Onset of Sexual Activity among Adolescents in HIV/AIDS Affected Households in Sub-Saharan Africa

Monica A. Magadi[1], Joseph Uchudi[2]

[1] Professor of Social Research, School of Social Sciences, University of Hull, UK
[2] M&E Coordinator, Merlin, Goma, North Kivu, Democratic Republic of the Congo

Onset of Sexual Activity among Adolescents in HIV/AIDS Affected Households in Sub-Saharan Africa

Summary:

This paper examines the effect of orphanhood and HIV status of adults in a household on onset of sexual activity among adolescent girls and boys aged 15-17 years in sub-Saharan Africa (SSA). We apply multilevel logistic models to pooled Demographic and Health Surveys data from19 countries of SSA where HIV test data were collected during 2003-2008 from nationally representative samples of men and women of reproductive age. The results highlight increased vulnerability among adolescent boys and girls living in households where an adult is infected with HIV, and adolescent boys who are paternal orphans. On average, adolescent boys and girls living in households where at least one adult is HIV-positive have about 25 percent higher odds of having initiated sexual activity compared to their counterparts of similar characteristics in households where no adult is HIV-positive. Furthermore, adolescent boys who are paternal orphans have about 25 percent higher odds of having initiated sexual activity than their non-orphan counterparts of similar individual characteristics. Further analysis reveals that household circumstances relating to living arrangements and poverty are important pathways through which household HIV/AIDS status is linked to adolescent sexual debut. The findings underscore the importance of international efforts in the SSA region to address the plight of other children in HIV/AIDS affected households, beyond orphans. (212 WORDS)

Onset of Sexual Activity among Adolescents in HIV/AIDS Affected Households in Sub-Saharan Africa

Introduction

HIV/AIDS poses a significant threat to adolescents' health and life prospects in sub-Saharan Africa (SSA) where AIDS remains the single largest cause of death, accounting for three-quarters of the estimated 1.6 million global deaths from HIV/AIDS in 2012 (UNAIDS 2013). It is estimated that SSA is home to 80 percent of all children in the developing world who have lost a parent to AIDS, and even where HIV prevalence has stabilized on begun to decline, the number of orphans is expected to remain high or continue to grow for years, given the time lag between HIV infection and death (UNICEF 2006). The problem of orphanhood extends well beyond childhood and available data suggest that adolescents make up the majority of orphans in all countries (UNAIDS, UNICEF and USAID, 2004). The numbers of orphans represents only a fraction of the number of children adversely affected by HIV/AIDS, with millions of other children, especially adolescents, facing various psychological and economic problems, including responsibilities of caring for ailing parents and siblings when the HIV-infected parents are still alive (UNICEF, 2006; Abebe & Skovdal, 2010) .

The mechanisms through which HIV/AIDS can have devastating effects on adolescents' prospects are multiple and complex, including the effects of orphanhood and residence in households impoverished by AIDS-related illnesses and opportunistic infections. When parents fall sick, particularly in poor families, adolescents tend to drop out of school and end up in income-generating activities (Funkquist et al., 2007; Abebe & Skovdal, 2010). Many

adolescents orphaned by AIDS lose their childhood and are forced by circumstances to become producers of income or food, or caregivers for sick family members. In many cases, they become increasingly vulnerable to abuse, exploitation, and ill-health, including high risk sexual activity (Mmari, 2011; Operario, et al, 2011). Although many children in sub-Sahara Africa live in impoverished households due to reasons other than HIV/AIDS and are similarly vulnerable as those in HIV/AIDS impacted households, HIV/AIDS vulnerability is characterized by unique factors and circumstances (e.g. stigma and prolonged AIDS-related illness and opportunistic infections), and occurs at a scale that separates its impact from that of other impoverishing conditions in sub-Sahara African countries.

A number of recent studies in Eastern and various Southern African settings have observed greater sexual risk among orphans than non-orphans (Gregson et al., 2005; Thurman, et al., 2006; Juma et al., 2007; Operario et al., 2007; Nyamukapa et al., 2008; Birdthistle et al., 2008; 2009; Operario et al., 2011). In particular, studies in Southern and Eastern Africa have observed higher risks of having ever had sex among female orphans than non-orphans (Gregson et al., 2005; Birdthistle et al., 2008). Findings from recent qualitative research in Tanzania revealed three important caregiving roles that contributed to adolescent health: the provision of basic needs, advising and monitoring adolescent behaviors, and assigning household chores. Adolescent participants believed that when these roles are compromised, female orphans' sexual behaviors are impacted (Mmari, 2011). In general, these studies suggest an elevated risk for involvement in high-risk sexual activities, especially among female orphans. Although there has been considerable attention to vulnerability of children orphaned by AIDS, few studies have examined sexual risk among other adolescents adversely affected by HIV/AIDS, such as those

whose parents (or other adult household members) are living with HIV/AIDS. This study adds to existing body of literature by (i) extending work on orphanhood conducted in selected settings of SSA to examine the wider patterns for the SSA region; and (ii) focusing attention to adolescents whose parents (or other adults in household) are infected with HIV.

We focus on adolescent sexual debut as a key determinant of adolescent sexual and reproductive health. Adolescent sexual onset is of public health importance because it contributes to ill sexual / reproductive health among adolescents by elevating the risk of unintended pregnancies and sexually transmitted diseases (STDs), including HIV/AIDS. This is particularly so in SSA where condom use, although steadily rising in recent years, has remained very low over the years (Maticka-Tyndale, 2012). Sexual debut increases adolescents' risk of infection with HIV and other STIs because youth who initiate sexual activity at a young age are more likely to have multiple sexual partners when they are older and less likely to use condoms than their counterparts who initiate sexual activity at a later age (Harrison et al., 2005; Uchudi et al, 2012). Consequently, delaying the onset of sexual activity has been a key feature of a number of adolescent sexual health interventions in sub-Sahara Africa (WHO 2008; Doyle, et al, 2012).

Household context, individual attributes and adolescent sexual behavior

Factors that are likely to place adolescents at risk for sexual debut include individual attributes (i.e., lack of relevant human capital attributes) and household context (i.e., HIV/AIDS-related vulnerabilities), in addition to the effects of the societal conditions in which young people and their families live. In particular, adolescent's girls vulnerability to initiation of sexual activity may be determined by lack of socioeconomic attributes that are empowering at the individual

level (i.e., education) and by poverty (deprivation of basic needs) in societies in which gaps between the rich and the poor continue to widen, where young women and girls have limited options for economic empowerment and financial autonomy, and where long-standing cultural norms legitimize cross-generational and transactional sexual activities (Collins and Rau, 2000; Nkosana and Rosenthal, 2007; Leclerc-Madlala, 2009). In economically desperate circumstances, unmarried young women and girls are likely to exchange sex for money, food or other favors (Meekers and Calvès 1997).

In this paper, we argue that residence in a household destabilized and/or impoverished by HIV/AIDS (either indirectly or directly through the illness of a household member or through the death of at least one parent) is likely to be a risk factor for sexual debut. It is assumed that adolescents from intact family structures are less likely to engage in high-risk sexual behaviors (sexual onset and transactional sex) than their peers from non-intact family backgrounds (i.e., homes destabilized and/or impoverished by HIV/AIDS processes) (Enaik et al., 2002; Oman et al., 2005). The argument here is that the HIV/AIDS pandemic is likely to translate into poor/unfavorable adolescent sexual outcomes through the effects of either lack of significant parental monitoring or lack of perception of parental affection and support (Lammers et al., 2000; Oman et al., 2005). A study in Kenya found that orphans reported less supervision by adults at home, and perceived that they were less loved at home than non-orphans (Juma et al., 2007). Psychological and emotional problems of this nature are likely to lead to onset of sexual activity.

We further hypothesize that adolescent sexual onset is triggered by adolescents' and households' lack of the human capital and social status attributes that support healthful choices. According to Coleman (1988: S100), "human capital is created by changes in persons that bring about skills and capabilities that make them able to act in more responsible and efficient ways." Hence, the human capital argument runs as follows: the likelihood of adolescent sexual debut is smallest among adolescents who have advanced human capital skills (e.g., education, household socioeconomic status) and more modern social status attributes (e.g., urban residence, media exposure). The modernization literature holds the belief that formal education is the key to human capital development by transforming people's attitudes and values from traditional to more modern, and their behavior from constrained to more emancipated (i.e., modern thinking, and greater decision-making autonomy). The human capital skills that individuals acquire in school, or from media exposure are likely to translate into aspirations for a healthier life. For example, education can provide protection against risky sexual behaviours by providing young men and women with a sense of self-confidence and authority that can allow them to choose healthier behaviours, including delayed sexual debut.

Aims and Objectives

The main hypothesis that guides this study is that adolescent children in SSA who live in households affected by HIV/AIDS are more likely to experience sexual debut than their peers who live in non-affected households. Specifically, we examine the effect of orphanhood and parents' HIV status on adolescent sexual/reproductive health, determined using sexual debut. The specific objectives are to:

(i)   compare adolescents from HIV/AIDS-affected households to those in households not affected by HIV/AIDS with respect to onset of sexual activity; and

(ii)   establish the role of background individual attributes and household context in explaining the associations between household HIV/AIDS status and sexual debut among adolescents in SSA.

Throughout the analysis, emphasis is placed on gender disparities and on national /sub-national variations in the link between household HIV/AIDS status and adolescent sexual debut. This paper aims at providing a general picture of patterns among adolescents across countries in sub-Saharan Africa, useful for relevant international policy and programmes across countries in the region. More targeted studies focusing on individual countries would be required to guide national policy and programme efforts to address relevant issues in specific countries.

Data and methods

The Data

The data used in this study come from population-based sample surveys that were conducted in mid-2000s (between 2003 and 2008) in 19 countries in sub-Saharan Africa as part of the Demographic and Health Surveys (DHS) program. The study sample comprised all SSA countries where DHS HIV test data were available at the time of the study, except Uganda 2005 and Tanzania 2004 AIDS Indicator Surveys (AIS) that were excluded for technical reasons. In addition to nationally representative samples of women and men of reproductive age (women aged 15-49 and men aged 15-49/54), the DHS and AIS collected detailed data on children and

adolescents, including maternal/paternal orphanhood status. Our analysis focuses on the sample

of adolescents aged 15-17 years. A summary of the analysis sample, disaggregated by gender, is

presented in Table 1.

(TABLE 1 ABOUT HERE)

In addition to detailed information about basic individual and household socio-economic and

demographic characteristics, the DHS and AIS surveys collected data on age at which

adolescents first engaged in sexual activity and whether or not the respondents ever had sex.

These data are crucial to this study because they provide information used to construct the

study's outcome variable. The key study variables are household HIV/AIDS status based on

orphanhood status of adolescents and HIV status of adults in the household, while other

covariates include a range of individual/household level socio-economic and demographic

characteristics. A summary description of the study variables is provided in Table 2.

(TABLE 2 ABOUT HERE)

Specification and measurement of the dependent variable

The dependent variable measures initiation of sexual activity among adolescents. Preliminary

analysis was undertaken to assess appropriateness of the two measures of sexual debut available

in the data: retrospective reports on 'age at first sex'; and current status data on 'whether ever

had sex'. Based on results of the preliminary analysis, the study adopted a dichotomous

measure of the dependent variable coded as "1" if an adolescent aged 15-17 years has ever had

sexual intercourse and "0" otherwise. Thus, our measure of sexual debut is based on current

status data on 'ever had sex' (adjusting for current age), rather than recall data on 'age at first

sex' (AFS) since the latter is subject to more serious misreporting errors due to recall bias, besides deliberate misreporting among young people who may wish to conceal (especially girls) or exaggerate (especially boys) their sexual activity. Preliminary analysis suggested inconsistent reporting of AFS, with some adolescents reporting AFS that was higher that their current age. Indeed, previous research in sub-Saharan Africa suggests that inconsistent reporting of AFS is not uncommon (Wringe, et al., 2009).

Specification and measurement of key independent variables

The key explanatory variables are presence of HIV positive adult in household and parental survival (maternal or paternal orphanhood). The background distribution of the proportion of adolescents in each country who are maternal/paternal orphans, or live in households where there is an adult who is infected with HIV is given in Table A1 in the Appendix.

HIV testing in the DHS is based on a standard procedure and strictly adheres to international ethical guidelines:

> *The DHS HIV testing protocol provides for informed, anonymous, and voluntary testing of women and men interviewed. The testing protocol undergoes a host country ethical review as well as an ethical review at ICF Macro. In countries with CDC involvement, the testing protocol is also reviewed by CDC. The testing is simple; in most cases, the interviewer collects dried blood spots (DBS) on filter paper from a finger prick and the filter paper is transported to a laboratory for testing. The laboratory protocol includes an initial ELISA test, and then retesting of all positive tests and 5% to 10% of the negative tests with a second ELISA. For those tests with discordant results on the two ELISA tests, another test, usually a Western blot, is used to determine the result (ICF Macro, 2010:4).*

It is important to note that orphanhood data for adolescents aged 15-17 years were only available for nine of the 19 countries and potential implications of missing data are discussed later in the paper. The higher orphanhood rates in most countries in southern Africa may be largely

attributable to the high adult HIV prevalence in these countries. However, higher orphanhood rates (especially paternal orphanhood) in countries of lower HIV prevalence such as Rwanda are mainly attributable to other factors such as civil strife in these countries.

In addition to the key explanatory variables, a number of individual human capital and household attributes are included in the analysis as covariates. These include adolescent's school attendance/enrolment, adolescent's educational attainment level, adolescent's media exposure, adolescent's urban/rural residence, religious affiliation, relationship to household head (kinship), household wealth index, household head's age, and household head's gender. The goal here is to identify potential pathways through which household HIV/AIDS status may be linked to adolescent sexual debut. We postulate that the covariates included in the model can help explain the sexual risk associated with orphanhood or presence of HIV infected adults in households. For instance, it is possible that expected greater sexual risk among orphaned adolescents may be partly explained by the impoverishing impact of HIV/AIDS on households.

Methods of Analysis

We apply multilevel logistic regression models to explore the association between household HIV/AIDS status (orphanhood and presence of HIV-positive adults in the household) and onset of sexual activity among 15-17 year-old adolescents in sub-Saharan Africa, adjusting for current age. The covariates are introduced to the models in successive stages to establish potential pathways of the determinants, starting with the household HIV/AIDS status before introducing background individual level characteristics, followed with household contextual factors.

The analysis places particular emphasis on country and regional variations in factors associated with adolescent sexual debut, and the extent of clustering of sexual risk within countries and regions in sub-Saharan Africa. The multilevel analysis is applied to pooled DHS data from 19 countries in sub-Saharan Africa. The pooled data have a hierarchical structure with individuals nested within regions which are in turn nested within countries. Preliminary analysis was first undertaken to assess appropriate multilevel units to be incorporated in the analysis, recognizing the hierarchical data structure, arising from multi-stage cluster sampling design of the DHS and pooling of data across countries. The data comprise individuals/households nested within clusters which are in turn nested within districts/regions and countries. Preliminary analysis based on variance components models revealed significant clustering of the outcome (i.e sexual debut) at region and country level, but there was no evidence of significant clustering at lower-level units (i.e. at cluster or district levels). The analysis, therefore, adopted 3-level models with individuals at Level-1, region at level-2 and country at level-3.

Thus, in the multilevel analysis applied in this paper, countries constitute the highest (third) level (n=19), while regions within countries constitute the second level. The general form of the three-level logistic regression model used may be expressed as:

$$Logit\ \pi_{ijk} = X'_{ijk}\beta + Y'_{ijk}u_{jk} + Z'_{ijk}v_k \qquad (1)$$

where: π_{ijk} is the probability of sexual risk (ever had sex) for an individual i, in the jth region in the kth country; X'_{ijk} is the vector of covariates which may be defined at the individual/household, region or country level; β is the associated vector of usual regression parameter estimates; Y'_{ijk} is a vector of covariates (usually a subset of X'_{ijk})

which vary randomly at region level; Z'_{ijk} is a vector of covariates (usually a subset of X'_{ijk}) which vary randomly at country level; and the quantities v_k, and u_{jk} are the residuals at the country and region level, respectively. These are assumed to have normal distribution with mean zero and variances σ^2_v and σ^2_u (Goldstein, 2003).

The analysis is based on multilevel random coefficient models, allowing for potential variation in the effect of household HIV factors across countries and across regions within countries. The modelling is carried out separately for males and for females, as well as for the combined sample to assess significance of gender differences. The analysis is undertaken using MLwiN multilevel software with calculation of parameter estimates based on second order PQL procedure (Rasbash et al, 2005).

The analysis starts with an examination of the bivariate distribution of the proportion of adolescent boys and girls aged 15-17 who have ever had sex (i.e the outcome variable) by age and country of residence. This is followed with an examination of the association between household HIV/AIDS factors and sexual debut across countries of sub-Saharan Africa in a multivariate multilevel analysis, progressively controlling for country and regional random effects, and other important factors. All the models adjusted for current age.

It is important to note that the analyses presented here are based on unweighted data. We recognize that the appropriateness of using sample weights in multivariate analysis is debatable (see, for example, Winship and Radbill 1994). In this case, weighting is not desirable for a various reasons. First, the multivariate models controlled for key factors that relate to varying

sample weights such as urban/rural residence, region and random country effect. In fact, the random country effect in the multilevel analysis represents unobserved country-level factors, which include any variations in sample design across countries. Second, although it was possible to derive the probability weights for individual survey samples based on the DHS samples and overall population size for respective countries, this was deemed unnecessary since the data included in the analysis do not cover all countries in the sub-Saharan Africa region. Despite constituting a fair representation of countries across sub-Saharan Africa, the data included in the analysis are not representative of all countries in the region

Data limitations

We acknowledge important data limitations and potential implications on our findings. The first relates to the cross-sectional nature of the DHS data analysed which does not permit temporal ordering of the events of interest. For example, we are unable to establish whether the current household HIV/AIDS status preceded reported adolescent sexual debut or vice versa. Therefore, the observed relationships reflect mere associations rather than infer precise causal links. Nevertheless, restricting the analysis to 15-17 year-old adolescents helps minimize the problem since sexual activity would have been initiated in the recent period – preliminary analysis suggests that the median gap between age of sexual debut and current age among those who ever had sex was 1year (mean of 1.8 years due to a positive skew).

The second limitation relates to missing data for one of the key explanatory variables: orphanhood status. The fact that data on orphanhood was only available for nine of the 19 countries included in the analysis limits the extent to which our results relating to orphanhood

status and adolescent sexual debut may be generalized across countries in sub-Saharan Africa. Nevertheless, it was worthwhile to include the variable on orphanhood status in the analysis by including a dummy for the 'not stated' category. This enabled estimation of the orphanhood effect for cases where data were available, while at the same time controlling for potential bias that may result from exclusion of some countries from the analysis. Preliminary analysis established that whether or not the variable on orphanhood was included in the model did not significantly affect estimates of the other parameters.

Finally, although it would have been useful to explore contextual regional/country HIV/AIDS effects on adolescent sexual risk, this was not possible due to data limitations. The DHS surveys used here are limited on contextual data at community/regional level and the number of countries included in the analysis (n=19) is too few to permit meaningful analysis of contextual country-level factors. In multilevel analysis, power for higher level estimates depends on the number of groups (Snijders, 2005), implying that the relatively small number of countries in the analysis sample limits our statistical power to detect significant country-level effects.

Results

Patterns of sexual debut across countries in sub-Saharan Africa

The bivariate distributions of onset of sexual activity by age presented in Table 3 suggest that there are considerable variations in the timing of sexual debut across countries in sub-Saharan Africa. The proportion of adolescent girls who have initiated sexual activity is lowest in Rwanda, where the proportion who have initiated sexual activity ranges from six percent at age 15 to 13 percent by age 17 years. These proportions are considerably lower than other countries such as

Liberia or Sierra Leone where more than 70 percent of the 17 year old adolescent girls have initiated sexual activity.

(TABLE 3 ABOUT HERE)

For adolescent boys, the proportion who have initiated sexual activity is particularly low in Ethiopia where the proportion who have initiated sexual activity ranges from only one percent among 15 year olds to less than five percent among the 17 year olds. This is in sharp contrast to countries such as Cote d'Ivoire, DR Congo and Malawi where more than 40 percent of the 15-17 year olds have initiated sexual activity. The proportion of 17 year old boys who have initiated sexual activity is particularly high in Cote d'Ivoire with almost 70 percent (68 percent) having initiated sexual activity.

The association between household HIV/AIDS status and sexual debut

Results of the multilevel logistic regression analysis of the association between orphanhood or household HIV status and sexual debut are presented in Tables 4a and 4b for adolescent females and males, respectively. This is followed with an analysis based on a combined sample of females and males in Table 4c. All models adjusted for current age of adolescents.

The results in Table 4a suggest that maternal and or paternal orphanhood status is not significantly associated with sexual debut among adolescent girls in sub-Saharan Africa. However, presence of an adult who is HIV positive in the household is associated with an increased risk of sexual debut when household circumstances such as kinship, household wealth and age of household head are controlled for. On average, adolescent girls living in households with a HIV positive adult have a 26 percent higher odds of having initiated sexual activity than

their counterparts of similar characteristics living in households with no infected adults. The vulnerability of adolescents living in households with HIV infected adults only becomes apparent when living arrangement (kinship) is controlled for. This suggests that adolescents living in households with HIV infected adults, whether living with parents or others, are more likely to have initiated sexual activity compared to their counterparts with similar living arrangements. Thus, having an HIV infected adult in the home increases risk irrespective of relationship of the adolescent to the household head.

(TABLE 4a ABOUT HERE)

The association between sexual debut and individual demographic and socio-cultural characteristics suggests a higher risk of sexual debut among adolescent girls who are older, living in rural areas, out of school, have lower educational attainment and lower media exposure. However, the associations with rural/urban residence, educational attainment and media exposure cease to be significant when household circumstances are controlled for (Model 3) suggesting that the observed associations are mainly explained by household circumstances. Household circumstances associated with increased odds of sexual debut include living in independent households where the adolescent is the household head or spouse to the head, and poorer households. It is probable that the observed higher risk of sexual debut among adolescent girls who live in rural areas, or have low educational attainment or low media exposure is mainly attributable to poverty, since these characteristics are associated with higher poverty – a factor associated with increased risk of sexual debut.

The results for male adolescents presented in Table 4b provide no evidence of a significant difference between maternal orphans and non-orphans among adolescent boys, similar to patterns observed for adolescent girls. However, adolescent boys who are paternal orphans are significantly more likely to have initiated sexual activity than their non-orphan counterparts of similar characteristics. On average, paternal orphans have about 25 percent higher odds of having initiated sexual activity than their non-orphan counterparts of similar individual characteristics. This orphan vulnerability is explained by differences in household circumstances with respect to living arrangements and household wealth – the association ceases to be significant when these factors are controlled for in the model.

(TABLE 4b ABOUT HERE)

Besides paternal orphanhood, the presence of HIV positive adults in a household is also associated with increased vulnerability for adolescent boys. On average, adolescent boys living in households where at least one adult is infected with HIV have about 20- 25 percent higher odds of having had sex compared to their counterparts of similar characteristics and household circumstances in households where no adult is HIV positive. Unlike paternal orphanhood where the higher risk of sexual debut was largely explained by household circumstances, the higher risk among those in households with adults living with HIV is exacerbated when household circumstances are controlled for. As in the case of adolescent girls, it is likely that those living in households with HIV infected adults are more likely to be living with parents - a factor associated with reduced odds of sexual debut. Consequently, the vulnerability of adolescent boys living in households with HIV infected adults is concealed when living arrangement (kinship) is not controlled for.

As in the case of adolescent girls, there are significant differences in adolescent boy's sexual debut by individual characteristics including age, urban/rural residence, school attendance, educational attainment and media exposure. However, while the observed patterns with respect to age, urban/rural residence and school attendance are similar to those observed for female adolescents, the patterns relating to educational attainment and media exposure are in the reverse direction. For adolescent boys, higher educational attainment and higher media exposure are both associated with increased odds of sexual debut. Furthermore, while the higher risk of sexual debut among rural residents is largely explained by household circumstances, as in the case of girls, this is not so for educational attainment or media exposure. The patterns with respect to household circumstances are similar to those observed for females, albeit the effect sizes differ. Overall, those who are themselves household heads, or live in household headed by the elderly, or in poorer households are significantly more likely to have initiated sexual activity than their counterparts of similar characteristics who are living with parents, or in households headed by 25-59 year olds, or in the richest households.

Consistent with patterns observed in the bivariate analysis, the results presented in Table 4c confirm that adolescent girls aged 15-17 are significantly more likely to have initiated sexual activity than their male counterparts of similar age. On average across countries in sub-Saharan Africa, the odds of having initiated sexual activity are about 40-50 percent higher for girls than boys of similar household HIV/AIDS status and individual demographic and socio-economic characteristics. The higher odds among girls is partly explained by household socio-economic and demographic circumstances.

An examination of the association between household HIV/AIDS factors and sexual debut based on a combined sample of adolescent females and males (Table 4c) shows patterns generally consistent with those observed in separate analyses for females or males in Tables 4a and 4b above. In particular, the results confirm increased vulnerability for adolescents living in households where an adult is living with HIV – a risk that is exacerbated when household circumstances are controlled for. Also, the findings confirm increased vulnerability among paternal orphans that is largely explained by household circumstances. However, an interesting pattern emerges in relation to maternal orphanhood, suggesting a reduced risk of sexual debut among maternal orphans when household circumstances are controlled for. Further investigation reveals that the reduced risk of sexual debut among maternal orphans becomes evident when living arrangement is controlled for. On average, maternal orphans have about 20 percent lower odds of having initiated sexual activity than non-maternal orphans in similar household circumstances. The effects of maternal/paternal orphanhood and presence of HIV positive adult in the household on sexual debut were allowed to vary by gender but none of the interactions were significant, suggesting that these associations did not vary significantly between adolescent girls and boys.

(TABLE 4C ABOUT HERE)

The patterns for the other individual and household socio-economic and background characteristics also conform to earlier observed patterns for females and males. In particular, the

analysis for the combined sample confirm the protective role of being enrolled in school, living with parents or in wealthier households.

Variations in sexual debut across regions and countries in sub-Saharan Africa

Besides the individual level and household level factors associated with adolescent sexual debut, there are significant variations in the odds of initiating sexual activity across countries in sub-Saharan Africa, and to a lesser extent across regions within countries. The intra-unit correlation coefficients suggest that about 15-20 percent of the total unexplained variation in sexual debut among adolescent girls or boys is attributable to unobserved country-level factors. However, there is no evidence that the effect of orphanhood or presence of a HIV positive adult in a household on sexual debut varies significantly across countries or across regions within countries. For both adolescent girls and boys, random coefficient models allowed for the effects of these factors to vary across countries and regions but there was no evidence of significance.

Discussion and conclusions

In this paper, we have used data from population-based sample surveys to establish household HIV/AIDS factors that place adolescents at risk of sexual onset in sub-Saharan Africa. Our results provide support to the argument that the propensity of initiation of sexual activity among adolescents is determined by household HIV status. In particular, the results suggest increased vulnerability among adolescent boys and girls living in households where an adult is infected with HIV and adolescent boys who are paternal orphans. The observed increased vulnerability among adolescents living in households where an adult is infected with HIV seem consistent with findings from previous studies that have focused on other aspects of adolescent

vulnerability such as mental health. In a recent study in Uganda, lower parent/guardian connectedness, and having a chronically ill adult in the household were associated with a higher level of depression, especially among male adolescents (Kaggwa and Hindin, 2010).

Although some of the previous studies in selected settings in sub-Saharan Africa have identified maternal orphanhood as a risk factor for sexual debut among adolescent girls (Gregson et al., 2005; Birdthistle et al., 2008), this study provides no such evidence. Indeed, there is no evidence of increased vulnerability among adolescent girls who are maternal or paternal orphans, despite an earlier observation from qualitative research that female orphans' sexual behaviors are impacted when parental care giving roles are compromised (Mmari, 2011). Lack of evidence of increased vulnerability (or indeed more favourable outcomes) for orphans compared to non-orphans in previous studies had mainly been attributed to the fact that orphans were more likely to be taken in by wealthier households (Zidron, et al., 2009). However, this is unlikely to be the main explanation here since the relationship remains unchanged even after household wealth is controlled for. Nevertheless, the non-significant association between maternal orphanhood and sexual debut among adolescent girls observed here seem consistent with patterns observed in previous research based on comparable populations. For example, the a study by Palermo & Peterman (2009) based on nationally representative DHS samples of 15-17 year olds observed no evidence of a significant relationship in 8 of the 10 countries included in their analysis[1].

---

[1] It is important to note that that only four surveys were used in both studies and that our analysis omitted the two countries (Uganda and Tanzania) in which Palermo and Peterman (2009) found an association.

For boys, there is no significant difference between maternal orphans and non-orphans, but paternal orphans are significantly more likely to have initiated sexual activity than their non-orphan counterparts of similar individual characteristics. The increased vulnerability among adolescent boys who are paternal orphans is consistent with findings from a number of recent studies in various Southern Africa settings which observed greater sexual risk (including ever had sex) among orphans than non-orphans (Thurman, et al., 2006; Operario et al., 2007; Nyamukapa et al., 2008; Birdthistle et al., 2009). The observed higher sexual risk among adolescent boys (but not girls) who were paternal orphans observed in this study is consistent with findings from a recent study in Uganda where the cause and timing of parental death were important only among the males, and loss of a parent to HIV was associated with worse psychological outcomes among the males and not the females (Kaggwa and Hindin, 2010).

One of the main objectives of this study was to identify potential pathways through which household HIV/AIDS factors may be linked to adolescent sexual debut. The findings suggest that household circumstances relating to living arrangements and wealth are key factors through which household HIV/AIDS status may be linked to adolescent sexual debut. In particular, the reduced risk of sexual debut among adolescent boys who are paternal orphans when these factors are controlled for in the model may be explained by the fact that paternal orphanhood is likely to lead to increased vulnerability for adolescent boys by increasing their likelihood of living in independent or poor households – factors associated with increased risk of sexual debut. These findings support the argument of increased adolescent vulnerability through HIV/AIDS impoverishing impact on households (Enaik et al., 2002; Oman et al., 2005). While previous studies have focused on young women's susceptibility to sexual risk resulting from poor socio-

economic circumstances (Meekers and Calvès 1997; Swidler and Watkins 2007; Operario et al., 2011), our findings draw attention to the vulnerability of adolescent boys. On the other hand, the increased vulnerability of adolescents (especially girls) who live in households where an adult is infected with HIV when living arrangement is controlled for may be explained by the fact that those living in households with HIV infected adults are more likely to be living with parents (rather than in independent households), a factor associated with a reduced risk of sexual debut. Thus, the increased risk among adolescents in households where an adult is infected with HIV is partly concealed when living arrangement is not controlled for.

Findings from the multilevel random effects estimates suggest that there are significant variations in the proportion of 15-17 year olds who have initiated sexual activity across countries in sub-Saharan Africa, consistent with patterns observed in the bivariate analysis. However, there is no evidence that the effect of orphanhood or presence of a HIV positive adult in a household on sexual debut varies significantly across countries or across regions within countries, suggesting that the observed patterns may be generalized across countries in the region.

This paper aimed at providing a general picture of patterns among adolescents across countries in sub-Saharan Africa, useful for informing relevant international policy and programmes across countries in the region. The fact that the patterns observed are consistent across countries in the region highlights the relevance of findings for international cross-national policy. In particular, a key finding relating to vulnerability of adolescents in households with HIV infected adults underscores the importance of extending current efforts in the region to address the plight of other children in HIV/AIDS affected households, beyond orphans.

REFERENCES

Abebe T., Skovdal M. (2010).Livelihoods, care and the familial relations of orphans in Eastern Africa. *AIDS Care*, 22(5):570-6.

Birdthistle, I. J., Floyd, S., Nyagadza, A., Mudziwapasi, N., Gregson, S., & Glynn, J. R. (2009). Is education the link between orphanhood and HIV/HSV-2 risk among female adolescents in urban Zimbabwe? *Social Science and Medicine*, 68:1810-1818.

Birdthistle, I.J., Floyd, S., Machingura, A., Mudziwapasi, N., Gregson, S., Glynn, J.R. (2008). From affected to infected? Orphanhood and HIV risk among female adolescents in urban Zimbabwe. AIDS, 22:759-766.

Boris, N.W., Thurman, T.R., Spencer, E., and Brown, L. (2006). Infants and Young Children Living in Youth-Headed Households in Rwanda: Implications of Emerging Data. *Infant Mental Health Journal,* 27 (6): 584-602.

Coleman, J.S. (1988). Social capital in the creation of human capital. *The American Journal of Sociology*, 94: S95-S120.

Collins J. and Bill R. (2000). AIDS in the context of development. *UNRISD Programme on Social Policy and Development, Paper No. 4*.

Doyle A.M., Weiss H.A., Maganja K., Kapiga S., McCormack S., et al. (2011) The long-term impact of the MEMA kwa Vijana adolescent sexual and reproductive health intervention: effect of dose and time since intervention exposure. PloS ONE 6: e24866. doi:10.1371/journal.pone.0024866

Enaik E., Patel M.P., Persad A.S., Westhoff W., Galwankar S. (2002). Adolescent high-risk sexual behavior in the Dominican Republic: an assessment of familial factors. *Int Conf AIDS.* Barcelona, Spain .

Funkquist A., Eriksson B., Muula AS. (2007). The vulnerability of orphans in Thyolo District, southern Malawi. *Tanzan Health Res Bull*, 9(2):102-9.

Goldstein, H. (2003). *Multilevel statistical models* (3rd edition). London: Arnold.

Gregson, S., Nyamukapa, C., Garnett, G.P., Wamba, M., Lewis, J.J.C., Mason, P.R., Chandiwana, S.K. and Anderson, R.M. (2005). HIV Infection and Reproductive Health in Teenage Women Made Vulnerable by AIDS in Zimbabwe. *AIDS Care*, 17(7):785-94.

Harrison A., Cleland J., Gouws E., Frohlich J. (2005). Early sexual debut among young men in rural South Africa: heightened vulnerability to sexual risk. *Sex Transm Infect. 81:259-261*

ICF Macro. (2010). *HIV Prevalence Estimates from the Demographic and Health Surveys*. Calverton – Maryland, ICF Macro.

Juma, M., Askew, I. and Ferguson, A. (2007). Situation Analysis of the Sexual and Reproductive Health and HIV Risks and Prevention Needs of Older Orphaned and Vulnerable Children in Nyanza Province. Department of Children's Services, Government of Kenya.

Kaggwa, E.B., and Hindin M.J. (2010). The psychological effect of orphanhood in a matured HIV epidemic: An analysis of young people in Mukono, Uganda. *Social Science and Medicine,* 70(7):1002-1010.

Lammers, C.M.I., Resnick M.D., and Blum R.W. (2000). Influences on Adolescents' Decision to Postpone Onset of Sexual Intercourse: A Survival Analysis of Virginity Among Youths Aged 13 to 18 Years. *Journal of Adolescent Health*, 26(1): 40-48.

Leclerc-Madlala S. (2009). Cultural scripts for multiple and concurrent partnerships in southern Africa: why HIV prevention needs anthropology. *Sex Health* 6(2):103-10.

Maticka-Tyndale E (2012). Condoms in sub-Saharan Africa. *Sex Health*, 9:59–72

Meekers D. and Calvès A-E. (1997). "Main" girlfriends, girlfriends, marriage, and money: The social context of HIV risk behavior in Sub-Saharan Africa. *Health Transition Review* 7(Suppl.): 361-375.

Mellins, C.A., Brackis-Cott, E., Dolezal, C. and Meyer-Bahlburg, H.F.L. (2005). Behavioral risk in early adolescents with HIV+ mothers. *Journal of Adolescent Health*, 36(4):342-351.

Mmari, K. (2011). Exploring the relationship between caregiving and health: Perceptions among orphaned and non-orphaned adolescents in Tanzania. *Journal of Adolescence*, 34(2): 301-309.

Nkosana J. and Rosenthal, D. (2007) The dynamics of intergenerational sexual relationships: the experience of schoolgirls in Botswana. *Sex Health* 4(3):181-7.

Nyamukapa, C. A., Gregson, S., Lopman, B., Saito, S., Watts, H. J., Monasch, R., et al. (2008). HIV-associated orphanhood and children's psychosocial distress: theoretical framework tested with data from Zimbabwe. *American Journal of Public Health*, 98(1): 133–141.

Oman R.F., Vesely S.K., and Aspy C.B. (2005). Youth assets and sexual risk behavior: The importance of assets for youth residing in one-parent households. *Perspect Sex Reprod Health* 37: 25-31.

Operario, D., Pettifor, A., Cluver, L., MacPhail, C., & Rees, H. (2007). Prevalence of parental death among young people in South Africa and risk for HIV infection. *Journal of Acquired Immune Deficiency Syndromes*, 44(1): 93–98.

Operario, D., Underhill, K., Chuong, C., Cluver, L. (2011). HIV infection and sexual risk behaviour among youth who have experienced orphanhood: systematic review and meta-analysis. *Journal of International AIDS Society*, 14: 25. Available online: http://www.jiasociety.org/content/14/1/25 .

Palermo, T. and Peterman, A. (2009). Are female orphans at risk for early marriage, early sexual debut, and teen pregnancy? Evidence from Sub-Saharan Africa. *Studies in Family Planning*, 40:101-112.

Rasbash J., Steele F., Browne W. & Prosser B. (2005). *A users Guide to MLwiN*, Version 2.0. Centre for Multilevel Modeling, University of Bristol.

Snijders, T.A.B. (2005) Power and sample size in multilevel modelling. In: B.S. Everitt and D.C. Howell (eds.). *Encyclopedia of Statistics in Behavioral Science.* 3:1570–1573.

Swidler, A. and Watkins, S. C. (2007). Ties of Dependence: AIDS and Transactional Sex in Rural Malawi. *Studies in Family Planning*, 38: 147–162.

Thurman, T. R., Brown, L., Richter, L., Maharaj, P., & Magnani, R. (2006). Sexual risk behaviour among South African adolescents: is orphan status a factor? *AIDS Behaviour*, 10(6):627–635.

Uchudi, J., Magadi, M and Mostazir M. (2012). A multilevel analysis of the determinants of high risk sexual behavior in sub-Saharan Africa. *Journal of Biosocial Science,* 44: 289–311

UNAIDS (2013) *Report on the Global AIDS epidemic*. UNAIDS, Geneva.

UNAIDS, UNICEF and USAID (2004) *Children on the Brink 2004: A joint report of the new orphan estimates and a framework for action*.
http://www.unicef.org/publications/files/cob_layout6-013.pdf

UNAIDS and WHO (2009) *AIDS Epidemic Update December 2009*. UNAIDS, Geneva

UNICEF (2006). *Africa's Orphaned and Vulnerable Generations: Children affected by AIDS*. Unite Nations, New York.

WHO (2008). Promoting adolescent sexual and reproductive health through schools in low income countries: an information brief Geneva. World Health Organization, Geneva. Available at: http://whqlibdoc.who.int/hq/2009/WHO_FCH_CAH_ADH_09.03_eng.pdf (Accessed 21 February 2014)

Winship, C. and Radbill, L. (1994). Sampling weights and regression analysis. *Sociological Methods & Research,* 23:230–57.

Wringe, A., Cremin, I., Todd, J., McGrath, N., Kasamba, I., Herbst, K., Mushore, P., Żaba, B. and Slaymaker, E. (2009). Comparative assessment of the quality of age-at-event reporting in three HIV cohort studies in sub-Saharan Africa. *Sex Transm Infect,* 85(Suppl 1):i56–63.

Zidron, A.M., Juma, E., Ice, G.H. (2009). Does being an orphan decrease the nutritional status of Luo children? *American Journal of Human Biology*, 21(6): 844-851.

Table 1 Sample of adolescents aged 15-17 years included in the analysis by country

Country	Females	Males	All
Burkina Faso 2003	591	519	1110
Cameroon 2004	766	740	1506
Cote d'Ivoire 2005	524	588	1112
DR Congo 2007	550	498	1048
Ethiopia 2005	825	662	1487
Ghana 2003	636	611	1247
Guinea 2005	498	421	919
Kenya 2003	430	434	864
Lesotho 2004-05	461	400	861
Liberia 2007	719	603	1322
Malawi 2004	296	259	555
Mali 2006	666	528	1194
Niger 2006	562	407	969
Rwanda 2005	834	684	1518
Senegal 2005	730	572	1302
Sierra Leone 2008	310	259	569
Swaziland 2006	744	777	1521
Zambia 2007	779	672	1451
Zimbabwe 2005-06	1058	1007	2065
All (Sub-Saharan Africa)	11979	10641	22620

Table 2: Description of Study Variables

NAME OF VARIABLE	MEASURE
Outcome Variable	
Sexual debut	Coded as 1= if respondent has ever had sexual intercourse; 0=otherwise. (Analysis undertaken separately for females and males and combined sample)
Household HIV/AIDS factors	
Maternal orphanhood (Ref=no)	Maternal orphanhood status, coded as: 0-non orphan, 1-maternal orphan, 2-orphanhood status not stated
Paternal orphanhood (Ref=no)	Paternal orphanhood status, coded as: 0-non orphan, 1-paternal orphan, 2-orphanhood status not stated
Household HIV status	A dichotomous variable for whether or not an adult in the household is infected with HIV, coded as: 1 if an adult in the household is HIV+; 0 otherwise.
Adolescent Individual-level covariates	
Age of adolescent	Age of adolescent in single years, included as a control variable for duration of exposure to the risk of sexual debut
Residence (Ref=Urban)	Place of residence, coded as 1=if respondent was living in a rural area at the time of the survey; 0=urban
School attendance (Ref=out of school)	School enrolment status of adolescent, coded as 0-out of school; 1-in school; and 2-school enrolment status not stated.
Education level (Ref=none)	Dummy variables for highest educational attainment classified into three categories: none, primary, secondary+.
Media exposure (Ref=low)	A composite summary index derived by PCA from information on frequency of reading newspapers, listening to radio and watching TV by respondents. The PCA scores are classified into tertiles: 'low', 'average' and 'high'.
Religion (Ref=Catholic/Orthodox)	Dummy variables for religious affiliation, re-coded into three categories: Catholic/Orthodox, Protestant/other Christian, Muslim/traditional/other.
Covariates for Household Circumstances	
Living arrangement (i.e. Kinship) (ref=household head)	A dummy variable for relationship to household head, coded as: 1-him(her) self household head; 2-daughter/son of household head; 3-other
Household wealth (Ref: poorest)	DHS household wealth index[2] derived from information on household possessions and amenities using Principal Components Analysis (PCA). The PCA scores are classified into wealth quintiles, the lowest quintile being the poorest.
Sex of household head (ref=male)	Coded as 1=if respondent was living in a female-headed household at the time of the survey; 0=otherwise.
Age of household head (ref=25-59)	A dummy variable for age of household head, coded as: 1=<25 yrs; 2=25-59; and 3=60+

Table 3 Percent of 15-17 year old adolescent in each country who have ever had sex by age in completed years

Country	Females				Males			
	15 yrs	16 yrs	17 yrs	All	15 yrs	16 yrs	17 yrs	All
Burkina Faso 2003	19.1	18.1	48.3	29.0	5.1	22.1	26.6	17.6
Cameroon 2004	22.8	43.6	59.2	40.8	14.8	33.9	41.9	31.0
Cote d'Ivoire 2005	28.9	31.8	59.6	41.0	32.4	58.6	68.2	52.0
DR Congo 2007	25.0	35.0	50.9	36.8	28.7	33.1	62.5	40.5
Ethiopia 2005	9.3	16.4	24.6	16.5	1.2	2.7	4.1	2.6
Ghana 2003	14.2	24.4	34.8	24.5	5.8	8.9	15.0	9.7
Guinea 2005	25.5	55.2	68.4	48.3	22.3	38.7	53.8	38.1
Kenya 2003	13.5	24.3	49.6	28.1	34.4	40.2	45.6	39.9
Lesotho 2004-05	12.5	28.3	46.2	29.7	25.7	32.2	46.0	35.0
Liberia 2007	35.7	65.0	77.7	60.0	17.5	28.3	45.4	30.1
Malawi 2004	20.0	37.6	48.8	35.5	34.2	41.6	54.4	44.2
Mali 2006	28.1	46.9	60.2	43.6	4.5	18.5	30.2	17.0
Niger 2006	34.0	45.8	56.9	46.4	8.5	8.0	13.8	10.2
Rwanda 2005	6.3	7.7	12.7	8.9	13.2	15.4	24.2	17.8
Senegal 2005	7.4	18.5	28.5	18.5	15.4	25.0	34.0	25.2
Sierra Leone 2008	36.8	56.1	72.1	53.3	14.9	31.5	34.7	26.6
Swaziland 2006	13.2	25.1	42.8	27.5	4.7	11.7	20.5	12.1
Zambia 2007	20.3	40.9	52.0	36.8	22.2	41.5	46.8	36.7
Zimbabwe 2005-06	8.0	18.3	29.6	19.0	6.2	14.7	29.3	17.3
All (SS Africa)	18.9	31.9	45.5	32.0	14.6	24.6	35.2	24.8

Table 4a Multilevel logistic regression average odds ratios (AOR) and 95% confidence intervals of AOR for sexual debut among female adolescents aged 15-17 in sub-Saharan Africa.

PARAMETER	Model 1		Model 2		Model 3	
	AOR	95% CI	AOR	95% CI	AOR	95% CI
Fixed Effects						
age	2.17*	(2.05, 2.30)	2.13*	(2.01, 2.26)	2.03*	(1.91, 2.16)
Maternal orphanhood [no]						
maternal orphan	1.10	(0.91, 1.34)	1.07	(0.88, 1.31)	0.82	(0.66, 1.02)
not stated	1.61	(0.90, 2.88)	1.68	(0.93, 3.04)	1.47	(0.79, 2.72)
Paternal orphanhood [no]						
paternal orphan	1.10	(0.94, 1.29)	1.07	(0.92, 1.26)	0.95	(0.80, 1.12)
not stated	1.32	(0.76, 2.30)	1.34	(0.76, 2.35)	1.07	(0.60, 1.93)
Household HIV status [no]						
HIV+ adult in hhld	1.07	(0.93, 1.24)	1.14	(0.98, 1.32)	1.26*	(1.08, 1.47)
Residence [urban]						
rural residence			1.20*	(1.07, 1.34)	1.10	(0.96, 1.27)
Schooling [no]						
in school			0.34*	(0.29, 0.40)	0.41*	(0.35, 0.49)
Not stated			1.41	(0.79, 2.54)	1.30	(0.72, 2.32)
Educ. attainment [none]						
primary			0.82*	(0.71, 0.95)	1.02	(0.87, 1.20)
secondary+			0.68*	(0.57, 0.81)	0.95	(0.78, 1.15)
Media exposure [low]						
average			0.92	(0.82, 1.03)	0.97	(0.85, 1.10)
high			0.78*	(0.68, 0.89)	0.89	(0.77, 1.03)
Religion [Catholic/orth]						
Protestant			0.86*	(0.74, 0.98)	0.83*	(0.72, 0.96)
other			0.99	(0.83, 1.17)	0.98	(0.82, 1.18)
Kinship [HH head]						
daughter					0.02*	(0.01, 0.03)
lives with others					0.04*	(0.03, 0.05)
HH wealth[poorest]						
Poorer					1.14	(0.97, 1.34)
Middle					0.91	(0.77, 1.07)
Richer					1.06	(0.89, 1.27)
Richest					0.71*	(0.58, 0.88)
Sex of hh head [male]						
Female					0.98	(0.88, 1.09)
Age of hh head[25-59]						
HH head <25					0.76*	(0.58, 1.00)
HH head 60+					1.01	(0.90, 1.13)
Random effects variance (Standard errors given in brackets)						
Country - const	0.68(0.236)*		0.71(0.248)*		0.61(0.218)*	
Region - const	0.32(0.048)*		0.32(0.049)*		0.35(0.054)*	

* - Significant at 5% level (p<0.05); [ ] Reference categories in square brackets.

Table 4b Multilevel logistic regression average odds ratios (AOR) and 95% confidence intervals of AOR for sexual debut among male adolescents aged 15-17 in sub-Saharan Africa.

PARAMETER	Model 1 AOR	Model 1 95% CI	Model 2 AOR	Model 2 95% CI	Model 3 AOR	Model 3 95% CI
Fixed Effects						
age	1.87*	(1.76, 2.00)	1.81*	(1.70, 1.93)	1.79*	(1.68, 1.91)
Maternal orphanhood [no]						
maternal orphan	0.97	(0.79, 1.19)	0.99	(0.80, 1.22)	0.83	(0.67, 1.04)
not stated	0.73	(0.39, 1.36)	0.71	(0.38, 1.34)	0.64	(0.34, 1.20)
Paternal orphanhood [no]						
paternal orphan	1.26*	(1.07, 1.48)	1.27*	(1.08, 1.50)	1.12	(0.94, 1.33)
not stated	1.75	(0.99, 3.12)	1.79	(1.00, 3.20)	1.66	(0.93, 2.97)
Household HIV status[no]						
HIV+ adult in hhld	1.22*	(1.05, 1.43)	1.19*	(1.02, 1.39)	1.24*	(1.06, 1.45)
Residence [urban]						
rural residence			1.19*	(1.05, 1.35)	1.06	(0.92, 1.22)
Schooling [no]						
in school			0.56*	(0.47, 0.65)	0.57*	(0.49, 0.68)
Not stated			0.73	(0.41, 1.31)	0.68	(0.38, 1.20)
Educ.attainment [none]						
primary educ			1.51*	(1.24, 1.83)	1.57*	(1.30, 1.91)
sec+ educ level			1.76*	(1.41, 2.19)	1.92*	(1.53, 2.39)
Media exposure [low]						
average			1.34*	(1.17, 1.52)	1.38*	(1.21, 1.58)
high			1.65*	(1.42, 1.92)	1.79*	(1.53, 2.09)
Religion [Catholic/orth]						
Protestant			1.02	(0.88, 1.18)	1.02	(0.88, 1.18)
other			0.97	(0.82, 1.16)	0.96	(0.81, 1.15)
Kinship [HH head]						
son					0.35*	(0.23, 0.51)
lives with others					0.50*	(0.34, 0.73)
HH wealth [poorest]						
Poorer					0.85	(0.71, 1.00)
Middle					0.90	(0.76, 1.06)
Richer					0.84	(0.70, 1.00)
Richest					0.60*	(0.48, 0.74)
Sexof hh head[male]						
Female					1.06	(0.94, 1.19)
Age hh head [25-59]						
HH head <25					1.08	(0.81, 1.43)
HH head 60+					1.15*	(1.02, 1.30)
Random effects variance (Standard errors given in brackets)						
Country - const	0.69(0.240)*		0.76(0.265)*		0.70(0.246)	
Region - const	0.28(0.047)*		0.28(0.047)*		0.26(0.045)	

* - Significant at 5% level (p<0.05); [ ] Reference categories in square brackets.

Table 4c Multilevel logistic regression average odds ratios (AOR) and 95% confidence intervals of AOR for sexual debut among female and male adolescents aged 15-17 in sub-Saharan Africa.

PARAMETER	Model 1 AOR	Model 1 (95% CI)	Model 2 AOR	Model 2 (95% CI)	Model 3 AOR	Model 3 (95% CI)
Fixed Effects						
***Gender* [male]**						
female	1.48*	(1.38, 1.57)	1.41*	(1.32, 1.51)	1.23*	(1.15, 1.32)
Age in years	1.98*	(1.90, 2.06)	1.94*	(1.86, 2.02)	1.87*	(1.79, 1.95)
***Maternal orphanhood* [no]**						
maternal orphan	1.03	(0.89, 1.18)	1.02	(0.88, 1.17)	0.82*	(0.71, 0.95)
not stated	1.15	(0.76, 1.74)	1.16	(0.76, 1.77)	0.97	(0.63, 1.49)
***Paternal orphanhood* [no]**						
paternal orphan	1.18*	(1.06, 1.32)	1.16*	(1.04, 1.30)	1.01	(0.90, 1.14)
not stated	1.45	(0.98, 2.14)	1.44	(0.97, 2.12)	1.25	(0.84, 1.87)
***Household HIV status* [no]**						
HIV+ adult in hhld	1.15*	(1.04, 1.28)	1.17*	(1.06, 1.30)	1.27*	(1.14, 1.42)
***Residence* [urban]**						
rural			1.17*	(1.08, 1.27)	1.07	(0.97, 1.18)
***Schooling* [no]**						
in school			0.46*	(0.42, 0.52)	0.51*	(0.46, 0.57)
Not stated			1.08	(0.74, 1.67)	0.97	(0.62, 1.50)
***Educ. Attainment* [none]**						
primary educ			0.92	(0.83, 1.03)	1.12	(0.99, 1.25)
sec+ educ level			0.90	(0.79, 1.02)	1.17*	(1.02, 1.34)
***Media exposure* [low]**						
average			1.06	(0.97, 1.15)	1.11*	(1.02, 1.21)
high			1.06	(0.96, 1.16)	1.17*	(1.06, 1.30)
***Religion* [Catholic/orth]**						
Protestant			0.92	(0.83, 1.02)	0.91	(0.82, 1.00)
other			0.93	(0.83, 1.05)	0.93	(0.82, 1.05)
***Kinship* [HH head]**						
Son/daughter					0.05*	(0.04, 0.06)
lives with others					0.08*	(0.06, 0.10)
***HH wealth* [poorest]**						
Poorer					1.00	(0.89, 1.12)
Middle					0.93	(0.83, 1.04)
Richer					0.98	(0.87, 1.11)
Richest					0.67*	(0.58, 0.78)
***Sex of hh head* [male]**						
Female					1.06	(0.99, 1.15)
***Age of hh head* [25-59]**						
HH head <25					0.71*	(0.59, 0.85)
HH head 60+					1.05	(0.97, 1.14)
Random effects variance (Standard errors given in brackets)						
Country - const	0.50(0.173)*		0.55(0.191)*		0.47(0.163)*	
Region - const	0.21(0.030)*		0.21(0.031)*		0.21(0.031)*	

* - Significant at 5% level (p<0.05); [ ] Reference categories in square brackets.

APPENDICES

Table A1 Percent of adolescents aged 15-17 in each country who are maternal/ paternal orphans or in households with HIV positive adults.

Country	Maternal orphanhood			Paternal orphanhood			HIV+ adult in Household
	Orphan	Non-orphan	Not stated	Orphan	Non - orphan	Not stated	
Burkina Faso 2003	N/A	N/A	100.0	N/A	N/A	100.0	4.7
Cameroon 2004	N/A	N/A	100.0	N/A	N/A	100.0	10.8
Cote d'Ivoire 2005	4.7	86.1	9.2	13.2	77.3	9.5	8.9
DR Congo 2007	8.5	87.6	4.0	13.9	81.9	4.2	4.4
Ethiopia 2005	N/A	N/A	100.0	N/A	N/A	100.0	1.7
Ghana 2003	N/A	N/A	100.0	N/A	N/A	100.0	2.4
Guinea 2005	N/A	N/A	100.0	N/A	N/A	100.0	5.3
Kenya 2003	N/A	N/A	100.0	N/A	N/A	100.0	10.7
Lesotho 2004-05	14.4	82.8	2.9	34.3	61.8	4.0	27.0
Liberia 2007	3.6	91.9	4.5	11.4	83.5	5.1	2.7
Malawi 2004	15.7	80.9	3.4	24.8	71.2	4.0	15.5
Mali 2006	N/A	N/A	100.0	N/A	N/A	100.0	3.6
Niger 2006	N/A	N/A	100.0	N/A	N/A	100.0	1.9
Rwanda 2005	15.4	81.7	2.9	33.6	62.4	4.0	4.8
Senegal 2005	N/A	N/A	100.0	N/A	N/A	100.0	2.0
Sierra Leone 2008	5.8	89.2	5.0	17.9	76.3	5.8	2.1
Swaziland 2006	15.3	79.4	5.2	28.7	65.3	6.0	43.8
Zambia 2007	15.8	81.6	2.6	24.1	72.7	3.2	23.7
Zimbabwe 2005-06	17.0	78.8	4.1	31.0	63.4	5.6	23.1
All (SS Africa)	6.5	44.1	49.4	12.8	37.4	49.8	11.4

N/A – Orphanhood information is not available

Acknowledgements