Age X Asset Index)	4.079	14.652	5.166	15.143	4.648	17.585	5.168	23.108	7.659	25.635	4.703	25.769
		[1.54]		[1.13]		[1.60]		[1.09]		[2.49]**		[1.91]*
Log (Education X Asset Index)	3.845	13.811	4.967	14.56	4.567	17.276	5.075	22.692	7.652	25.613	4.416	24.195
		[1.48]		[1.10]		[1.59]		[1.09]		[2.52]**		[1.81]*
Marital status												
Married	0.264	0.924	0.59	5.668	0.201	0.765	-0.37	-4.191	0.431	1.453	-0.483	-4.319
		[15.88]***		[79.29]***		[11.50]***		[65.90]***		[21.17]***		[47.29]***
Living with partner	0.217	0.937	0.541	5.705	0.186	0.622	-0.232	-4.297	0.376	1.356	-0.305	-4.321
		[13.52]**		[.]		[7.42]**		[.]		[17.86]**		[.]

	Ever taken an HIV test				Taken HIV test as a couple							
	Women		Men		Women		Men		Women Test part of Antenatal visit		Men: Ever circumcised	
	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient
Widowed	0.192	0.877	0.231	0.708	0.131	0.438	0.163	0.631	0.225	0.788	-0.016	-0.089
		[7.52]***		[3.09]***		[3.37]***		[2.48]**		[6.78]***		[0.27]
Divorced/separated	0.192	0.834	0.097	0.286	0.131	0.449	0.113	0.458	0.311	1.124	0.037	0.189
		[10.36]***		[3.64]***		[5.02]***		[4.17]***		[14.46]***		[1.71]
In polygamous union	0.01	0.035	-0.394	-5.289	-0.045	-0.176	0.595	5.215	-0.011	-0.036	0.474	4.399
		[0.57]		[60.54]***		[3.48]***		[48.29]***		[0.72]		[41.51]***
Religious affiliation												
Anglican	0.015	0.053	-0.003	-0.008	-0.005	-0.019	-0.012	-0.052	0.011	0.036	0.028	0.15
		[1.22]		[0.20]		[0.42]		[1.04]		[0.86]		[2.49]**
Moslem	0.03	0.11	0.022	0.065	0.026	0.097	0.002	0.008	0.024	0.082	0.793	3.216
		[1.85]*		[1.10]		[1.49]		[0.12]		[1.49]		[22.15]***
Other Denominations	0.021	0.076	0.052	0.153	0.025	0.092	0.053	0.224	-0.014	-0.048	0.047	0.242
		[1.22]		[2.26]**		[1.54]		[3.25]***		[0.78]		[3.30]***
Urban	0.059	0.217	0.03	0.088	-0.003	-0.012	0.015	0.065	0.027	0.09	0.053	0.274
		[2.31]**		[1.09]		[0.16]		[0.63]		[1.36]		[1.58]
Cluster level for male circumcision	-0.074	-0.267	-0.05	-0.147	0.012	0.044	-0.005	-0.022	-0.064	-0.216		
		[2.28]**		[1.33]		[0.41]		[0.16]		[2.01]**		
Cluster level testing for HIV/ AIDS											-0.177	-0.972
												[3.06]***
Log of distance to clinic	-0.064	-0.229	-0.015	-0.044	-0.004	-0.017	-0.001	-0.003	-0.039	-0.13	-0.021	-0.117
		[4.03]***		[0.86]		[0.33]		[0.05]		[2.37]**		[1.10]
Constant		-1.619		-1.667		-0.797		-2.354		0.729		-2.888
		[2.00]**		[1.54]		[0.86]		[1.87]*		[0.79]		[2.48]**
Observations	8,990	8,990	7,915	7,915	8,990	8,990	7,915	7,915	8,990	8,990	7,915	7,915

As part of the Ministry of Health's campaign to reduce HIV transmission, Uganda has implemented a large scale safe male circumcision campaign in the past 2 years. As such, the final two columns in Table 4 examine the correlates of male circumcision and it is indicated that it mainly younger and middle aged men that are undertaking circumcision. Also education attainment is important as factor in encouraging male circumcision. At the cluster level, high rates of HIV/AIDS testing are associated with reduced likelihood of male circumcision.

4.4 Determinants of the risk of HIV infection and self-perceived chances of contracting HIV.

Table 5 reports the marginal effects and coefficients for the determinants of risk of HIV infection for women and men. The results for women indicate that higher educational attainment is important for reducing the risk of infection. Each additional year of either primary or secondary schooling reduces the risk of HIV infection among women by 2%. The education results for men are counter-intuitive—additional years of education of primary and secondary education area associated with increasing risk of infection.

With regard to demographics, widows are most likely to be infected with HIV. In particular, widows are as much as 20% more likely to be infected than single individuals. This may be partly explained by fact HIV/AIDS may have been the reason for the loss of spouses for a majority of widows. Related, divorced/separated individuals have a 9% higher chance of being infected with HIV. Whereas women in polygamous marriages have a 2% higher chance of being infected, about 1 in 2 men in polygamous marriages are infected with HIV. Finally, Moslem women and men have lower chance of HIV infection compared to their catholic counterparts, after accounting for the higher likelihood of polygamous marriages among Moslems.

Similar to other studies on HIV/AIDS status in SSA (see, e.g., Corno and De Walque 2007 for Lesotho), our results indicate that the risk of HIV infection increases with household wealth status; however, the direct wealth impacts are only significant for women. With regard to location, urban residence increases the risk of HIV infection by over 3% for women while no significant differences are registered for men. Access to health facilities is not important for women but for men, increasing proximity to health facilities is associated with a reduced likelihood of HIV infection.

Table 5: Determinants of HIV Infection and perception about the high risk of HIV infection

	HIV Infection (Positive=1)				Self-reported chances of contracting HIV: High			
	Women		Men		Women		Men	
	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient
Age category								
20-24 years	0.066	0.431	-0.013	-0.13	0.059	0.175	0.04	0.149
		[3.12]***		[0.90]		[2.27]**		[1.63]
25-29 years	0.066	0.424	-0.032	-0.36	0.081	0.235	0.001	0.005
		[2.19]**		[1.69]		[1.95]*		[0.03]
30-39 years	0.076	0.49	-0.019	-0.183	0.068	0.201	-0.014	-0.056
		[1.88]*		[0.69]		[1.15]		[0.30]
40-49 years	0.034	0.23	-0.042	-0.456	0.017	0.049	-0.056	-0.232
		[0.68]		[1.35]		[0.22]		[0.96]
Years of primary education	-0.023	-0.178	-0.003	-0.027	0.031	0.094	-0.007	-0.029
		[2.40]**		[0.31]		[1.97]**		[0.47]
Years of secondary education	-0.02	-0.15	-0.005	-0.044	0.014	0.043	-0.001	-0.002
		[4.10]***		[1.08]		[1.85]*		[0.08]
Log (Age X Education years)	6.189	47.001	1.086	10.267	-8.826	-26.568	-4.201	-16.236
		[4.06]***		[0.64]		[2.58]**		[1.34]
Log of asset index	12.129	92.108	2.04	19.289	-17.329	-52.164	-8.526	-32.949
		[4.06]***		[0.61]		[2.57]**		[1.38]
Log (Age X Asset Index)	-6.106	-46.367	-0.955	-9.026	8.712	26.225	4.273	16.513
		[4.05]***		[0.56]		[2.57]**		[1.37]
Log (Education X Asset Index)	-6.026	-45.759	-1.067	-10.087	8.619	25.945	4.204	16.246
		[4.07]***		[0.64]		[2.57]**		[1.36]
Marital status								
Married	-0.01	-0.079	-0.469	-4.132	0.045	0.134	-0.471	-4.618
		[0.82]		[41.03]***		[2.19]**		[51.85]**
Living with partner	0.01	0.076	-0.119	-3.925	0.112	0.32	-0.232	-4.529
		[0.73]		[.]		[4.40]***		[.]
Widowed	0.212	0.966	0.179	0.942	-0.063	-0.201	0.028	0.103
		[7.12]***		[3.70]***		[1.74]*		[0.40]
Divorced/separated	0.09	0.529	0.088	0.587	0.055	0.161	0.024	0.091
		[5.03]***		[4.42]***		[2.16]**		[0.78]
In polygamous union	0.023	0.165	0.459	4.266	0.121	0.344	0.489	4.614
		[2.27]**		[34.70]***		[7.53]***		[46.28]**
Religious affiliation								
Anglican	-0.011	-0.089	0.001	0.005	0.006	0.019	-0.025	-0.099
		[1.52]		[0.09]		[0.45]		[2.02]*
Moslem	-0.019	-0.159	-0.024	-0.262	0.054	0.159	0.027	0.101
		[2.14]*		[2.43]*		[2.89]***		[1.24]
Other Denominations	-0.01	-0.078	-0.011	-0.114	-0.016	-0.05	-0.03	-0.12
		[0.95]		[1.16]		[0.89]		[1.81]
Urban	0.035	0.244	0.02	0.178	-0.041	-0.124	0.043	0.159
		[2.45]**		[1.51]		[1.32]		[1.53]
Sub Region								
Central 1	0.043	0.282	0.061	0.447	-0.035	-0.109	0.089	0.311
		[2.25]*		[3.45]**		[1.12]		[2.67]***
Central 2	0.018	0.127	0.055	0.415	0.062	0.18	0.082	0.29
		[1.07]		[3.20]***		[1.82]*		[1.99]**
East central	0.002	0.012	0.056	0.418	-0.07	-0.223	0.036	0.135
		[0.08]		[2.71]***		[1.93]*		[1.05]
Mid-eastern	-0.025	-0.217	0.039	0.305	0.078	0.225	0.114	0.393
		[1.57]		[1.46]		[1.70]*		[2.91]***
North east	-0.024	-0.201	0.032	0.256	0.009	0.027	-0.06	-0.254
		[1.30]		[1.65]		[0.21]		[1.61]
West Nile	-0.027	-0.229	0.03	0.245	-0.065	-0.204	-0.07	-0.3
		[1.53]		[1.45]		[1.78]*		[2.14]**
Mid northern	0.02	0.144	0.024	0.205	0.057	0.166	0.034	0.128
		[1.02]		[1.19]		[1.05]		[0.86]

	HIV Infection (Positive=1)				Self-reported chances of contracting HIV: High			
	Women		Men		Women		Men	
	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient
South western	0.019	0.136	0.031	0.249	0.025	0.074	0.109	0.375
		[1.08]		[1.83]*		[0.57]		[2.61]***
Mid-western	0.022	0.153	0.047	0.361	-0.036	-0.111	-0.048	-0.199
		[1.30]		[2.43]**		[1.01]		[1.65]
Sexual behaviors								
Had concurrent sexual relations					0.066	0.191	0.086	0.304
						[1.67]*		[5.60]***
Used condom every time with partners					-0.009	-0.028	-0.003	-0.013
						[0.39]		[0.18]
Alcohol use during sex					0.026	0.078	0.067	0.242
						[1.69]*		[4.02]***
STI in the past 12 month					0.071	0.207	0.08	0.28
						[5.17]***		[4.34]***
Male circumcision							0.012	0.047
								[0.78]
Cluster/Community level								
Cluster level testing for HIV/AIDS	0.042	0.321	0.044	0.412	0.021	0.063	0.054	0.211
		[1.75]*		[2.05]**		[0.31]		[1.14]
Log of distance to clinic	0.005	0.036	0.013	0.118	0	-0.001	-0.005	-0.018
		[0.63]		[1.84]*		[0.03]		[0.31]
Cluster level for male circumcision			-0.022	-0.207			-0.021	-0.083
				[1.17]				[0.67]
Constant		-5.661		-6.61		0.923		-1.739
		[4.73]***		[4.97]***		[0.97]		[1.72]*
Observations	8,990	8,990	7,915	7,915	8990	8990	7915	7915

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 determinants of the risk of HIV infection and self-perceived risks of contracting HIV are similar. In addition, we are able to include variables of sexual behavior in the regressions of self-perceived risk of contracting HIV unlike the former case. The behavior indicators included are: having concurrent relationships in the past 12 months; using a condom consistently; alcohol use during sex; and having an STI in the past 12 months. For men, we include an additional indicator of whether circumcised. The last 4 columns of Table 5 show the determinants of high self-perceived risk of contracting HIV for women and men. For women, the results indicate that women who are divorced/separated as well as those in polygamous unions have a significant self-perceived risk of contracting HIV/AIDS. We do not find similar effects of marital status on the high risk of contracting HIV.

With regard to sexual behavior, Table 5 shows that women who have had concurrent partners as well as those who have used alcohol during sex considered themselves at high risk of

contracting HIV. However, the coefficients for above two variables are only weakly significant at the 10% level. On the other hand, women who have had an STI in the past 12 months significantly considered themselves to be at higher chance of contracting HIV. Specifically, women who have had an STI are 7% more likely to report having a high chance of contracting HIV. A similar effect is observed for men—those who had an STI in the past 12 months are 8% more likely to report having a high chance of contracting HIV. At the same time, men with concurrent partners in the past 12 months are about 9% more likely to report having a high chance of contracting HIV than other men. Related, men who use alcohol are about 7% more likely to report a high chance of contracting HIV; unlike the case for women where alcohol abuse is not significant. 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.

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 ages 15-49 years for HIV virus and other STIs. As expected, we find significant gender differences in terms of sexual behavior. Highly educated women are more likely to be tested for HIV/AIDS outside of routine antenatal services and are also less likely to be unfaithful. We also find that individuals who engage in risky sexual behavior are normally aware of the risk of contracting the HIV virus. In addition, we find that education attainment is a key determinant of the risk of HIV infection and sexual behavior, such as casual sex and unprotected sex. In particular, higher educational attainment is associated with the avoidance of risky sexual behavior, although highly educated individuals have the highest rates of HIV infections. The findings suggest that Uganda's investment in primary and secondary education through the UPE and USE programs will not lead to higher incomes but may lead to lower HIV infections in the long term, as more educated individuals avoid risky sexual behavior.

Our results also highlight the issues of access to and the cost of health facilities. 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 are 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.

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