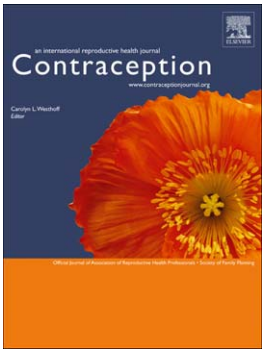

HIV/AIDS and contraceptive use: Factors associated with contraceptive use among sexually-active HIV-positive women in Kenya

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HIV/AIDS and contraceptive use: Factors associated with contraceptive use among sexually-active HIV-positive women in Kenya

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Key words: HIV-positive women, contraceptive uptake, Kenya, multilevel logistic regression.

Re-submitted to Contraception

28 October 2016

HIV/AIDS and contraceptive use: Factors associated with contraceptive uptake among sexually-active HIV-positive women in Kenya

Abstract

Objectives: With increased availability of anti-retroviral therapy and improved survival for people living with HIV, more HIV-positive women are leading full reproductive lives. However, HIV-positive women have special contraceptive needs/concerns. This paper examines the individual and community-level HIV/AIDS factors associated with contraceptive use and compares predictors of contraceptive uptake between HIV-positive and HIV-negative women in Kenya.

Study design: The study is based on secondary analysis of cross-sectional data of a sample of 9132 sexually-active women of reproductive age from the Kenya Demographic and Health Surveys collected in 2003 and 2008. Multilevel logistic regression models are used to examine individual and contextual community-level factors associated with current contraceptive use.

Results: The study provides evidence of lower contraceptive uptake among women living in high HIV-prevalence communities. It further reveals striking differences in factors associated with contraceptive uptake between HIV-positive and HIV-negative women. Education and the desire to stop childbearing are strongly associated with contraceptive uptake among uninfected women, but both factors are not significant among HIV-positive women for whom wealth is the most important factor. While HIV-negative women in the richest wealth quintile are about twice as likely to use contraceptives as their counterparts of similar characteristics in the poorest quintile, this gap is about seven-fold among HIV-positive women.

Conclusion: These findings suggest that having the desire and relevant knowledge to use contraceptives does not necessarily translate into expected contraceptive behavior for HIV-positive women in Kenya and that poor HIV-positive women may be particularly in need of increased access to contraceptive services.

Implications:

- Study provides evidence of lower contraceptive uptake among women living in high HIV-prevalence communities in Kenya.
- Results reveal striking differences in factors associated with contraceptive use between HIV-positive and HIV-negative women.
- Poverty may be an impediment to contraceptive uptake among HIV-positive women in Kenya.

1. Introduction

The rapidly changing HIV-treatment scenario in sub-Saharan Africa with respect to accessibility of anti-retroviral therapy (ART) and prevention of mother-to-child transmission (PMTCT) of HIV has important implications for reproductive choices of women in the region. With increased availability of ART, survival has improved for people living with HIV, and more HIV-positive women are leading full reproductive lives.[1,2] It has been noted that HIV-positive women have special concerns regarding family planning, which calls for research to better understand contraceptive behavior and needs of women living with HIV.[3]

Many HIV-positive women desire to stop childbearing and prevent pregnancy,[4,5,6] but unintended pregnancies are as common among this group as among HIV-negative women.[7,8,9] Unintended pregnancies among HIV-positive women are of particular concern as this poses risks for maternal and child health.[10,11,12] Although regular clinic attendance presents a unique opportunity to address contraceptive needs of HIV-positive women on ART, a recent study in Botswana found discordance between pregnancy planning and contraceptive use among women on ART.[13] Furthermore, in many settings of sub-Saharan Africa, HIV-positive women who get pregnant are looked down upon.[14] An improved understanding of factors associated with contraceptive use among HIV-positive women can, therefore, help inform appropriate family planning policies, programmes and training of healthcare workers to ensure comprehensive service provision without stigma or prejudice.[13]

The association between HIV/AIDS and contraceptive use in sub-Saharan Africa has recently received considerable research attention but patterns have remained unclear, with significant variations across countries.[15,16] Some studies have shown HIV-positive status to be associated with low fertility intentions and at the same time low contraceptive use.[17,18,3] In particular, a multi-country analysis of Demographic and Health Survey (DHS) data from nine countries revealed lower contraceptive uptake among HIV-positive women with prior knowledge of their status than counterparts who were HIV-negative in three of the countries included in the study: Zimbabwe, Kenya, and Malawi.[16] The apparent disconnect between fertility desire and contraceptive uptake among HIV-positive women has been attributed to diverse factors ranging from social desirability or stigma surrounding childbearing for HIV-positive individuals [19] to low contraceptive use among HIV-positive women based on the perception that they and their partners were infertile due to HIV infection [20]. Despite the general association between HIV-positive status and low fertility intention, perceived risk or uncertainly about HIV status have both been linked to desires to accelerate childbearing.[21,22] Mumah et al [16] recommended further research to elucidate the pathways through which reproductive decisions by HIV-positive individuals are made, considering that such decisions do not happen in a vacuum but are influenced by diverse factors at individual, family, and community/societal levels.

This paper focuses on factors associated with contraceptive use with particular reference to HIV/AIDS at both individual and community levels. The study setting, Kenya, is considered ideal for an in-depth investigation as it is one of the countries showing an apparent disconnect between fertility desire and contraceptive uptake among HIV-positive women,[16] as well as unique patterns in the link between HIV/AIDS and fertility intentions

and behavior.[23,24] Besides HIV status, other HIV/AIDS factors, including risk perception, stigma, awareness and knowledge of HIV status are considered of interest as they may also influence individual's contraceptive behavior. For instance, it is possible that in settings where most individuals do not know their HIV status, the perceived HIV risk may be a more important determinant of health-seeking behavior than actual HIV status. The paper further underscores the importance of societal context in influencing individual's contraceptive behavior, consistent with existing sociological theories of health-seeking behavior.[25,26] Particular emphasis is placed on contraceptive use predictors that differ between HIV-positive and HIV-negative women to inform policies and programmes targeting the special sub-group of women living with HIV. The specific objectives are to:

(i) Examine individual and societal HIV/AIDS factors associated with contraceptive use in Kenya; and

(ii) Compare factors associated with contraceptive uptake between HIV-positive and HIV-negative women.

2. Data and Methods

The study presented in this paper is based on secondary analysis of cross-sectional data from the Kenya Demographic and Health Surveys (KDHS) conducted in 2003 and 2008.[23,27] These two surveys included HIV-test data, providing a unique opportunity for investigation of the association between HIV status and reproductive behavior. The KDHS HIV-testing procedures complied with rigorous ethical standards. The protocols for blood specimen collection and analysis were based on the anonymous linked protocol developed by the international DHS programme [27] and was revised and enhanced by the Kenya

Medical Research Institute (KEMRI) and the National AIDS Control Council (NACC). These were reviewed and approved by the Scientific and Ethical Review Committee of KEMRI. The protocol allowed for the linking of the HIV results to the background socio-economic and demographic data collected in the individual questionnaires, ensuring that any information that could potentially identify an individual was destroyed before the linking took place.[28]

The overall sample includes sexually-active (had sex within the past 12 months) women tested for HIV in the two surveys (n=9132), of whom 752 were infected with HIV. However, the multivariate analysis is based on 9113 cases (8362 HIV-negative and 751 HIV-positive women) with non-missing values for all variables included in the final model. The comparative nature of DHS data allows for pooling of data across surveys to achieve sufficient samples of HIV-positive cases.

The analysis adopts two modelling approaches, aligned with the two objectives. The first focuses on an examination of HIV/AIDS factors associated with contraceptive use (Objective i). Factors relating to HIV/AIDS at individual and community level (i.e. knowledge of HIV status, awareness, stigma, risk perception and sero-status) constitute the key exposure variables, while current contraceptive use is the outcome variable. The association between HIV/AIDS and contraceptive use is likely to be explained by proximate factors relating to sexual behavior and fertility desires/intention that are more directly linked to contraceptive uptake. This relationship is likely to be further influenced by a range of background demographic and socio-economic confounders known to be associated with both HIV/AIDS and contraceptive use in Kenya and similar settings in sub-Saharan Africa.[29,30] The perceived link between the study variables is shown in the directed acyclic graph (DAG) [31]

in Figure 1, with direction of arrows representing perceived causal pathway, based on theoretical considerations. For example, HIV-positive status or perceived high risk may lead to reduced fertility desire/intention and subsequent contraceptive uptake. The modelling involved introducing various background demographic and socio-economic characteristics (i.e: age, number of living children, marital status, education, wealth, urban/rural residence, region, ethnicity and religion) and proximate factors (i.e. desired fertility and sexual activity) directly associated with contraceptive use in the models in successive stages to investigate potential pathways of the relationships. Interactions with HIV status were included in the models to investigate possible differences in the predictors of contraceptive behavior between HIV-positive and HIV-negative women.

(FIGURE 1 ABOUT HERE)

The second part of our multivariate analysis is based on explanatory predictive modelling and focuses on predictors of contraceptive uptake among HIV-positive women. It involves a comparison of factors associated with contraceptive use between HIV-positive and HIV-negative women (Objective ii). All predictors, including factors considered as confounders and modifiers in the association between HIV/AIDS and contraceptive uptake outlined above, are considered of interest. A description of key study variables included in the analysis is presented in Appendix A .

The multivariate analysis featured multilevel modelling,[32] placing particular emphasis on community (i.e cluster) contextual factors and variations in HIV/AIDS factors associated with

contraceptive uptake in Kenya. The two-level random intercepts logistic Regression model used is of the form:

$$Logit\ \pi_{ij} = X'_{ij}\beta + u_j$$

Where:
π_{ij} is the probability of current contraceptive use for individual *i*, in the j^{th} cluster;
X'_{ij} is the vector of covariates which may be defined at individual or cluster level;
β is the associated vector of usual regression parameter estimates; and
u_j are the residuals at cluster level which are assumed to have normal distribution with mean zero and variance σ^2_u . [32].

Multilevel analysis was employed to enable investigation of community/cluster-level factors and to take into account the hierarchical data structure resulting from the DHS sampling design. The KDHS used a multi-stage sampling approach, involving selection of clusters (primary sampling units) in the first stage, followed with systematic random selection of households within each cluster. This generated a hierarchical data structure, with households/respondents nested within clusters, necessitating application of multilevel modelling to account for potential correlation of individuals within the same cluster. The analysis was undertaken using MLwiN and estimates obtained using second order PQL, as implemented in MLwiN.[33]

3. Results

3.1 Bivariate associations between HIV/AIDS-related factors and contraceptive use

Preliminary bivariate associations between current contraceptive use and HIV/AIDS-related factors (Table 1) suggests that those who were HIV positive seemed somewhat less likely to be currently using contraceptives (33%) than those who were negative (37%). Furthermore, women who knew their HIV status (i.e. previously tested for HIV and received results), knew

someone living with or died of HIV, had higher HIV/AIDS awareness, or perceived higher risk of HIV were significantly more likely to be currently using contraceptives than those who did not know their HIV status, had no personal acquaintance with HIV/AIDS victims, had low HIV/AIDS awareness, or perceived no or low risk of HIV infection.

(TABLE 1 ABOUT HERE)

Multivariate analysis presented in the next section incorporated community-level effects and revealed interesting pathways through which HIV status may be linked to contraceptive behavior.

3.2 Multivariate analysis of association between HIV/AIDS factors and current contraceptive use

The results of multilevel logistic regression analysis of individual and community-level HIV/AIDS factors associated with current contraceptive use (Table 2) suggest that while there is no evidence of an individual's HIV status having an effect on current contraceptive use once other significant factors are controlled for, women in clusters/communities of higher HIV prevalence are significantly less likely to use contraceptives. The effect of community HIV prevalence on current contraceptive use is partly explained by background demographic and socio-economic factors (Model 2), but remains significant when proximate factors relating to sexual behavior (marital status and recent sexual activity) and childbearing intentions are controlled for (Model 3).

The results suggest that perceived moderate or high risk of HIV infection is associated with increased odds of current contraceptive use once other HIV/AIDS factors are controlled for, consistent with patterns observed in the bivariate analysis. This is not unexpected,

especially since those who perceive themselves to be at high risk of HIV infection are more likely to report (data not shown) that they want no more children, and the desire to stop childbearing is a major predictor of contraceptive use. The association between perceived HIV risk and contraceptive use ceases to be significant when fertility intention, marital status and sexual activity are controlled for (Model 3), suggesting that the apparent association between perceived HIV risk and contraceptive use are explained by these factors. Further analysis reveals that the link is mainly explained by marital status - women married in polygamous unions are more likely to perceive themselves to have high HIV risk (data not shown) and at the same time are less likely to use contraceptives.

(TABLE 2 ABOUT HERE)

Higher HIV/AIDS awareness (both at individual and community level) and knowledge of HIV status are both associated with increased odds of current contraceptive use. These associations are partly explained by background socio-economic factors which is expected since those of higher socio-economic status are likely to have higher HIV/AIDS awareness or been previously tested for HIV and received results and at the same time more likely to use contraceptives. The effect of community HIV/AIDS awareness is further explained by fertility intention as those from communities of higher awareness are more likely to want no more children (data not shown), leading to higher contraceptive use.

To enable a more methodical understanding of the role of HIV/AIDS on contraceptive use, we examined interactions between HIV status and other factors associated with current contraceptive use. The results reveal significant interactions between HIV status and both wealth and education (see Appendix D), with the effect of wealth on contraceptive use being stronger while the education effect is weaker for HIV-positive than HIV-negative

women. Although the association between HIV status and contraceptive use may be expected to differ between those who know and those who do not know their status, an interaction between HIV status and knowledge of status was not significant.

3.3 Predictors of contraceptive use among HIV-positive women

A comparison of factors associated with current contraceptive use between HIV-positive and HIV-negative women (Table 3) provides further insights of factors associated with current contraceptive use among women living with HIV. With respect to HIV/AIDS-related factors, it is only HIV/AIDS awareness that is significant among HIV-positive women, with greater awareness being associated with higher odds of contraceptive use, consistent with patterns observed among HIV-negative women. The average odds ratios for knowledge of HIV status are more or less similar for HIV-positive and HIV-negative women (OR=1.14 vs 1.15 - albeit not significant for the former, presumably due to lower statistical power), consistent with the non-significant interaction between HIV status and knowledge of status noted earlier. While HIV prevalence in cluster and average awareness are both associated with current contraceptive use among all women (Table 2), neither of these contextual factors are significant for HIV-positive nor HIV-negative women, possibly due to reduced statistical power.

(TABLE 3 ABOUT HERE)

The most striking difference between factors associated with contraceptive uptake among HIV-positive and HIV-negative women relates to wealth and educational attainment (consistent with the significant interactions in Appendix D). Although greater wealth is associated with increased contraceptive uptake among both HIV-positive and HIV-negative women, the effect is much stronger for HIV-positive women. For instance, while among HIV-

negative women the odds of contraceptive use are about double for women in richest than those in poorest households, the odds are about seven times higher among HIV-positive women. On the other hand, education is one of the most important predictors of contraceptive use among HIV-negative women, but the effect is not significant among HIV-positive women. Also, we note that while HIV-negative women who desire to have no more children are more likely to use contraceptives as may be expected, there is no evidence that fertility intention has a significant effect on current contraceptive use among HIV-positive women.

Although there is evidence of a significant variation in current contraceptive use between communities among all or HIV-negative women, the intra-community correlation is quite low, suggesting that only about 5% of the total unexplained variation in contraceptive use is attributable to unobserved community factors. There is no evidence of a significant community/cluster variation in contraceptive uptake among HIV-positive women, possibly due to the limited number of cases of HIV-positive women within each cluster.

4. Discussion and Conclusions

The main objectives of this paper were to: examine the individual and community HIV/AIDS-related factors associated with contraceptive use; and compare factors associated with contraceptive uptake between HIV-positive and HIV-negative women in Kenya. Results of the analysis of HIV/AIDS factors associated with current contraceptive use provide evidence of the importance of both individual-level as well as community-level HIV/AIDS factors on contraceptive uptake. High actual or perceived HIV positivity/prevalence are both

associated with reduced odds of current contraceptive use. These patterns are consistent with findings from a recent multi-country study which showed that in three (Kenya, Malawi and Zimbabwe) of the nine countries across sub-Saharan Africa included in the analysis, HIV-positive women who knew their status were less likely to be current modern contraceptive users compared with HIV-negative women of similar characteristics.[16] These findings suggest that it is knowledge of HIV-positive status or high risk perception that is associated with reduced contraceptive uptake, rather than HIV status per se. Our findings further reveal that it is HIV prevalence at community level, rather than individual HIV-status that is an important factor in contraceptive uptake. This is consistent with existing sociological theories which have long recognized that an individual's health-seeking behavior is influenced not only by individual risk factors, but also by the social context/environment.[25,26]

The observed positive association between perceived HIV risk and contraceptive uptake is consistent with previous studies which suggest that being HIV-positive is associated with increased desire to stop childbearing,[4,6] an important predictor of contraceptive uptake. These patterns do not support some recent studies which have linked perceived risk or uncertainly about HIV status to expressed desires to accelerate childbearing.[21,22] Further examination reveals that the patterns observed with respect to risk perception are partly explained by one confounding factor: polygamous marriage. Women in polygamous unions perceive themselves to be at a high risk of HIV infection [24] and at the same time are also less likely to use contraceptives (analysis not shown). Our findings further suggest that knowledge of HIV status is associated with increased use of contraceptives (albeit only significant among HIV-negative women), and does not support the apparent negative

association between knowledge of HIV-positive status and contraceptive uptake observed in the analysis by Mumah et al.[16] An earlier study had attributed low contraceptive uptake among HIV-positive women to perceived infertility due to HIV infection.[20] We recognize that behavioral response by HIV-positive women would be expected to depend on their knowledge of HIV status.[16] However, an examination of the interaction between HIV status and knowledge of status provided no evidence that this was significant.

Perhaps the most important finding reported in this paper relates to the evidence of interaction effects of education and wealth with HIV status on contraceptive uptake. Although both higher education attainment and wealth status are associated with increased contraceptive uptake as would be expected, the effect of educational attainment is considerably weakened while the effect of wealth is amplified among HIV-positive compared to HIV-negative women. These patterns are also evident in the bivariate analysis (see Appendix C), although the differences are less pronounced possibly due to confounding factors not controlled for. A comparison of factors associated with contraceptive uptake among HIV-positive and HIV-negative women reveals remarkable differences. In particular, while education and desire for no more children are among the most important predictors of contraceptive uptake for HIV-negative women as may be expected, these factors are not significant for HIV-positive women, once potential confounding factors are controlled for. For these women, wealth is the most important predictor of contraceptive use. It is important to assess whether possible bias in HIV coverage by socio-economic status may have influenced observed associations. Despite overall high response rates in the Kenya DHS, those of higher socio-economic status tended to have lower response rates.[23] However, an earlier comprehensive assessment of non-response in the Kenya DHS showed

that eligible respondents who were not tested for HIV did not differ in significant ways from those tested.[34]

An important limitation that should be borne in mind when interpreting our findings relates to our inability to infer precise causal relationships. Given the cross-sectional nature of data analysed, we are unable to establish the time sequencing of events of interest: that is, whether the HIV/AIDS-related factors considered here preceded contraceptive uptake or were a consequence of it. Therefore, the relationships provide evidence of associations rather than infer causality.

These findings have important policy implications. First, the fact that neither educational attainment nor the desire to stop childbearing are important predictors of contraceptive uptake among HIV-positive women suggests that having the desire and relevant knowledge to use contraceptives does not necessarily translate into expected behavior for HIV-positive women. Indeed, wealth emerges as a major predictor of contraceptive uptake among HIV-positive women, with women in the richest wealth quintile being about seven times more likely to use contraceptives than their counterparts of similar characteristics in the poorest quintile. This gap is much narrower among HIV-negative women - about double. These findings have important policy and programme implications for addressing unmet need for family planning among HIV-positive women in Kenya and also possible in similar settings across countries in sub-Saharan Africa.

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Table 1 : Current contraceptive use by HIV/AIDS-related factors

HIV/AIDS-related factor	Percent currently using contraceptives	Unweighted cases
HIV sero status (p=0.024)		
Negative	37.4	8380
Positive	33.1	752
Knows HIV status (p=0.000) [$]		
No	32.0	5431
Yes	44.3	3701
Knows someone who has or died of HIV/AIDS (p=0.000)[£]		
No	24.5	2014
Yes	40.3	7020
HIV/AIDS awareness (p=0.000)		
Lowest	24.3	2198
Lower	39.1	2360
Higher	40.6	2369
Highest	42.2	2205
HIV/AIDS Stigma (p=0.781)		
Low	36.9	4266
high	37.2	4866
Perceived HIV/AIDS risk (p=0.000)		
Mod-high	42.6	4675
No-low risk	30.7	4457
All	37.0	9132

[$] previously tested for HIV and received results

[£] Overall cases do not add up to the given total due to missing data.

Table 2: HIV/AIDS factors associated with current contraceptive use (n=9113)

Parameter (reference categories in brackets)	[1]Model 1 Adjusted OR (95% CI)	[2]Model 2 Adjusted OR (95% CI)	[3]Model 3 Adjusted OR (95% CI)
2008 survey (2003)	1.42 (1.23, 1.64)	1.59 (1.39, 1.82)	1.52 (1.32, 1.76)
HIV positive (negative)	0.96 (0.81, 1.15)	0.89 (0.75, 1.07)	1.03 (0.85, 1.25)
Knows HIV status[$] (no)	1.30 (1.17, 1.44)	1.11 (1.00, 1.24)	1.14 (1.01, 1.28)
HIV awareness (lowest)			
- lower	1.72 (1.49, 1.92)	1.36 (1.17, 1.58)	1.35 (1.15, 1.58)
- higher	1.87 (1.62, 2.17)	1.44 (1.24, 1.67)	1.44 (1.23, 1.70)
- highest	1.83 (1.57, 2.12)	1.38 (1.18, 1.61)	1.37 (1.16, 1.62)
Perceived mod-high HIV risk (no-low)	1.39 (1.26, 1.54)	1.28 (1.15, 1.42)	1.09 (0.97, 1.22)
HIV prevalence in cluster	0.15 (0.06, 0.34)	0.42 (0.17, 1.01)	0.35(0.14, 0.90)
HIV awareness in cluster	2.35 (1.95, 2.83)	1.33 (1.10, 1.62)	1.26 (1.03, 1.55)
Random cluster variance	0.36 (0.28, 0.44)	0.17 (0.11, 0.23)	0.20 (0.13, 0.27)

[$]previously tested for HIV and received results

[1]Model 1 – no other factors controlled for, besides significant individual and cluster –level HIV/AIDS exposure variables

[2]Model 2 – controlling for HIV/AIDS and background confounders (i.e. age group, number of living children, educational attainment level, household wealth index, religious affiliation, ethnic group, region and urban/rural residence).

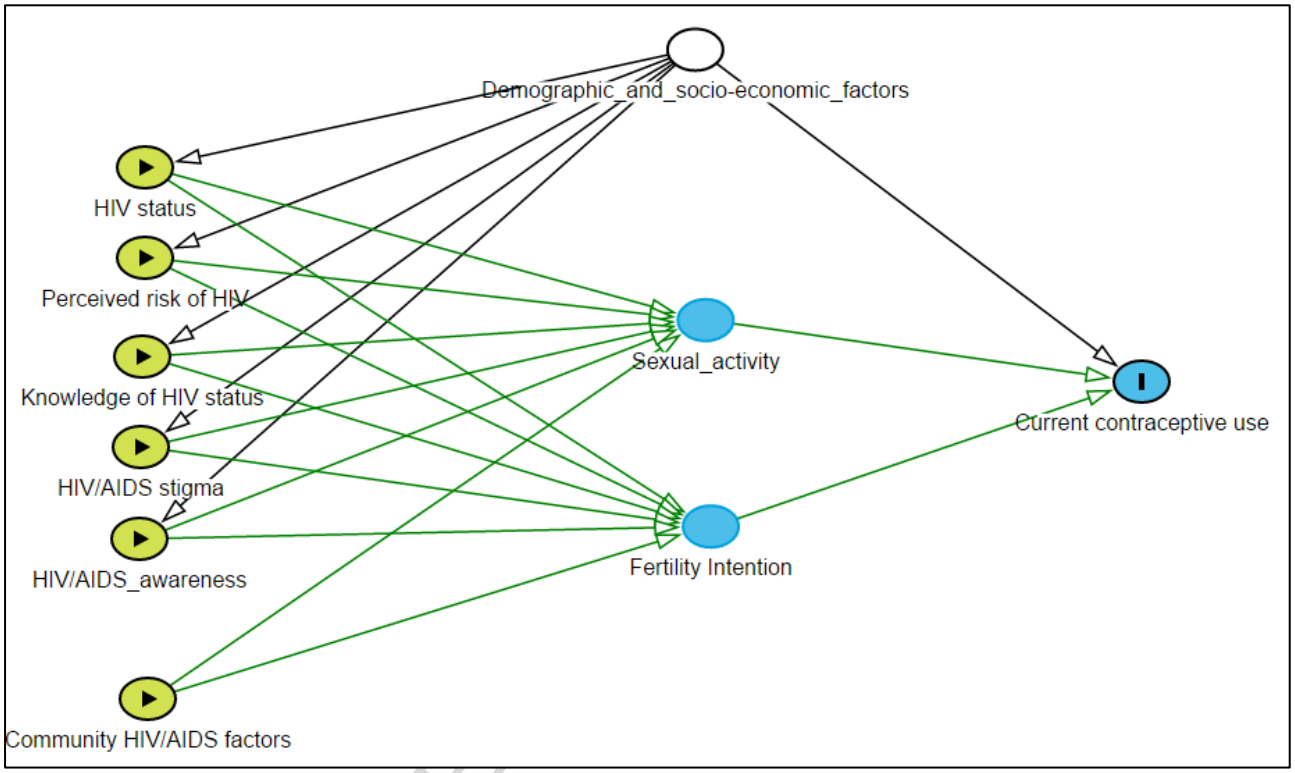
[3]Model 3 – controlling for HIV/AIDS exposure factors, background confounders, and proximate factors (i.e. fertility intention, marital status, and recent sexual activity)

Table 3: Comparison of factors associated with current contraceptive use among HIV-positive and HIV-negative women.

Parameter (reference categories in brackets)	HIV-positive women (n=751)	HIV-negative women (n=8362)
	Adjusted OR (95% CI of OR)	Adjusted OR (95% CI of OR)
2008 survey (2003)	1.56 (1.00, 2.43)	1.50 (1.29, 1.75)
Knows HIV status[$] (no)	1.14 (0.76, 1.72)	1.15 (1.02, 1.30)
HIV awareness (lowest)		
- lower	1.10 (0.61, 1.96)	1.37 (1.16, 1.62)
- higher	1.43 (0.82, 2.50)	1.45 (1.23, 1.72)
- highest	1.90 (1.08, 3.33)	1.33 (1.12, 1.58)
Perceived HIV /AIDS mod-high risk (no-low)	0.79 (0.53, 1.17)	1.12 (1.00, 1.26)
HIV prevalence in cluster	0.15 (0.02, 1.33)	0.43 (0.16, 1.17)
HIV awareness in cluster	1.56 (0.82, 2.97)	1.24 (1.00, 1.53)
Age group (15-24)		
- 25-34	1.37 (0.81, 2.30)	0.96 (0.82, 1.12)
- 35+	1.06 (0.56, 1.99)	0.74 (0.61, 0.90)
Living children (0)		
- 1-2	1.24 (0.67, 2.30)	2.33 (1.90, 2.87)
- 3-4	2.66 (1.31, 5.51)	3.34 (2.62, 4.25)
- 5+	3.97 (1.71, 9.22)	2.74 (2.09, 3.60)
Education (none)		
- Primary	1.35 (0.56, 3.25)	2.58 (1.99, 3.35)
- Sec+	1.80 (0.71, 4.55)	4.12 (3.11, 5.46)
Wealth index (poorest)		
- Poorer	2.69 (1.16, 6.22)	1.72 (1.40, 2.11)
- Middle	3.00 (1.28, 7.06)	1.94 (1.57, 2.39)
- Richer	5.18 (2.21, 12.17)	2.01 (1.62, 2.50)
- Richest	6.88 (2.71, 17.47)	1.87 (1.44, 2.44)
Religion (Catholic)		
- Protestant	0.76 (0.51, 1.14)	1.08 (0.95, 1.24)
- Muslim/ Other	0.79 (0.35, 1.76)	0.54 (0.43, 0.68)
Ethnic group (Kikuyu)		
- Luhya	0.69 (0.28, 1.66)	0.82 (0.62, 1.08)
- Luo	0.75 (0.34, 1.65)	0.74(0.56, 0.99)
- Other	0.76 (0.37, 1.59)	0.92 (0.74, 1.13)
Region (Central)		
- Nairobi	1.53 (0.62, 3.77)	0.69 (0.50, 0.94)
- Coast	0.90 (0.33, 2.44)	0.88 (0.64, 1.21)
- Eastern/North Eastern	0.72 (0.25, 2.07)	0.66 (0.49, 0.89)
- Nyanza	1.32 (0.51, 3.41)	0.66 (0.48, 0.91)
- R.Valley	0.82(0.33, 2.07)	0.96 (0.73, 1.27)
- Western	1.69 (0.58, 4.90)	0.69 (0.48, 0.98)
Urban residence (rural)	0.66(0.38, 1.16)	0.95 (0.76, 1.18)
Want another child (no)	0.79(0.53, 1.19)	0.48 (0.43, 0.55)
Marital status (single)		
- married-monogamous	0.30 (0.15, 0.59)	0.41 (0.32, 0.51)
- married-polygamous	0.33 (0.15, 0.76)	0.36 (0.27, 0.49)
- div./sep./widowed	0.44 (0.23, 0.86)	0.62 (0.46, 0.82)
Last sexual activity		
- within one month	0.91 (0.57, 1.48)	0.67 (0.58, 0.77)
- 1-6 months	0.68 (0.40, 1.18)	0.31 (0.26, 0.37)
- > 6 month	0.10 (0.05, 0.20)	0.05 (0.04, 0.07)
Random cluster variance	0.08 (0.00, 0.42)	0.20 (0.13, 0.28)

[$]previously tested for HIV and received results

Figure 1: DAG of perceived link between HIV/AIDS-related factors and contraceptive use



Source: Authors' formulation.

Appendix A: Description of Key Study Variables

NAME OF VARIABLE	MEASURE
Outcome Variables (Contraceptive practice)	
Current contraceptive use	Coded as 1 if respondent is currently using any contraceptives, modern or traditional methods; 0=otherwise. This included condoms, if reported use was for contraceptive purposes.
Individual HIV/AIDS factors	
HIV status	Coded as 1= if respondent is HIV-positive; 0=otherwise.
Knows HIV status	Coded as 1 if respondent was previously tested for HIV and received results ; 0 otherwise
Personal acquaintance with HIV/AIDS	Coded as 1= if respondent personally knows someone who has or died of HIV/AIDS; 0=otherwise.
HIV/AIDS awareness/knowledge	A composite index derived from a series of questions on knowledge of how HIV is transmitted and ways to avoid infection (see Appendix B). The resulting index is classified into quartiles and the higher the index, the higher the knowledge.
HIV/AIDS Stigma	A composite index derived from three questions on HIV/AIDS stigma (See Appendix B). Resulting score classified as 0 = 'low' or 1 = 'high' stigma.
Perceived risk of HIV/AIDS	Classified as: no/low risk; or moderate/high risk
Contextual community/cluster HIV/AIDS factors	
HIV prevalence	Proportion of individuals in the cluster who are HIV-positive
HIV/AIDS awareness	Average HIV/AIDS awareness/knowledge index in the cluster
Intermediate/proximate factors	
Desired fertility	Coded as 1 if respondent wants no more children; 0=otherwise
Marriage/Union status	Current marital/union status, classified as: never married, currently married (monogamous/polygamous) or cohabiting, widowed, and divorced/separated
Recent sexual activity	Time since last sex, coded as: within one week, 1-4 weeks, 1-6 months; and more than 6 months
Background demographic and socio-economic factors	
Age group	Age group classified into three categories: 15-24, 25-34 and 35+.
Living children	Number of living children, classified into four categories: 0, 1-2, 3-4 and 5+
Education	Highest educational attainment classified into three categories: no formal education; primary level, and secondary/higher.
Wealth index	Wealth quintiles based on household possessions and amenities derived through Principal Components Analysis, classified as: poorest, poorer, middle; richer and richest
Religion	Religious affiliation classified into three categories: Catholic, Protestant/other Christian, and Muslim and other.
Ethnicity	Classified into four categories: Kikuyu, Luhya, Luo, and other, the first three constituting the largest groups in our analysis sample.
Region	Seven provinces: Central, Coast, Eastern/North Eastern, Nairobi, Nyanza, Rift Valley and Western
Urban/rural residence	Coded as 1 if respondent resides in urban area; 0 for rural residence.

Appendix B: items used to derive composite HIV/AIDS indices using Principal Components Analysis

knowledge/awareness items – questions	Correct answer		Factor loading
	Yes	No	
Reduce risk of getting sex by not having sex at all	X		0.631
Reduce chances of AIDS by always using condoms during sex	X		0.606
Reduce chance of AIDS: have 1 sex partner with no other partner	X		0.664
Get AIDS from mosquito bites		X	0.059
Get AIDS by sharing food (utensils) with person who has AIDS		X	0.149
Can a healthy person have AIDS	X		0.589
AIDS transmit. during pregnancy	X		0.341
AIDS transmit. during delivery	X		0.587
AIDS transmit. by breastfeeding	X		0.602
Drugs to avoid AIDS transmission to baby during pregnancy	X		0.532

Cronbach's Alpha = 0.65

Stigma items - questions	Answer		Factor loading
	yes	no	
Willing to care for relative with AIDS		X	0.676
Person with AIDS allowed to continue teaching		X	0.794
Would buy vegetables from vendor with AIDS		X	0.779

Cronbach's Alpha =0.61

Appendix C: Bivariate distribution of current contraceptive use by background characteristics

Background characteristic	HIV-positive women		HIV-negative women	
	Contraceptive prevalence (%)	Unweighted Cases	Contraceptive prevalence (%)	Unweighted Cases
Survey year	(p=0.045)		(p=0.000)	
- 2003	28.8	289	28.4	3046
- 2008	36.5	463	42.2	5334
Age group	(p=0.116)		(p=0.000)	
- 15-24	27.2	166	28.7	2774
- 25-34	36.8	312	44.2	2765
- 35+	32.1	274	39.2	2841
Living children	(p=0.001)		(p=0.000)	
- 0	33.8	90	26.2	1992
- 1-2	25.6	319	40.5	2548
- 3-4	40.3	214	48.0	1983
- 5+	42.2	129	34.3	1857
Education	(p=0.000)		(p=0.000)	
- none	18.6	53	10.9	1220
- Primary	30.0	480	36.0	4323
- Sec+	43.1	219	47.2	2837
Wealth index	(p=0.000)		(p=0.000)	
- poorest	9.5	79	21.0	1645
- Poorer	27.1	139	33.5	1414
- Middle	31.8	115	39.0	1422
- Richer	35.1	160	44.3	1632
- Richest	42.7	259	44.0	2267
Religion	(p=0.004)		(p=0.000)	
- Catholic	36.8	197	37.8	1895
- Protestant	34.1	498	40.7	4976
- Muslim/ Other	13.8	57	16.5	1509
Ethnic group	(p=0.219)		(p=0.000)	
- Kikuyu	36.7	106	49.3	1576
- Luhya	27.0	117	33.5	1357
- Luo	36.1	304	32.7	911
- Other	30.6	225	34.9	4536
Region	(p=0.016)		(p=0.000)	
- Nairobi	48.8	97	39.2	925
- Central	40.6	74	50.7	1067
- Coast	25.0	70	29.6	1109
- Eastern/North Eastern	28.7	59	34.2	1614
- Nyanza	32.5	264	34.5	1177
- R.Valley	26.5	92	39.6	1375
- Western	33.3	96	30.4	1113
Residence	(p=0.014)		(p=0.000)	
- rural	30.3	467	36.1	5941
- urban	39.6	285	41.2	2439
Want another child	(p=0.241)		(p=0.000)	
- no	34.8	432	41.8	4659
- yes	30.7	320	30.6	3721
Marital status	(p=0.098)		(p=0.000)	
- never married	33.0	92	28.7	1945
- married-monogamous	37.5	346	43.8	4901
- married-polygamous	32.0	105	28.1	864
- div./sep./widowed	27.1	209	28.1	670
Last sexual activity[£]	(p=0.000)		(p=0.000)	
- within one week	39.1	323	48.7	3985
- within one month	47.3	143	45.0	1633
- 1-6 months	39.0	118	27.4	1186
- > 6 month	8.1	167	9.2	1558
Total	33.1	752	37.4	8380

[£] Overall cases do not add up to the given total due to missing data.

Appendix D: Multilevel Logistic regression results for contraceptive uptake, including significant interactions with HIV status.

Parameter (reference in brackets)	Estimate	S.Error	OR	p-value
const	-1.56	0.203		
2008 survey (2003)	0.42	0.074	1.49	0.000
HIV positive (negative)	0.21	0.630	0.81	0.697
Knows HIV status	0.13	0.059	1.14	0.025
Educational attainment (none)				
primary	0.96	0.133	2.62	0.000
sec+	1.42	0.142	4.15	0.000
Wealth quintile (lowest)				
Poorer	0.54	0.105	1.71	0.000
Middle	0.67	0.106	1.95	0.000
Richer	0.71	0.109	2.04	0.000
Richest	0.65	0.132	1.91	0.000
HIV status - wealth Interaction				
HIV positive - poorer	0.49	0.436	1.63	0.258
HIV positive - middle	0.31	0.442	1.37	0.478
HIV positive - richer	0.63	0.424	1.87	0.139
HIV positive - richest	0.93	0.413	2.55	0.024
HIV status – educ. Interaction				
HIV positive - primary	-0.75	0.444	0.47	0.089
HIV positive - secondary+	-1.01	0.465	0.36	0.029
Random cluster variance	0.20	0.035		0.000

* - sig at 5% level (p<0.05)

Other variables included in the model are: perceived HIV risk, individual and cluster level HIV awareness, HIV prevalence in cluster, age group, number of living children, religious affiliation, ethnicity, region of residence, urban/rural residence, marital status, fertility intention and recent sexual activity.