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The Link Between HIV/AIDS and Fertility Patterns in Kenya

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ABSTRACT

This study examines the effect of individual and contextual community-level HIV/AIDS factors on fertility in Kenya. Multilevel models are applied to the 2003 KDHS, introducing various proximate fertility determinants in successive stages, to explore possible mechanisms through which HIV/AIDS may have influenced fertility. The results corroborate findings from earlier studies of the fertility inhibiting effect of HIV/AIDS among infected women. HIV/AIDS infected women have 40 per cent lower odds of having had a recent birth than their uninfected counterparts of similar background characteristics and child mortality experience. Further analysis suggests that the effect of HIV/AIDS on fertility is partly through proximate fertility determinants relating to sexual exposure, breastfeeding duration, and foetal loss. Whilst HIV/AIDS may have contributed to reduced fertility, mainly through reduced sexual exposure, there is also evidence that it has contributed to increased fertility through increased desire for more children, mainly resulting from increased infant and child mortality.

Introduction

Study Rationale and Objectives

Kenya has experienced one of the most dramatic fertility declines in world history, and although the fertility had earlier been projected to continue declining to a total fertility rate (TFR) of 3.2 by 2015-2020 (Central Bureau of Statistics (CBS) 2002), the 2003 Kenya Demographic and Health Survey (KDHS) showed that the decline in fertility has stalled at a TFR of about five children per woman with evidence of an upsurge in specific sub-groups (CBS et al. 2004; Westoff and Cross 2006). This stall has been attributed in part to lack of recent progress in socio-economic development (Bongaarts 2005). The overall stagnation in fertility decline was one of the most surprising and worrisome findings from the 2003 KDHS (CBS et al. 2004) and adds to the list of existing demographic challenges in the country, including the recent upsurge in infant and child mortality which has been partly attributed to the HIV/AIDS epidemic. Although the impact of HIV/AIDS on mortality and life expectancy in Kenya is reasonably well understood (Ministry of Health 2005), the possible impact of HIV/AIDS on fertility remains unclear. Early evidence from the 2003 KDHS showed interesting patterns, with the regions worst affected by HIV/AIDS epidemic (e.g. Nyanza Province), showing the clearest sign of a reversal trend in fertility decline. This calls for further investigations to better understand the possible link between the HIV/AIDS epidemic and the observed recent fertility patterns in the country, with particular reference to the most adversely affected regions.

Considerable attention has been paid to the recent fertility stall in Kenya and to the HIV/AIDS and fertility link. Bongaarts (2005) examined causes of stalling fertility decline in a number of mid-transition countries, including Kenya, while other studies have specifically investigated recent fertility transitions in Kenya (Anyara and Hinde 2006; Westoff and Cross 2006). These studies did not primarily focus on the role of HIV/AIDS, although Westoff and Cross (2006) made reference to the role of HIV/AIDS (especially risk perceptions and personal acquaintance with people infected with HIV/AIDS) on contraceptive use and reproductive preferences. One particular study focussed on individual and community effects of HIV/AIDS infection on marital fertility (DeRose 2006), but did not take into account the proximate fertility determinants or important socio-cultural factors such as ethnicity which have an important role in both fertility and HIV/AIDS transmission in the country. Westoff and Cross (2006) noted that although it seemed reasonable that the increase in child

mortality, partly due to AIDS, had played a role in changes in reproductive intentions, additional work was needed to better understand the connections between concern about HIV/AIDS and the stall or reversal in reproductive preferences in Kenya. In this study, we carry out a comprehensive analysis of the link between HIV/AIDS factors and recent fertility patterns in Kenya, with particular reference to individual and contextual community HIV/AIDS factors and role of the proximate fertility determinants. The main objectives of this study are:

- to examine regional variations in the link between HIV/AIDS and fertility;
- to examine the effect of individual and contextual community level HIV/AIDS factors on fertility; and
- to explore possible mechanisms through which HIV/AIDS may have influenced fertility.

Understanding the Relationship between HIV/AIDS and Fertility

The HIV/AIDS epidemic is believed to be partly responsible for the recent upsurge in mortality in a number of countries in sub-Saharan Africa, but the effect on fertility has remained unclear. As illustrated by the United Nations (2002), the relationship between HIV/AIDS and fertility is a complex one. First, the causality can run in either direction. While HIV/AIDS can affect fertility desires and outcomes, it is also possible for fertility to affect the risk of HIV/AIDS and disease progression. Second, HIV/AIDS and fertility may share common causes that induce an association between the two. In this analysis, we focus primarily on the effect of HIV/AIDS on fertility, which is itself not a straightforward one since HIV/AIDS can have a positive or a negative effect on fertility. It is, therefore, important that we recognize the possible complex interrelationships while interpreting our findings.

The effect of HIV/AIDS on fertility may operate both at the individual level, and at the aggregate level. This effect can differ not only in magnitude but also in direction (United Nations 2002). At the individual level, there may be differential effects on fertility on infected and uninfected women. The effect of HIV/AIDS on fertility of infected persons (which is mainly through biological and behavioural factors) is far better understood, and with more precision than the corresponding effect for uninfected persons, which operates mainly through behavioural mechanisms (United Nations 2002). Existing studies from sub-

Saharan Africa show that fertility of HIV-positive women is 25-40 per cent lower than for uninfected women (Ryder et al. 1991; Allen et al. 1993; Zaba and Gregson 1998).

A reasonable understanding of the impact of HIV/AIDS on fertility requires an examination of the impact both at the individual level as well as at the aggregate level. Unfortunately, few studies in sub-Saharan Africa have data linking the epidemic and fertility of populations. Existing studies across sub-Saharan Africa generally support the claim that fertility has been decreased by the HIV/AIDS epidemic (Ntozi 2001). However, the patterns of fertility and HIV/AIDS recently observed in Kenya, where the region with highest HIV/AIDS prevalence also showed the greatest fertility upsurge (CBS et al. 2004) does not conform to the general patterns earlier observed in other countries in sub-Saharan Africa.

In their analysis of factors associated with the stall in fertility decline in Kenya, Westoff and Cross (2006) noted that the stall in rise of contraceptive prevalence could be mainly due to a decline in the proportion of women who want no more children. They noted that in general, the evidence about the connections of AIDS, child mortality and reproductive intention in Kenya were consistent with the conclusions of earlier studies in Kenya and Tanzania that an increase in child mortality can be expected to increase fertility, while an increase in adult mortality or concerns about AIDS would reduce fertility (Ainsworth et al. 1998; Gyimah and Rajulton 2004).

Ntozi (2001) noted that the contribution of HIV/AIDS to current fertility transitions in sub-Saharan Africa is not evident for four reasons. Firstly, isolating the factor of HIV/AIDS from other factors of fertility is a complex process because it is not a proximate variable, but one of the contributors to several proximate determinants of fertility. Secondly, for the impact of the epidemic to be felt, the prevalence has to be high in the region of 20 per cent and sustained for a long time of a decade or longer. Thirdly, behaviour factors may reduce fertility of women with symptoms of AIDS, but not those asymptomatic, since many women in sub-Saharan Africa are not aware of their sero-status. Fourthly, as infant mortality increases, the need to replace dead children and produce more to ensure survival of some will challenge implementation of family planning programmes. Furthermore, increasing HIV/AIDS prevalence in the region will mean that HIV/AIDS programmes will compete for resources with family planning programmes, which would weaken the latter. Ntozi (2001) concluded that although available studies point to the epidemic resulting in fertility reduction, what was lacking in understanding of the impact of the epidemic on fertility was population-level data to understand the relationship at the macro level.

Conceptual Framework

HIV/AIDS is likely to influence fertility of individual women through a number of behavioural and biological factors, namely, marriage, contraception, breastfeeding, postpartum abstinence, foetal loss, pathological and natural sterility. For example, fertility may decline in the era of AIDS because of: delayed onset of sexual relations and age at first union; reduced premarital sexual relations and remarriage, and increased marital resolution and spousal separation; increased condom use; increased duration of post partum amenorrhea (PPA); reduced pregnancy rates and increased foetal loss; increased prevalence of sexually transmitted diseases (STDs)¹; and reduced frequency of sexual intercourse and production of spermatozoa. On the other hand, HIV/AIDS may increase fertility through: reduced breastfeeding; reduced postpartum abstinence; and increased infant mortality.

HIV/AIDS may influence fertility through one or more behavioural or biological proximate fertility determinants. A conceptual framework used for the analysis of the link between HIV/AIDS is given in Figure 1. HIV/AIDS factors, including sero-status, perceived risk and knowledge may influence desired fertility either directly or through child mortality. Desired fertility in turn influences actual fertility through behavioural proximate determinants of fertility, mainly contraception. Alternatively, HIV/AIDS factors may directly influence the behavioural or biological proximate fertility determinants, which in turn influence actual fertility. A number of factors in the background may influence desired fertility or proximate fertility determinants either directly or through HIV/AIDS related factors.

(FIGURE 1 ABOUT HERE)

Data and Methods

The Data

This study is based primarily on secondary analysis of the 2003 Kenya Demographic and Health Survey (KDHS) data. The 2003 KDHS provides a unique opportunity to explore the impact of the HIV/AIDS epidemic on the affected populations, being the fourth survey in the

¹ Co-infection of HIV/AIDS with other STDs (gonorrhoea, syphilis and chlamydia) is an important explanation for reduced fecundability. It has been reported that Gonorrhoea and syphilis transmission rates double in presence of HIV while even more dramatic is the effect of gonorrhoea and syphilis on HIV/AIDS transmission (Bracher and Santow (2001), cited in United Nations, 2002)

international DHS programme to include HIV testing, and the first to anonymously link the HIV results with key behavioural, social and demographic factors (CBS et al. 2004). The 2003 KDHS data make it possible to link HIV/AIDS status of individual women with their behavioural and demographic characteristics, including fertility behaviour.

The 2003 KDHS was a nationally representative sample survey of 8,195 women aged 15-49 and 3,578 men aged 15-54 selected from 400 sample points (clusters) throughout Kenya. This study used primarily the women sample, although some community level factors (e.g. proportion of men in the cluster who are circumcised, HIV prevalence) were derived from the male sample or a combination of the two samples. The survey used a two-stage sample and was designed to produce separate estimates of key indicators for each of the eight provinces in Kenya. The first stage involved selecting clusters from a national master sample frame, while the second stage involved a systematic sample of households within each cluster. All women aged 15-49 in sampled households were eligible for the interview. In every second household selected for the survey, all men aged 15-54 were eligible to be interviewed. One of the important features of the 2003 KDHS was HIV/AIDS testing of adults. All women and men living in households selected for the Men's Questionnaire were asked to voluntarily give a few drops of blood for HIV testing.

Specific information of interest in this study relate to information on fertility, HIV/AIDS, and the proximate determinants of fertility. The fertility outcome variables (at individual level) include: actual fertility (recent fertility experience, within the last three years); and desired fertility (ideal family size; whether want no more children). The key HIV/AIDS variables include: HIV/AIDS sero-status; HIV/AIDS knowledge and perceived risk; and contextual community level HIV/AIDS factors, (including proportion of individuals who are HIV/AIDS sero-positive, proportion who perceive themselves to be at high risk of HIV/AIDS, and the proportion of men who are circumcised). The proximate determinants of fertility, through which HIV/AIDS may influence fertility included in the study were: sexual activity and marital resolution/dissolution; infant and child mortality experience; contraception; breastfeeding practices; postpartum amenorrhea; and foetal loss.

In addition to the KDHS 2003 data, we have used background information on trends in fertility indicators and changes in the proximate fertility determinants, obtained from the 1993 and 1998 KDHS.

Methods of analysis

The analysis starts with an examination of background trends and regional variations in fertility and the proximate determinants of fertility, before focusing on the association between HIV/AIDS and fertility. An examination of background levels and trends of fertility and the proximate determinants in Kenya based on 1993, 1998 and 2003 KDHS make particular reference to various proximate determinants through which HIV/AIDS may influence fertility. Changes in the key proximate determinants examined include marital resolution/dissolution, contraception, breastfeeding practices, and infant mortality. The analysis in this section is limited to descriptive analysis of trends and regional variations. Of particular interest are the links between HIV prevalence and changes in various fertility indicators across regions, including desired and recent fertility.

The analysis of the association between HIV/AIDS and fertility include both bivariate analyses as well as multivariate modelling of individual and contextual community-level HIV/AIDS risk factors of desired and actual recent fertility. The analysis of recent fertility incorporated the proximate determinants of fertility to decipher the mechanisms through which HIV/AIDS factors may influence fertility. The multivariate analysis involved multilevel modelling, taking into account individual level factors as well as contextual community-level effects. The contextual community-level factors relate mainly to averages within clusters.

In addition to the HIV/AIDS factors and proximate determinants of fertility variables mentioned in the Data section above, a number of background factors known to be associated with fertility, such as educational attainment, age, residence (urban/rural), etc., were taken into account in the multivariate models and included as controls. The modelling was carried out in stages, starting with the key variables relating to HIV/AIDS, before introducing the various proximate determinants in successive stages, to explore possible mechanisms through which HIV/AIDS may influence fertility.

Preliminary analysis was undertaken to determine the appropriate number of levels for the multilevel analysis (i.e. women: households: clusters: districts), and whether the response variables should be modelled as linear or discrete outcomes. Results from the preliminary analysis showed that most of the households (75 per cent) had only one woman respondent, and there was little evidence of clustering of the outcomes of interest at district level, suggesting that a two-level model (with individual women at level-1 and cluster at

level-2) sufficed. The distribution of the outcome variables suggested that a logistic, rather than a linear model was more appropriate for the outcomes analysed.

The multilevel models allowed for the effect of HIV/AIDS factors to vary randomly at community-level to establish if there was any differential effect of HIV/AIDS in low-fertility and high-fertility communities. The general form of the random-coefficients two-level logistic model used in the analysis may be expressed as:

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

Where:

- π_{ij} - is the probability of a given outcome for a particular woman, i , in community, j ;
- X'_{ij} - is the vector of covariates which may be defined at woman, or community level;
- β - is the associated vector of fixed parameters;
- Y'_{ij} - is a vector of covariates (usually a subset of X'_{ij}) the effects of which vary randomly at community level; and
- u_j - is the vector of community-level random effects.

The multilevel regression analyses were carried out using the *MLwiN* statistical package (Rasbash et al. 2004), and estimation based on second order PQL procedure (Goldstein 1995).

Results

The results are presented in three main parts: background regional trends in fertility and the proximate determinants in relation to the HIV/AIDS epidemic; the association between HIV/AIDS factors and desired fertility; and the associations between HIV/AIDS factors and actual fertility, with special reference to the role of the proximate determinants of fertility.

Background trends and regional variations in fertility and the proximate determinants

An examination of the background trends and regional variations in fertility and the proximate determinants is useful in identifying appropriate programme targets for specific regions. For example, it is important to establish whether there are notable unique features of recent fertility patterns in worst affected regions such as Nyanza province. This section starts by examining overall background national trends in fertility and proximate determinants

(Table 1) before focusing on regional variations. All the analyses in this section exclude data from the Northern part of Kenya which had been excluded in 1993 and 1998 surveys, but included in the 2003 survey.

(TABLE 1 ABOUT HERE)

Overall, the desired family size and total wanted fertility remained fairly constant between 1993 and 2003. Notable fertility features include a drop in the proportion of women who want no more children and the stall in fertility decline. These fertility patterns seem inconsistent with changes in the proximate determinants of fertility with respect to sexual activity and marital union. The recent rise in age at first sex and age at first marriage and the drop in the proportion of women in union might be expected to sustain a declining trend in fertility. However, patterns in some of the proximate determinants of fertility, such as shortening of breastfeeding duration and stalled increase in contraceptive use are consistent with the observed stall in fertility decline. It is possible that the HIV/AIDS epidemic may have contributed to the recent breastfeeding patterns or the drop in the proportion of women who want no more children, through its contribution to the recent upsurge in infant and child mortality.

The changes in fertility indicators during the 1993-2003 period by region show mixed patterns by HIV/AIDS prevalence (Table 2). Fertility declined most notably in Nairobi and Eastern Province. The greatest decline in the proportion of women in union, the largest rise in the median age at first sex, and the largest rise in the mean duration of postpartum amenorrhea were all observed in Nairobi, the region with the second highest prevalence of HIV/AIDS. On the other hand, Nyanza province, the region with the highest HIV/AIDS prevalence, had the lowest overall rise in age at first sex and age at first marriage. Unlike all the other regions, Nyanza hardly witnessed any overall increase in contraceptive prevalence during the 1993-2003 period. Nairobi and Nyanza also had among the greatest declines in mean duration of breastfeeding and at the same time the most increase in mean duration of post partum amenorrhea (PPA).

(TABLE 2 ABOUT HERE)

Whilst the decline in mean duration of breastfeeding would be expected to result in a decline in the duration of PPA due to lactational amenorrhea, HIV infection may at the same

time lead to increased menstrual disorders (Noel-Miller 2003), resulting in increased duration of PPA. In Western province, the notable decline in both the duration of breastfeeding and PPA does not support the HIV/AIDS explanation since this region has the lowest HIV/AIDS prevalence. It is interesting to note that the biggest increases in infant and child mortality are not in regions with the highest HIV/AIDS prevalence. In particular, Western province had among the biggest increases in infant/child mortality, yet it had the lowest HIV/AIDS prevalence. It is possible that the unexpected patterns observed for Western Province may have been due to recent declines in HIV/AIDS prevalence in the region (Note that the region borders Uganda where dramatic declines in HIV/AIDS have been observed in recent years). Available district-level data on HIV/AIDS trends from sentinel surveillance suggest that in 1999, Busia (urban) in Western Province had the highest HIV/AIDS prevalence in the country of 32 per cent, compared to 25 per cent in Kisumu (urban), the Nyanza provincial headquarters. By 2003, the prevalence in Busia had declined to 16 per cent, while in Kisumu the prevalence was still 26 per cent (National AIDS Control Council 2005).

Despite mixed patterns for some of the indicators, the overall regional variations in changes of some fertility indicators between 1993 and 2003 by HIV/AIDS prevalence show some systematic relationships (Figure 2). There was a general tendency for regions with higher HIV/AIDS to have: lower increase in contraceptive prevalence; higher increase in duration of postpartum amenorrhea; and greater declines in duration of breastfeeding (except for Western province). However, the regional patterns in changes in the proportion of women in union by HIV/AIDS prevalence do not show a clear pattern.

(FIGURE 2 ABOUT HERE)

Association between HIV/AIDS and desired fertility

It has been suggested that HIV/AIDS may have a role in the reversal of reproductive preferences in Kenya, through its contribution to an increase in child mortality, since women who have experienced the death of a child would be more likely than other women to want another child (Westoff and Cross 2006). This section examines the association between various HIV/AIDS factors and reproductive preferences with reference to reported ideal family size and the desire to stop childbearing.

The bivariate associations suggest that actual and perceived HIV/AIDS risk are associated with the desire to limit fertility but not with the desired family size (Table 3).

Although women who were HIV sero-positive were more likely to state that they wanted no more children, their ideal family size was not lower than those who were sero-negative. Similarly, those who perceived their HIV/AIDS risk to be high were more likely to state that they wanted no more children, but there was no significant difference in reported ideal family size by perceived HIV/AIDS risk.

(TABLE 3 ABOUT HERE)

Having previously been tested for HIV/AIDS, personal acquaintance with HIV/AIDS victims and overall HIV/AIDS awareness were all significantly associated with both the desire for a small family size and the desire to limit fertility. Contrary to the patterns observed above with respect to HIV/AIDS sero-status and risk perception, women who had never been previously tested for HIV/AIDS or did not know anyone ill or dead from HIV/AIDS were significantly more likely to report a small ideal family size and to want no more children, compared to those who had ever been tested or knew someone ill or dead of HIV/AIDS. Higher HIV/AIDS awareness was associated with increased desire for a small family size, while those with about average HIV/AIDS awareness were the most likely to report wanting no more children.

The bivariate associations presented above are likely to be confounded by the effect of other significant factors. The multivariate analysis of individual and community-level HIV/AIDS factors on desired fertility, controlling for the effects of important background characteristics, are presented in Table 4. The contextual community-level HIV/AIDS factors were derived from individual level HIV/AIDS factors (e.g. HIV/AIDS prevalence in the community, proportion who perceive themselves to be at moderate or high risk of HIV/AIDS infection, proportion who know someone with or who had died of AIDS, mean HIV/AIDS knowledge index). The analysis explored the possible role of child loss in the association between HIV/AIDS factors and desired fertility, and tested possible variation of the effect of HIV/AIDS factors in different communities.

(TABLE 4 ABOUT HERE)

The association between background socio-economic factors and desired fertility generally conformed to the expected patterns. Higher educational attainment was associated with lower desired fertility, with those having at least secondary education being the most

likely to state that they wanted no more children and also the most likely to report a small ideal family size of no more than three children. Similarly, higher socio-economic status (i.e. wealth index) was associated with lower ideal family size (three or fewer children), but there was no association between wealth index and the desire to limit fertility (i.e. want no more children). Rural residence was generally associated with higher desired fertility, but the effect ceased to be significant when contextual community level HIV/AIDS factors were introduced in the model.

There were significant variations in desired fertility by region, ethnicity and religion. Women in North Eastern province were the least likely to want no more children or have a small ideal family size, while those in Eastern province and Central were the most likely. The Mijikenda/Swahili and other minority ethnic groups were the least likely to indicate desire to limit fertility or have a small ideal family size, while the Kikuyu and the Meru/Embu were the most likely to desire lower fertility. The patterns of desired fertility by religious affiliation were not straightforward. The Protestants were more likely to desire to limit fertility but at the same time less likely to desire small family size compared to the Catholics.

As might be expected, there were strong associations between demographic factors and reproductive preferences. Older women (aged 35 or more years) were more likely to desire to limit fertility, but less likely to desire a small family. The desire to have no more children sharply rose with parity, but those of higher parity were less likely to desire small families. It was interesting to note that women with one child were significantly more likely to report a small ideal family size than those with no children. Those in union were less likely to want no more children or to desire small families.

The results confirm the expected significant role of child mortality in reproductive preferences. Women who had ever experienced under-five child mortality or foetal loss were significantly less likely to want no more children. Furthermore, women in communities with higher child mortality were less likely to report a small ideal family size. These patterns suggest that whilst personal experience of child death affects whether or not the woman wants another child, community child mortality affects ideal family size, which can be viewed as more reflective of community norms. This is consistent with insurance behaviour at the community level and replacement behaviour at the individual level.

The results suggest that HIV/AIDS awareness, rather than sero-status or perceived risk, is the important factor in reproductive preferences. At the individual level, higher HIV/AIDS awareness was associated with reduced desire to limit fertility (want no more

children). All the other individual level HIV/AIDS factors, including sero-status, perceived risk or personal acquaintance with AIDS victims were not significantly associated with desired fertility. At the community (cluster) level, the mean HIV/AIDS awareness index was associated with the desire to limit fertility as well as ideal family size. Women in communities with higher HIV/AIDS awareness were more likely to state that they wanted no more children and to report a small ideal family size of three children or fewer.

Association between HIV/AIDS and recent fertility

As noted by the United Nations (2002), the effect of HIV/AIDS on fertility may operate both at individual level and at the aggregate level. At the individual level, there may be differential effects on infected and uninfected women. Whilst the effect of HIV/AIDS on fertility of infected women may be through both the biological and behavioural proximate determinants of fertility, the effect on uninfected women mainly operates through behavioural mechanisms. This section focuses on: how individual and community-level HIV/AIDS knowledge, risk perceptions and sero-status are associated with recent fertility patterns in Kenya; and the proximate fertility determinants through which HIV/AIDS factors may have influenced fertility in the country.

Understanding the mechanisms through which HIV/AIDS factors influence fertility is crucial in determining what components of the population and reproductive health programming may need to be targeted. For instance: is it possible that high infant mortality due to HIV/AIDS is leading to increased fertility through ‘replacement’ or ‘insurance’ effect. Also, is it possible that reduction in breastfeeding due to perceived or real risk of HIV transmission is contributing to increased fertility. It is important to understand what implications this has on current breastfeeding guidelines, or perhaps more importantly on post-partum contraceptive recommendations, since breastfeeding guidelines are driven by risks of mother to child transmission versus risks of not breastfeeding for the infant.

Bivariate associations: The bivariate associations between HIV/AIDS factors and recent fertility among all women, women who have ever had sex, and currently married women are shown in Table 5. Sexually active women who were HIV sero-positive were significantly less likely to have had a birth in the three years preceding the survey than those who were sero-negative. Although perceived higher risk of HIV/AIDS appeared to be associated with higher fertility, the association was not significant when the sample was restricted to sexually

active or currently married women. However, women who had previously never been tested for HIV/AIDS, or did not know anyone with HIV/AIDS, or had poor HIV/AIDS awareness were more likely to have had a recent birth than their counterparts who had previously been tested, knew someone with HIV/AIDS or had high HIV/AIDS awareness.

(TABLE 5 ABOUT HERE)

The profile of sexually active HIV-infected and uninfected women by proximate determinants of fertility or related factors (Table 6) show significant associations by marital status, age at first sex and experience of child loss. Compared to uninfected women, a significantly lower proportion of HIV-infected women were in monogamous unions while a higher proportion were in dissolved unions (widowed, divorced, or separated). For instance, only 41 per cent of sexually-active women who were infected with HIV/AIDS were in monogamous unions, compared to 60 per cent of uninfected women. On the other hand, the proportion of HIV/AIDS infected women who were widowed, divorced or separated was almost triple that of uninfected women. HIV/AIDS infected women were more likely to have initiated sexual activity earlier than their counterparts who were uninfected. Also, those who were infected were significantly more likely to have experienced a child loss (33 per cent) than those who were uninfected (22 per cent).

(TABLE 6 ABOUT HERE)

More proximate determinants of fertility show significant associations with risk perception of HIV/AIDS than with sero-status. Consistent with the patterns of sero-status, women who perceived their risk of HIV/AIDS as moderate or high were more likely to have experienced a child loss than those who perceived their risk as none or low (Table 7). In addition, those who perceived their risk as high or moderate were also more likely to have experienced a foetal loss. The relationship between HIV/AIDS risk perception and age at first sex is also consistent with that of sero-status, but the association is weaker. Although marital status shows a strong association with perceived risk of HIV/AIDS, the pattern was not consistent with that of HIV sero-status. Unlike sero-status where marital dissolution was a major risk factor, it was being married in a polygamous union that was associated with perceived higher risk of HIV/AIDS. A considerably higher proportion of women who perceived their HIV/AIDS risk as high or moderate were in polygamous union (24 per cent)

than those who perceived their risk as none (11 per cent). One important proximate determinant of fertility that shows a significant association with perceived risk of HIV/AIDS, but not with sero-status is contraceptive use. Current use of contraceptives was associated with perceived higher risk of HIV/AIDS.

(TABLE 7 ABOUT HERE)

Multivariate association between HIV/AIDS indicators and recent fertility: Table 8 examines individual and community-level HIV/AIDS risk factors of recent fertility, taking into account significant background characteristics (Model 1). Special focus is placed on the role of the proximate determinants of fertility to explore potential pathways through which HIV/AIDS may have affected fertility (Model 2).

(TABLE 8 ABOUT HERE)

The results of the multivariate analysis confirm the expected patterns for most of the control variables. Women who were employed or with higher wealth index were less likely to have had a birth in the three years prior to the survey compared to those who were unemployed or poorer. Primary education appeared to be associated with higher fertility but the effect diminished when proximate determinants of fertility (especially marital status) were included in the model, suggesting that the apparent higher fertility among those with lower education observed in Model 1 was partly attributable to a higher proportion being in union. There were significant regional variations in fertility. Both Rift valley and Eastern provinces were associated with higher recent fertility than Nairobi. There were also significant variations in recent fertility by ethnicity and religious affiliation. The Luhya, Luo and Kalenjin ethnic groups had significantly higher fertility than the Kikuyu, even after taking into account the effect of proximate determinants of fertility. With respect to religion, the Muslim were associated with higher fertility than the Roman Catholic. Women in their twenties were significantly more likely to have had a recent birth compared to those aged 15-19 years, but those aged 35 years or older had the lowest recent fertility. Having had at least one child before the observation period was associated with significantly lower odds of having a recent birth when proximate fertility determinants (especially marital status) were taken into account.

Consistent with the patterns of fertility desires, women who had experienced a child loss before the observation period were significantly more likely to have a recent birth than those who had not previously lost a child. However, it was interesting to note that living in a community where child mortality was high was associated with reduced odds of having a recent birth.

The results confirm the earlier observed fertility inhibiting effect of HIV/AIDS among infected women. Women who were HIV sero-positive were significantly less likely to have had a recent birth than those who were sero-negative. The effect was reduced when proximate determinants of fertility, especially marital status, were taken into account but remained significant altogether. Compared to HIV sero-negative women, those who were sero-positive had on average about 40 per cent lower odds of having a recent birth, when significant background socio-economic and demographic factors and child mortality experience were controlled for. After the proximate determinants of fertility relating to sexual exposure, duration of breastfeeding and foetal loss were taken into account, the odds for HIV-positive women were 33 per cent lower. This reduction was mainly accounted for by sexual exposure factors relating to union status.

However, there was no evidence of a significant association between community (cluster) level HIV prevalence and fertility. In addition, various interactions between HIV sero-status and important individual level factors including observed and unobserved cluster-level factors were considered but there was no evidence that the association between HIV sero-status and fertility varied significantly between different population sub-groups.

There was some indication that perceived high risk of HIV/AIDS was associated with higher recent fertility, but the effect ceased to be significant when proximate fertility determinants (especially marital status and duration since last sex) were taken into account. Also, there was some indication that personal acquaintance with AIDS victims was associated with lower recent fertility, especially when marital status was taken into account. Although there was no evidence of a significant association between individual women's HIV/AIDS awareness and their recent fertility behaviour, women in communities with higher HIV/AIDS awareness had significantly lower odds of having a recent birth, even after controlling for significant background factors and proximate determinants of fertility.

The associations between recent fertility patterns and most proximate determinants of fertility were largely as would be expected. Women who had never been in union had considerably lower odds of having a recent birth than those currently in union or previously in union (i.e. divorced/separated or widowed). Other significant proximate determinants

included sexual activity, foetal loss and duration of breastfeeding. Longer duration since last sex and experience of a foetal loss were both associated with lower recent fertility. In addition, women in communities where the mean duration of breastfeeding was longer had lower odds of having a recent birth. However, it was interesting to note that contraceptive use was not significantly associated with recent fertility. It is possible that some contraceptive use may have occurred after the birth and indeed may be the result of the recent birth, diluting the expected fertility inhibiting effect of contraception.

There was some indication of a significant variation in recent fertility across communities in Kenya. However the community level variation ceased to be significant when the mean duration of breastfeeding in the community was included in the model, suggesting that the community variations were attributable to differences in the duration of breastfeeding across communities. Although the effect of HIV/AIDS sero-status was allowed to vary at cluster level, there was no evidence that the association between HIV/AIDS and recent fertility varied significantly across communities.

Discussions and Conclusions

The main objectives of this study were to; examine regional variations in the link between HIV/AIDS and fertility; examine the effect of individual and community –level HIV/AIDS factors on recent fertility pattern in Kenya; and explore possible mechanisms through which HIV/AIDS may have influenced fertility. The study makes particular reference to infant / child mortality and the proximate determinants of fertility in investigating the HIV/AIDS and fertility link.

There are potential data limitations that should be borne in mind while interpreting the findings of this study. The first relates to the problem of causality, since it is unclear when HIV/AIDS infection took place. Hence, the study focuses on associations, rather than causal relationships. The second one relates to possible selectivity bias in HIV/AIDS test data. High fertility HIV/AIDS sero-positive women are more likely to develop AIDS symptoms and die earlier, since pregnancy may hasten AIDS progression. Hence, HIV-positive women interviewed may represent a select sub-group with low fertility, distorting the observed relationship between HIV/AIDS and fertility. Although there were further concerns about possible selectivity bias in HIV/AIDS test data due to refusals to have the test, analysis presented elsewhere (see Magadi and Agwanda 2007) showed little evidence of systematic

selectivity in refusals by key factors associated with HIV sero-status or fertility.

Nevertheless, these data limitations should be borne in mind while interpreting the findings.

It is important that findings on the link between HIV/AIDS and recent fertility patterns in Kenya be interpreted within the broader context of other factors, identified in earlier studies to play an important role in the recent fertility patterns in the country. Bongaarts (2005) partly attributed the stall in fertility decline to lack of recent progress in socio-economic development, while Westoff and Cross (2006) suggested that perhaps more general social and economic changes have recently occurred in the country that explain the recent stall in contraceptive prevalence and fertility decline, beyond the individual characteristics measured in the Demographic and Health Surveys. The HIV/AIDS and fertility link demonstrated in this study should, therefore, be viewed as reflective of possible contribution of HIV/AIDS to the recent fertility patterns, rather than the sole or main factor explaining these patterns.

Individual and community-level HIV/AIDS effects on fertility

The associations between HIV/AIDS and desired fertility suggested that HIV/AIDS awareness, rather than sero-status or risk perception, was the important factor in reproductive preferences. Women in communities with higher HIV/AIDS awareness were more likely to want no more children and to desire smaller families. These associations were observed after controlling for the effect of education, implying that the patterns are not attributable to higher educational attainment among those with higher HIV/AIDS awareness. The patterns may suggest reasonable integration of reproductive health information, education and communication (IEC), such that communities with higher HIV/AIDS awareness also endorse prevailing family planning messages which tend to encourage small families.

The analysis of the link between HIV sero-status and actual fertility confirmed the expected fertility inhibiting effect of HIV/AIDS among infected women. On average women who were HIV sero-positive had about 40 per cent lower odds of having a recent birth than their uninfected counterparts of similar background characteristics and child mortality experience. After taking into account the proximate determinants relating to sexual exposure, duration of breastfeeding and foetal loss, the odds for HIV sero-positive women were still 33 per cent lower. These patterns are consistent with findings in earlier studies in sub-Saharan Africa which suggest that fertility of HIV-positive women is 25-40 per cent lower than for

uninfected women (Ryder et al. 1991; Allen et al. 1993; Zaba and Gregson 1998; DeRose 2006).

The low fertility among HIV/AIDS women observed after taking into account the proximate fertility determinants may be attributable to the other proximate factors not included in the analysis. In particular, the effect of HIV/AIDS on fertility may be partly through secondary infertility, given the expected strong correlation between HIV/AIDS infection and other sexually transmitted diseases, some of which are major causes of secondary infertility. Nevertheless, it is also important to point out that lower fertility among HIV/AIDS infected women observed in survey data may be subject to selectivity bias discussed above, since higher fertility HIV/AIDS sero-positive women are more likely to develop AIDS symptoms and die earlier, implying that HIV-positive women interviewed may represent a select sub-group with low fertility.

At community level, the results show no evidence of a significant association between community level HIV/AIDS prevalence and fertility. This does not support findings from an earlier study which suggested that living in a community with higher HIV prevalence was associated with higher fertility (DeRose 2006). A number of factors may explain the apparent discrepancy between our finding and the association observed in the earlier study: the earlier analysis was restricted to currently married women aged at least 18 years, while this study considers all ever sexually active women of reproductive age; and some of the key factors that partly explain community-level variations in fertility such as ethnicity were not included in the earlier analysis.

The individual and community-level HIV/AIDS effects on fertility discussed here provide little explanation for the stall in fertility decline in Kenya. The fact that HIV/AIDS has a fertility inhibiting effect on infected women while there is no evidence of a significant effect at community level may seem to suggest that high HIV/AIDS prevalence should in fact enhance the fertility decline, contrary to the recent trends and regional patterns observed in Kenya. This highlights the complex nature of the relationship between fertility and HIV/AIDS alluded to earlier in the introduction.

Possible mechanisms through which HIV/AIDS may have influenced fertility in Kenya

There is evidence that HIV/AIDS may have contributed to reduced fertility in Kenya mainly through reduced sexual exposure, especially marital dissolution (i.e. widowhood, divorce and separation). The analysis of factors associated with HIV/AIDS infections presented

elsewhere (see Magadi and Agwanda 2007) showed a particularly high risk of infection among the widowed or the divorced/separated. These groups are also observed to have reduced recent fertility.

Two mechanisms through which the HIV/AIDS epidemic has possibly contributed to increased fertility in Kenya are its contribution to increased infant/child mortality and reduced duration of breastfeeding. The analysis of factors associated with fertility indicators identified child loss as a significant factor in desired as well as actual fertility. Women who had experienced under-five child mortality or foetal loss were significantly less likely to desire to stop childbearing. Consistent with the patterns of fertility desires, women who had experienced a child loss before the observation period were significantly more likely to have had a recent birth. However, it was interesting to note that being in communities with higher child mortality was associated with reduced odds of having a recent birth. The observed patterns suggest possible 'replacement' rather than 'insurance' phenomenon.

The analysis of factors associated with recent fertility in Kenya identified duration of breastfeeding as an important factor, with longer mean duration of breastfeeding in communities being associated with lower fertility. Given the high public awareness of the risk of HIV transmission during breastfeeding (Ministry of Health, 2005), actual or perceived risk of HIV/AIDS is likely to lead to reduced duration of breastfeeding. Correlation analysis between HIV/AIDS prevalence in clusters and mean duration of breastfeeding (not shown) confirmed that clusters with higher HIV/AIDS prevalence had significantly shorter mean duration of breastfeeding ($p < 0.01$).

The analysis of overall trends in fertility and the proximate determinants suggested that whilst recent trends in some of the indicators of fertility such as shortening of birth interval, stalled increase in contraceptive use, and a decline in the proportion of women who want no more children were consistent with the observed stall in fertility decline, the trends in sexual exposure factors, namely, rising age at first sex and age at first marriage, coupled with a decline in the proportion of women in union might be expected to sustain a declining trend in fertility. It is possible that the overall fertility enhancing effects of the desire for more children, accompanied with a stalled increase in contraceptive use has offset the fertility-suppressing effects of changes in sexual exposure factors, resulting in the observed stall in fertility decline in Kenya.

Regional patterns in indicators of fertility and possible link with HIV/AIDS

The regional trends in fertility and the proximate determinants show interesting patterns in relation to HIV/AIDS prevalence. The most notable recent increase in fertility, and the greatest decline in contraceptive prevalence were observed in Nyanza Province, the region with the highest HIV/AIDS prevalence. On the other hand, contraceptive prevalence increased most notably in Western Province, the region with the lowest HIV prevalence among women (besides North Eastern Province).

The regional patterns in the other proximate determinants of fertility are also consistent with the observed reversal of fertility decline in Nyanza. For instance, both age at first sex and age at first marriage are lowest in Nyanza province and the region has also witnessed the least overall rise in age at first sex and first marriage between 1993 and 2003. Whilst the rise in age at first sex was greatest in Nairobi, the region with the second highest HIV/AIDS prevalence, the rise was minimal in Nyanza. The regional patterns further show that the duration of breastfeeding declined most notably in Nairobi, Western and Nyanza, and it is possible that HIV/AIDS may have had a role.

In general, the regional patterns in the proximate determinants of fertility observed here are consistent with patterns observed in a separate study. Anyara and Hinde (2006) noted that the patterns of increasing contraceptive use and rising age at marriage offsetting the impact of shorter durations of breastfeeding on fertility as modernization progresses was only found in regions of low fertility in Central and Eastern provinces, and in Nairobi.

Perhaps the most important regional patterns, of significance to the HIV/AIDS and fertility link relate to reproductive intentions and child mortality experiences. Nyanza province has consistently recorded the highest infant and child mortality over the years, and even though the increase in the 1998-2003 period was relatively lower than the other regions, the level is still considerably higher than all the other regions. The high HIV/AIDS prevalence has undoubtedly contributed to the elevated infant and child mortality levels in the region. It is possible that infant and child mortality in the region has reached appreciably high levels where the effect of the 'replacement' phenomenon, alongside other reproductive patterns such as early marriage /initiation of sexual activity and reduced breastfeeding duration, are substantial enough to result in a reversal of fertility decline.

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Table 1 Background levels and trends of fertility and the proximate determinants in Kenya (KDHS 1993, 1998 and 2003)

Indicator	1993	1998	2003	Per cent change	
				1993-98	1998-03
Fertility Indicators					
Total Fertility Rate (TFR)	5.4	4.7	4.8	-13.0	2.1
Desired family size	3.7	3.8	3.7	2.7	-2.6
Per cent who want no more children ¹	51.7	53.3	48.7	1.9	-7.0
Total wanted fertility rate	3.4	3.5	3.5	2.9	0.0
Median birth interval	30.1	32.9	32.6	9.3	-0.9
Proximate determinants of fertility					
Per cent in union	60.8	61.5	59.9	1.2	-2.6
Median age at first union	18.8	19.2	19.8	2.1	3.1
Median age at first sex	16.8	16.7	17.8	-0.6	6.6
Contraceptive prevalence ²	27.3	31.5	32.9	15.4	4.4
Median duration of breastfeeding	21.1	20.9	20.1	-0.9	-3.8
Median duration of PPA	10.8	8.9	9.0	-17.6	1.1
Under Five mortality rate	96	112	115	16.7	2.7
Infant mortality rate	62	74	77	19.4	4.1

Note: National trends exclude the Northern part of Kenya which had been excluded in 1993 and 1998 surveys but was included in the 2003 survey.

1 - Computed among currently married women; those sterilized considered to want no more children.

2 - CPR computed for only currently married women for modern methods

Table 2 HIV/AIDS prevalence and per cent change (1993-2003) in fertility and proximate fertility determinants in Kenya by region

Indicator	Nairobi	Central	Coast	East-ern	Nyanza	Rift Valley	Western
HIV/AIDS prevalence among women¹	11.9	7.6	6.6	6.1	18.3	6.9	5.8
Per cent change in fertility indicators							
Total Fertility Rate (TFR)	-19.7	-13.2	-7.7	-18.2	-1.8	2.4	-8.9
Total wanted fertility rate	-8.0	7.2	0.0	0.1	-7.1	13.6	12.4
Mean birth interval	9.4	23.6	3.2	10.3	7.5	5.6	5.6
Desired family size	17.7	0.0	0.1	0.0	7.9	0.0	5.0
Want no more children	-8.1	-5.1	9.2	-7.2	-0.4	0.8	-3.2
Per cent change in proximate determinants of fertility							
Per cent in union	-9.2	-0.8	2.6	-5.5	0.0	6.8	-7.4
Median age at first union	5.2	4.9	6.8	4.1	2.3	4.2	4.3
Median age at first sex	7.6	3.9	4.0	5.4	2.5	5.9	3.7
Contraceptive prevalence	18.5	16.0	16.0	24.7	0.3	18.5	25.6
Mean breastfeeding duration	-14.2	-6.6	2.1	0.1	-14.5	0.0	-18.4
Mean duration of PPA	49.1	-4.2	-15.2	-8.2	12.2	5.1	-21.0
Under-five mortality	15.8	31.7	6.4	27.3	10.2	26.2	30.9

1 - Source: Central Bureau of Statistics [Kenya], Ministry of Health [Kenya] and ORC Macro, 2004, pp 223.

Table 3 Per cent of women who desire small families or want no more children by HIV/AIDS indicators (KDHS 2003)

HIV/AIDS Factor	Ideal family size of 3 or fewer children	Want no more children	Cases
HIV/AIDS Sero-status ¹		*	
Negative	41.4	35.8	2998
Positive	37.5	42.3	275
Perceived HIV/AIDS risk ¹		***	
None/Low	41.4	29.7	3014
Medium	43.4	36.0	3105
High	41.4	46.4	1911
Ever previously tested for HIV/AIDS ¹	***	**	
Tested	39.7	35.7	6811
Never tested before	57.0	39.9	1239
Knows someone with or who have died of AIDS ¹	***	***	
Yes	36.8	30.0	2118
No	44.1	38.4	5902
HIV/AIDS knowledge index	***	***	
1 st quartile (poorest knowledge)	28.0	31.0	2040
2 nd quartile	38.1	39.8	2059
3 rd quartile	46.0	38.5	1992
4 th quartile (best knowledge)	54.7	34.5	2104
All	41.9	36.1	8195

Base Population: all women in sample.

¹ – data for some cases missing or not applicable.

* - Chi Square p<0.05; ** - p<0.01; *** - p<0.001

Table 4 Individual and community level HIV/AIDS factors associated with desired fertility in Kenya (KDHS 2003): Logistic regression parameter estimates (standard errors given in brackets)

Parameter	Want no more children	Small ideal family size of 3 or fewer children
Intercept	-2.84(0.327)	0.01(0.319)
Background control factors		
Educational attainment (no education) ¹		
Primary incomplete	0.26(0.121)*	0.14(0.133)
Primary complete	0.44(0.130)*	0.34(0.138)*
Secondary+	0.50(0.137)*	0.85(0.140)*
Rural residence (urban) ¹	-0.21(0.118)	-0.13(0.120)
Wealth index (poorest quartile) ¹		
2 nd quartile	-0.03(0.092)	0.06(0.091)
3 rd quartile	-0.02(0.107)	0.26(0.101)*
Richest quartile	-0.04(0.153)	0.55(0.143)*
Ethnicity (Kikuyu) ¹		
Luhya	-0.20(0.153)	-0.43(0.135)*
Luo	-0.11(0.173)	-0.42(0.151)*
Kamba	-0.46(0.171)*	-0.08(0.152)
Kalenjin	-0.36(0.172)*	-0.66(0.165)*
Mijikenda/Swahili	-1.16(0.245)*	-0.75(0.225)*
Kisii	-0.23(0.203)	0.03(0.190)
Meru/Embu	-0.01(0.202)	0.21(0.189)
Other	-0.65(0.168)*	-0.77(0.156)*
Religion (Roman Catholic) ¹		
Protestant	0.16(0.075)*	-0.17(0.067)*
Muslim/other	0.11(0.147)	-0.26(0.142)
Region (Nairobi) ¹		
Central	0.55(0.178)*	0.43(0.179)*
Coast	0.47(0.194)*	0.12(0.187)
Eastern	0.61(0.205)*	0.56(0.200)*
Nyanza	0.06(0.201)	-0.13(0.200)
Rift valley	0.38(0.169)*	0.19(0.171)
Western	0.38(0.192)*	0.14(0.189)
North Eastern	-1.77(0.325)*	-2.54(0.796)*
Age (15-19 years) ¹		
20-24	-0.26(0.142)	0.28(0.093)*
25-29	-0.18(0.153)	0.15(0.114)
30-34	0.22(0.162)	0.04(0.130)
35 +	0.46(0.165)*	-0.36(0.134)*

Table 4 (continued)

Parity (0) ¹		
1	1.64(0.160)*	0.48(0.104)*
2-3	3.25(0.180)*	-0.09(0.118)
4-5	4.03(0.200)*	-0.76(0.143)*
6 +	4.70(0.218)*	-0.90(0.168)*
Marital/union status (never married) ¹		
Married monogamous	-0.56(0.128)*	-0.37(0.098)*
Married polygamous	-0.50(0.153)*	-0.24(0.137)
Widowed	0.57(0.193)*	-0.11(0.182)
Divorced/separated	0.56(0.159)*	0.20(0.138)
Child mortality experience		
Ever experienced under-5 child loss	-0.49(0.084)*	-0.04(0.092)
Proportion in cluster who experienced child loss	-0.11(0.167)	-0.47(0.188)*
Ever experienced foetal loss	-0.19(0.092)*	-0.16(0.097)
Individual level HIV/AIDS factors		
HIV sero-status (negative) ¹		
Positive	0.04(0.166)	-0.23(0.156)
Status not known/not tested	0.05(0.064)	-0.02(0.058)
Perceived risk of HIV/AIDS (no risk) ¹		
Low risk	-0.04(0.075)	0.06(0.066)
Moderate/high risk	0.10(0.084)	0.14(0.078)
Index of HIV/AIDS awareness (lowest quartile) ¹		
2 nd quartile	-0.09(0.095)	-0.12(0.088)
3 rd quartile	-0.23(0.100)*	0.04(0.090)
top quartile	-0.21(0.104)*	0.15(0.093)
Knows person with or who died of AIDS	-0.01(0.083)	0.08(0.073)
Contextual cluster level HIV/AIDS factors		
Proportion who are HIV/AIDS positive /prevalence	-0.55(0.444)	-0.26(0.449)
Prop. who perceive HIV/AIDS risk as mod./high	0.41(0.292)	0.37(0.300)
Mean index of HIV/AIDS awareness	0.39(0.128)*	0.80(0.147)*
Prop. who know someone with or dead of AIDS	-0.53(0.298)	-0.56(0.315)
Community/Cluster Level Random Variance		
Intercept	0.10(0.032)*	0.19(0.034)*

Base population: All women with non-missing data on analysis variables (n=7994)

1 – reference category

* - p<0.05.

Table 5 Per cent (weighted) of all, sexually active, and currently married women who had a birth within the last three years prior to the 2003 KDHS by HIV/AIDS indicators

HIV/AIDS Factor	All women	Sexually active	Currently married
HIV/AIDS Sero-status ¹		**	
Negative	38.5	46.6	53.9
Positive	37.1	38.2	49.1
Perceived HIV/AIDS risk ¹	***		
None	31.2	44.5	53.9
Low	40.4	46.5	54.7
Medium/High	45.2	47.0	51.4
Ever previously tested for HIV/AIDS ¹	***	*	*
Tested	36.8	45.3	52.8
Never tested before	46.5	49.1	56.6
Knows someone with or who has died of AIDS ¹	***	***	***
No	41.9	53.6	62.6
Yes	37.0	43.6	50.5
HIV/AIDS knowledge index	*	***	***
1 st quartile (poorest knowledge)	41.0	53.0	61.0
2 nd quartile	39.0	47.0	53.2
3 rd quartile	37.7	43.7	50.0
4 th quartile (best knowledge)	36.2	42.5	51.6
All			
Per cent	38.4	46.3	53.7
Unweighted Cases	8195	6797	4876

¹ – data for some cases missing or not applicable.

* - p<0.05, ** - p<0.01, *** - p<0.001

Table 6 Profile of sexually active HIV-infected and uninfected women by proximate determinants of fertility (KDHS, 2003)

Proximate determinant of fertility	Non-infected	Infected	All women
Current contraceptive use			
Non-user	65.9	69.6	66.2
User	34.1	30.4	33.8
Recent breastfeeding practice			
Breastfed <12 months	22.7	22.3	22.7
12-23 months	23.9	21.9	23.7
24-60 months	12.6	13.8	12.7
Did not breastfeed	1.4	1.1	1.4
No recent birth/missing	39.4	41.0	39.6
Recent birth interval (**)			
Less than 2 years	13.9	15.8	14.1
2-3 years	23.8	19.0	23.3
3 years or longer	31.8	33.8	32.0
First birth	16.6	22.5	17.2
no recent birth	13.9	8.8	13.4
Current marital/union status (***)			
Never married	15.1	13.1	14.9
Married (monogamous)	60.2	41.3	58.3
Married (polygamous)	14.0	15.9	14.2
Widowed	4.0	15.5	5.1
Divorced/separated	6.8	14.1	7.5
Age at first marriage			
15 or younger	14.9	14.5	14.9
16-17	19.4	17.7	19.3
18-19	20.5	21.6	20.7
20 +	30.0	33.2	30.3
never married	15.1	13.1	14.9
Age at first sex (**)			
15 or younger	36.1	45.4	37.0
16-17	24.7	22.7	24.5
18-19	21.7	22.0	21.7
20 +	17.5	9.9	16.7
Ever experienced infant/child loss (***)			
No	78.4	67.1	77.3
Yes	21.6	32.9	22.7
Ever experienced foetal loss			
No	86.4	87.3	86.5
Yes	13.6	12.7	13.5
Number of women	2468	266	2734

Base population: sexually active sample tested for HIV/AIDS (n=2734)

(*) – Chi Square p<0.05, (**) - p<0.01, (***) - p<0.001

Table 7 Profile of sexually active women who perceive their risk of HIV/AIDS infection as none, low or moderate/high by proximate determinants of fertility (KDHS 2003)

Proximate determinant of fertility	No risk	Low risk	Moderate or high risk	All women
Current contraceptive use (***)				
Non-user	70.7	64.2	62.3	65.6
User	29.3	35.8	37.7	34.4
Recent breastfeeding practice (*)				
Breastfed <12 months	20.3	22.6	23.9	22.3
12-23 months	22.8	22.9	23.2	22.9
24-60 months	11.7	12.2	13.3	12.4
Did not breastfeed	1.3	1.6	1.2	1.4
No recent birth/missing	43.9	40.7	38.3	41.0
Recent birth interval (***)				
Less than 2 years	15.0	12.7	14.8	14.0
2-3 years	20.9	22.7	24.1	22.6
3 years or longer	30.1	30.4	36.0	31.9
First birth	18.3	18.8	15.8	17.8
no recent birth	15.7	15.4	9.3	13.8
Current marital/union status (***)				
Never married	17.7	16.7	11.6	15.6
Married (monogamous)	57.9	62.7	54.4	58.9
Married (polygamous)	10.6	8.2	23.5	13.3
Widowed	6.8	4.8	3.5	5.0
Divorced/separated	6.9	7.6	7.0	7.2
Age at first marriage (***)				
15 or younger	14.6	13.2	14.0	13.9
16-17	19.2	17.1	20.8	18.8
18-19	18.8	21.2	21.0	20.4
20 +	29.6	31.8	32.6	31.3
never married	17.7	16.7	11.6	15.6
Age at first sex (*)				
15 or younger	33.8	35.0	36.1	35.0
16-17	24.1	24.9	26.1	25.0
18-19	24.2	21.3	22.6	22.5
20 +	17.8	18.8	15.1	17.5
Ever experienced infant/child loss (***)				
No	80.0	78.5	74.3	77.7
Yes	20.0	21.5	25.7	22.3
Ever experienced foetal loss (***)				
No	89.1	87.7	84.7	87.3
Yes	10.9	12.3	15.3	12.7
Number of women	2144	2695	1832	6671

Base population: sexually active women (overall n=6671)

(*) – Chi Square $p < 0.05$, (**) - $p < 0.01$, (***) - $p < 0.001$

Table 8 Individual and community/cluster level HIV/AIDS factors associated with having a recent birth (last 3 years before 2003 KDHS) – multilevel logistic regression parameter estimates (standard errors in brackets)

Parameter	Model 1	Model 2
Intercept	-0.49(0.299)	-1.08(0.307)
Background individual level factors		
Educational attainment (none) ¹		
Primary incomplete	0.28(0.115)*	0.15(0.119)
Primary complete	0.25(0.123)*	0.13(0.129)
Secondary+	-0.00(0.130)	-0.07(0.137)
Employed (unemployed) ¹	-0.27(0.064)*	-0.21(0.067)*
Wealth index (poorest quartile) ¹		
2 nd quartile	-0.35(0.085)*	-0.34(0.088)*
3 rd quartile	-0.66(0.096)*	-0.71(0.099)*
Richest quartile	-0.97(0.128)*	-1.09(0.132)*
Ethnic group (Kikuyu) ¹		
Luhya	0.42(0.142)*	0.48(0.148)*
Luo	0.63(0.157)*	0.73(0.164)*
Kamba	0.17(0.158)	0.28(0.166)
Kalenjin	0.41(0.160)*	0.50(0.164)*
Mijikenda/Swahili	0.31(0.223)	0.22(0.227)
Kisii	-0.09(0.188)	-0.07(0.191)
Meru/Embu	-0.38(0.195)*	-0.30(0.200)
Other	0.34(0.157)*	0.29(0.161)
Religion (Roman Catholic) ¹		
Protestant	0.11(0.070)	0.04(0.073)
Muslim/other	0.42(0.137)*	0.36(0.141)*
Region (Nairobi) ¹		
Central	0.32(0.157)*	0.26(0.157)
Coast	0.04(0.179)	0.04(0.180)
Eastern	0.49(0.183)*	0.43(0.187)*
Nyanza	0.28(0.180)	0.17(0.181)
Rift valley	0.58(0.153)*	0.47(0.153)*
Western	0.38(0.177)*	0.26(0.178)
North Eastern	-0.17(0.261)	-0.37(0.260)
Age (15-19 years) ¹		
20-24	1.12(0.107)*	0.94(0.117)*
25-29	0.93(0.127)*	0.68(0.138)*
30-34	0.49(0.144)*	0.24(0.154)
35 +	-0.99(0.155)*	-1.15(0.166)*

Table 8 (continued)

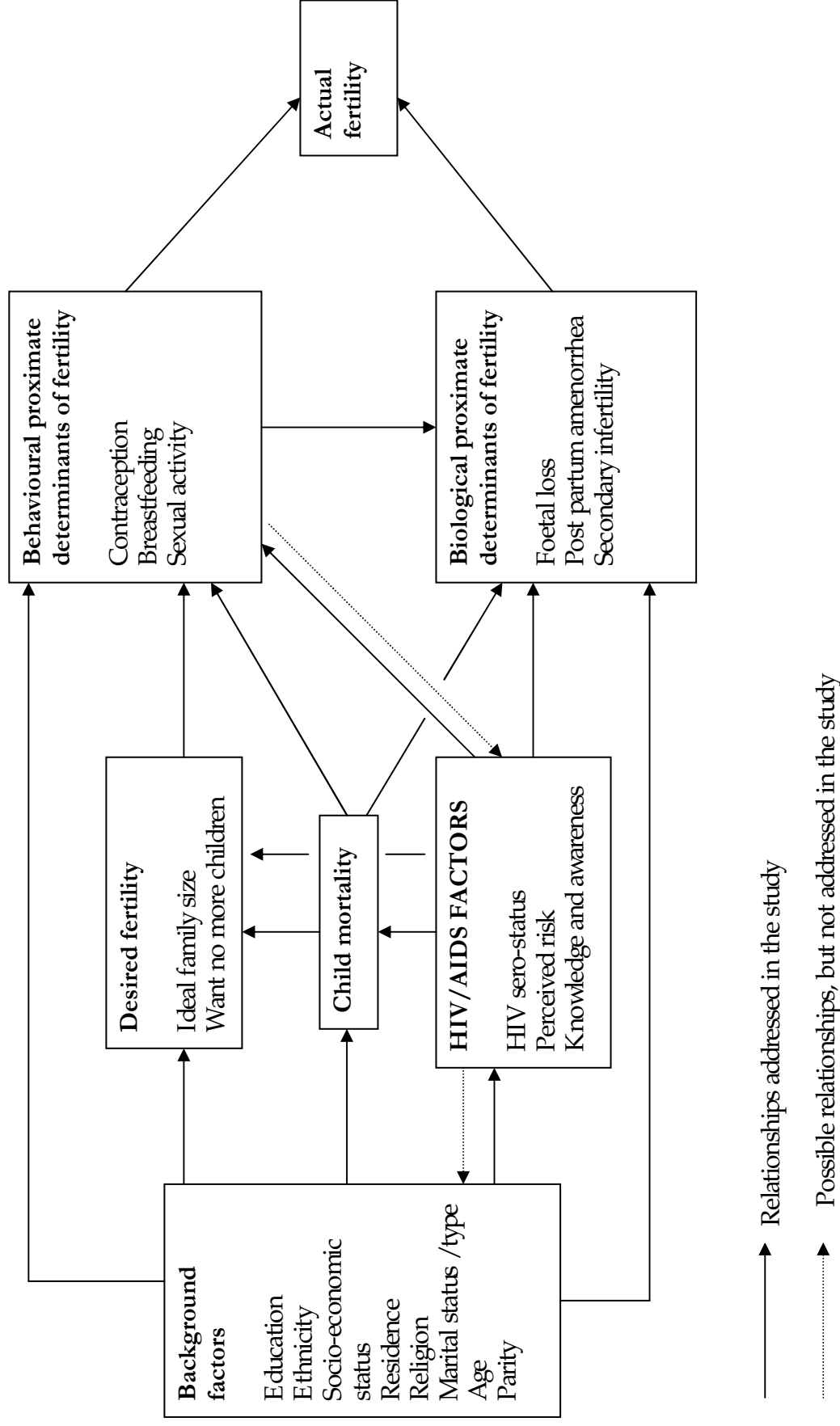
Parity 3 years prior to survey (0) ¹		
1	-0.05(0.097)	-0.43(0.107)*
2-3	0.05(0.107)	-0.52(0.117)*
4-5	0.13(0.138)	-0.45(0.147)*
6 +	0.07(0.156)	-0.47(0.166)*
Child mortality experience		
Had under-5 child loss 3 yrs before survey	0.18(0.086)*	0.26(0.089)*
Under-5 mortality rate in cluster (per cent)	-0.02(0.005)*	-0.02(0.005)*
Individual level HIV/AIDS factors		
HIV sero-status (negative) ¹		
Positive	-0.49(0.154)*	-0.40(0.162)*
Status not known/not tested	0.07(0.059)	0.09(0.062)
Perceived risk of HIV/AIDS (no risk) ¹		
Low risk	0.14(0.069)*	0.07(0.072)
Moderate/high risk	0.24(0.078)*	0.12(0.083)
Index of HIV/AIDS awareness (lowest quartile) ¹		
2 nd quartile	0.11(0.089)	0.06(0.093)
3 rd quartile	0.08(0.093)	0.04(0.098)
top quartile	0.06(0.097)	0.04(0.103)
Knows person with or who died of AIDS	-0.11(0.076)	-0.17(0.080)*
Contextual cluster level HIV/AIDS factors		
Prevalence of HIV/AIDS in cluster	-0.07(0.396)	-0.38(0.395)
Prop. who perceive HIV/AIDS risk as mod./high	-0.19(0.268)	-0.15(0.266)
Mean index of HIV/AIDS awareness	-0.37(0.116)*	-0.32(0.116)*
Prop. who know someone with or dead of AIDS	-0.03(0.280)	0.11(0.279)
Proximate fertility determinants		
Marital status (never married) ¹		
Married monogamous		1.70(0.106)*
Married polygamous		1.55(0.134)*
Widowed		0.77(0.195)*
Divorced/separated		1.16(0.143)*
Ever used contraception		0.13(0.074)
Months since last sex		-0.01(0.003)*
Experienced foetal loss		-0.30(0.090)*
Mean breastfeeding duration in cluster		-0.12(0.020)*
Community level random variance		
Intercept	0.08(0.027)*	0.05(0.026)

Base Population: ever sexually active women (n=6643).

1 – Reference category

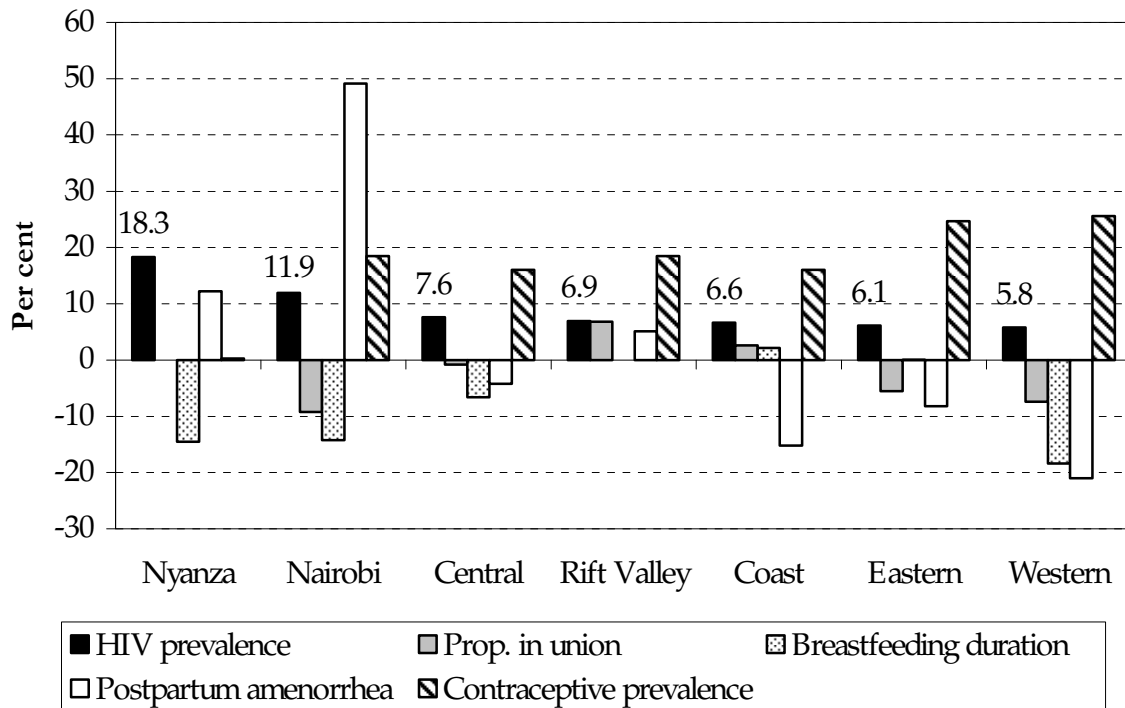
* - p<0.05

Figure 1 Conceptual framework for analysis of the link between HIV/AIDS and fertility



Source: Authors' formulation

Figure 2 Per cent change in selected fertility indicators (1993-2003) by region, ranked according to 2003 HIV/AIDS prevalence



Source: HIV/AIDS prevalence (CBS et al. 2004); changes in fertility indicators (computed from 1993, 1998 and 2003 KDHS)