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A Closer Examination of the HIV/Fertility Linkage

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ABSTRACT

Recent research on African countries suggests their fertility transitions are slowing or reversing. Authors have suggested that this trend change may relate to widespread HIV/AIDS, but speculation abounds as to how the disease interacts with fertility. Different behavioral and medical mechanisms can lead to positive or negative correlations between HIV and fertility, and these correlations can be opposite on the individual and aggregate levels. This article provides a synopsis of the mechanisms relating HIV to fertility, attempting to describe their relative importance in affecting larger fertility trends. We discuss what outcome measures would be impacted by the different mechanisms, and suggest methods on how to study whether HIV plays a significant role in fertility trends. Case studies of several variables from three countries (Uganda, Burkina Faso, and Zimbabwe) show that fertility declines appear to stall during the height of the epidemics in these countries, and effects are larger depending on extremity of the epidemic. Indicators of other measures of fertility behavior suggest that women are attempting to avoid HIV while maintaining high fertility. While these results show suggestive evidence of fertility behavior changes in relation to the HIV epidemic, more rigorous empirical analyses are necessary to control for conditional effects.

INTRODUCTION

Recent research has suggested a slowing of fertility decline (Casterline 2003; Westoff and Cross 2006) in sub-Saharan African countries, or even a reversal of the demographic transition (Kalemli-Ozcan 2005). Given the slowing in fertility declines observed in several African countries, researchers have suggested the role that HIV/AIDS prevalence may play in this demographic trend. Different behavioral and medical mechanisms can lead to positive or negative correlations between HIV and fertility, and these correlations can be opposite on the individual and aggregate levels. The suggested mechanisms relating HIV and fertility on the individual level can be broadly characterized as behavioral and biological (see Notzi 2002 for a discussion). These pathways are more or less evident at different levels of population analysis; negative relationships between HIV and fertility at the individual level can show a positive relationship at the aggregate level, due to varying death rates of low-fertility women compared with high-fertility women.

While much research explores the effects of HIV on mortality in sub-Saharan Africa, less has considered the relationship between fertility and HIV. This article provides a synopsis of the mechanisms, attempting to describe their relative importance in affecting larger demographic trends. We discuss what outcome measures would be impacted by the different mechanisms and suggest methods on how to study whether HIV plays a significant role in fertility trends. We also examine trends in HIV prevalence, fertility, and fertility behaviors for three countries (Zimbabwe, Uganda, and Burkina Faso).

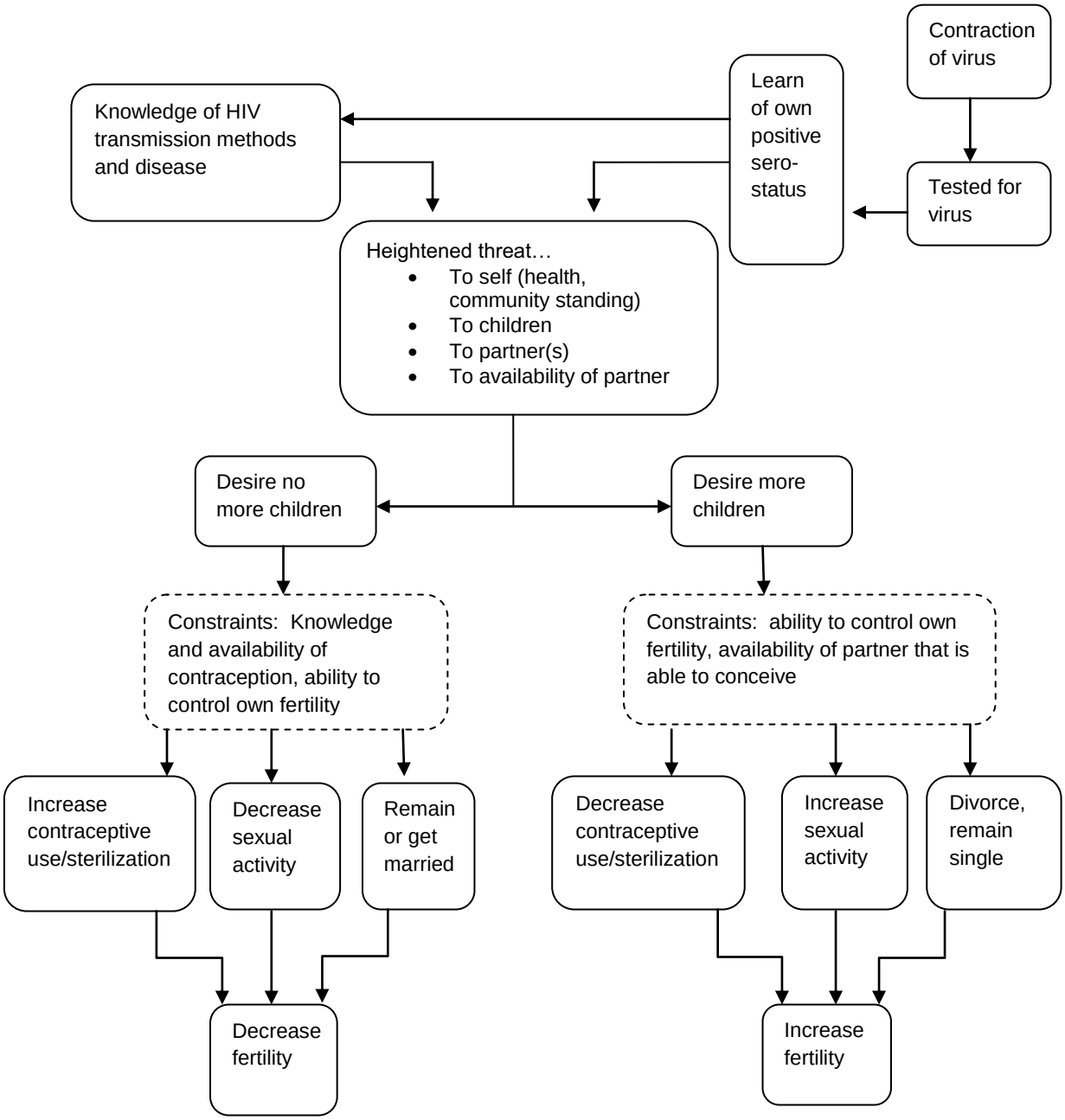
Fertility Change in Response to HIV

In recent years, several authors have compiled excellent overviews of the mechanisms by which fertility may respond to HIV. The Population Division of the U.N. (2002) provides a concise overview of the different mechanisms and the research supporting these mechanisms. Other useful overviews can be found in Gregson, Zaba, and Hunter (2002); Gregson and coauthors (1997); and Nöel-Miller (2003). The pathways through which HIV may affect fertility are numerous, and they interact at a number of levels. While the reviews mentioned above provide much-needed elucidation of the mechanisms, they generally do not provide empirical analysis of how these mechanisms may interact, or how they may affect large-scale trends. A relatively brief overview of these mechanisms follows.

1. Behavioral mechanisms

The behavioral mechanisms describe how women of child-bearing age intentionally respond to HIV. Behavioral responses are deliberate and in this sense distinguishable from biological mechanisms. Research has suggested both directions of fertility change as a behavioral response to HIV, and effects may differ in relationship to knowledge of own HIV status versus perceived threat of HIV. This section outlines two behavioral mechanisms (see Figure 1 below) suggesting how HIV can lead to various fertility responses.

Figure 1: Fertility behavior responses to HIV



1.1. Threat response behavior

The threat response behavioral mechanism is the impact on fertility behavior arising from a perceived risk of HIV. This behavior is generally described in relation to people who do not know their actual HIV status, but who may or may not be HIV-positive. This behavioral mechanism can be described in more detail by describing five steps: 1) introduction of the threat, 2) perception of heightened threat, 3) changes in fertility desires based on the threat, 4) changes in fertility actions based on desired fertility, and 5) fertility outcomes.

Introduction of threat: The first step requires an occurrence or situation related to HIV/AIDS that is out of the ordinary. This could be either an elevated mortality or morbidity known to be attributable to HIV/AIDS, or increased information on the disease and its transmission. In an area or time period with a low HIV prevalence and lack of information, people may not notice anything unusual, particularly in a context of high mortality. Documentation of this stage would occur through either mortality or morbidity data that exceeds some baseline trend. A threat could also be introduced via wide-scale dissemination of information on HIV and its transmission.

Perception of threat: The second step in the behavioral mechanism is perception of a heightened threat. If the occurrence is perceived as ordinary, or is unknown, then people may not change their behavior in response. The threat could be seen to endanger a number of different groups. From the perspective of a woman of child-bearing age, the threat may be to herself, her children, and/or her partner. She may worry about her own contraction of HIV and its ramifications for her own health, community status, future births, and support in old age. Contraction may affect the ability to have future children, which may lower her community standing. A woman may

worry about passing the virus to any future child or leaving children as orphans. If a woman has a partner, she may worry about his contracting the virus, particularly if she believes that he has sex with other people. If she does not have a partner, she may perceive a threat to the availability of partners if she believes that men are becoming HIV-infected.

Change in fertility desires: Once the threat has been perceived, it may change a woman's desires concerning childbearing. This step presupposes an understanding of fertility as something that can be desired or not, rather than a foregone conclusion. Changes in fertility desires may be in either direction—toward having more or fewer children. One model suggests that women respond to elevated mortality related to AIDS by desiring more children, in order to increase the chance that more will live to adulthood. If children are viewed as care-takers of the elderly, then it is important for children to survive to adulthood. Because women may finish their child-bearing years before their children reach adulthood, mothers may have more children in the expectation that more of their offspring will die of HIV in early adulthood. This "insurance" mechanism could also exacerbate any desires related to "replacement" fertility—that is, when the mother wishes to conceive another child in order to "replace" a child that has died, whether from AIDS or another cause.

The behavioral mechanism in which women want to have more children in order to replace children who have died, or insure themselves against possible higher mortality of offspring in the future, has been explored within the context of the HIV epidemic. Research find mixed results for a replacement or insurance response to HIV prevalence. Greiser and coauthors (2001) use qualitative methods in Zimbabwe to suggest a weak replacement response to childhood mortality, while Gyimah and Rajulton (2004) econometrically find a strong intentional

replacement behavior in Ghana and Kenya. Kalemli-Ozcan (2005) uses cross-country regressions to suggest an insurance behavior mechanism via a positive correlation between HIV and the total fertility rate.

Another possibility is that women who perceive a higher risk of death from HIV/AIDS may desire fewer children, possibly in the belief that no one would be able to take care of the children. Greiser and coauthors (2001) based on qualitative evidence from Zimbabwe find that couples are more likely to want fewer children in response to fears of their own HIV-related mortality.

Changes in fertility actions: The extent to which a woman puts her new fertility desires into practice and actually changes her fertility will be constrained by her knowledge of how to control her fertility, availability of contraceptive methods, and ability to practice fertility control. Practices that can alter fertility roughly follow the classic proximate determinants of fertility, including traditional and modern methods of contraception, age at first marriage or coitus, divorce, breastfeeding, coital frequency, and sterilization.

The ability to change coital frequency and type of sexual act will depend not only on a woman's fertility desires, but also on her ability to control childbearing. Women may be subject to violence, domestic or otherwise, that constrains their ability to limit their fertility (see Rutenberg 2000 for a discussion). There is little in the literature to suggest that male partners have a fertility response to perceived risk of HIV. However, it is quite possible that men may change their fertility desires and behaviors in response to HIV.

Changes in fertility outcomes: Whether changes in fertility desires and actions change the number of births supposes that no other events occur simultaneously that mitigate changes to fertility choices, including HIV contraction. Additionally, desire to increase childbearing will only manifest in actual increased fertility with the availability of a sexual partner with healthy sperm.

1.2. Own seropositive status behavioral mechanism

The evidence has been mixed with respect to how women who know they are HIV-positive respond in terms of their fertility. Women who are HIV-positive may decide to have fewer children, separate from any biological mechanism, in order to avoid passing the virus to children. These behaviors are here considered to be separate from any ability to conceive or carry a fetus to term.

Alternatively, women who learn of their HIV-positive status may increase their desire to have children (Setel 1995). This may be due to a wish to maintain the appearance of health and fecundity, given the strong connection between child-bearing and community standing in many sub-Saharan African countries. A positive fertility response may also manifest if a woman decides to have her desired number of children more quickly, believing that she will eventually become unable to conceive due to HIV infection. Importantly, there will probably be a bigger disjoint between fertility desires and actual fertility for HIV-positive women due to their declining health and increased mortality.

In order for either of these pathways to be followed, a woman would need to first be tested for HIV, and then to know about the results. Most research suggests that knowledge of own status is rare (for discussion see Setel 1995), hence it is unlikely that the behavioral

mechanisms in response to own seropositive status would have much impact on larger fertility trends. Additionally, a series of studies also find that women who become aware of their HIV-positive status do not adjust their fertility behaviors (see Nöel-Miller 2003 and Rutenberg 2000 for discussions). Finally, those who discover their own seropositive status may only do so when symptoms arise at an advanced stage in the disease; at that point, their health may be so compromised that any desired fertility increases would be unlikely.

2. Biological mechanisms

A biological linkage between HIV and fertility—another mechanism through which fertility could change in response to HIV—can be further broken down into three possible mechanisms: reduced fecundity, lowered spermatozoa production, and death.

2.1. Fecundity

Women's ability to conceive and carry fetuses to term may be hurt by HIV contraction (see Gray et al. 1998). While HIV itself may not decrease fecundity, it increases the probability of contracting other sexually transmitted infections (STIs). These STIs, such as gonorrhea and syphilis, are associated with infecundity. Further, women who have advanced from HIV infection to AIDS may not have the physical capacity to carry a fetus to term. The U.N. Population Division estimates that HIV infection yields a 25 to 40 percent reduction in fertility (2002). The biological mechanism is explored most thoroughly by Lewis and coauthors (2004), who compare fertility of HIV-infected versus uninfected women. They find that HIV-infected women have lower fertility than those not infected by the virus, except in the 15-19 age group. The authors assert that as infected women get older, they are less likely to have children because

of the increased likelihood of passing on the disease to their children, and because they are more likely than younger women to be aware that they are infected. This research shows no correlation between sero-positive status and trends in fertility desires, and only a weak association between the stage of the epidemic and fertility trends.

2.2. Spermatozoa production

A second biological linkage between HIV infection and fertility arises through the male partner. HIV is linked to lower production of sperm but not semen (see UNPD 2002). If a large portion of men produce non-viable sperm, then fertility levels may decline regardless of other mechanisms.

2.3. Death

If a woman dies from HIV, then obviously she cannot bear future children. At the aggregate level, higher death rates from HIV/AIDS can play an important role in reducing fertility levels. Earlier research on the linkage between HIV and fertility focused predominantly on this aspect (Gregson 1994). In times of high AIDS-related mortality, this effect of HIV on fertility could dampen the crude birth rate.

A more nuanced mechanism by which HIV-related mortality could affect not just the crude birth rate but also age-specific fertility rates is via fertility-selected death. Seropositive women may have lower fertility due to the accompanying STIs; before the HIV epidemic, these STIs were not correlated with death. However, during the epidemic these women are also more likely to die, leaving higher-fertility women as a greater percentage of the population. Alternatively, women with HIV may be more likely to be the ones with higher fertility in a

period before HIV, and by dying in the epidemic they would leave lower-fertility women as a greater share of the population. These potential effects could only be witnessed at the aggregate level when comparing age-specific fertility rates before and after a period of epidemic. In order to estimate which effect dominates, it would be necessary to compare age-specific birth rates before and after an epidemic, netting out any concurrent effects on fertility rates, such as education and income.

A somewhat different mechanism by which AIDS-related deaths could influence fertility is via availability of male partners. If more men are dying of AIDS than before, the availability of partners may decrease. However, HIV prevalence rates are generally higher for women than for men, suggesting that AIDS-related mortality will lead to a disproportionate number of men, not women.

3. Which mechanisms would matter most to aggregate fertility trends?

Which effects would have the largest impacts, when considering fertility transition? Given the small percentage of people who know about their sero-status, any behavioral response to own status would likely not be large enough to impact aggregate trends. If any behavioral response to HIV impacts larger trends, it would be the community threat response. The magnitude of any community threat response would be constrained by availability and effectiveness of methods to control fertility.

A lower fertility rate due to HIV-contraction will affect the age groups where HIV prevalence is highest. The estimates suggest that the biological constraints due to HIV contraction lower fertility rates by 25 to 40 percent (UNPD 2002). At a maximum, 30 percent of women in a country have HIV; therefore the total fertility rate (TFR) could be lowered by 7.5 to

12 percent. Reductions in fertility rates would be larger for age groups where HIV prevalence is higher.

The removal of a significant portion of the child-bearing-age population may or may not have an impact on the TFR or individual age-specific fertility rates (ASFRs). Each ASFR could remain the same in the presence of high mortality if the women who die do not have significantly different fertility rates than the women who continue to live. If more high-fertility women die, then the TFR or ASFRs may decline (all else constant), and if more low-fertility women die, then the TFR or ASFRs may increase. The magnitude of the change in the TFR or ASFRs based on this mechanism would depend on how large fertility differences are between those who die and those who live.

4. Measurement of mechanisms

Identification of the various mechanisms would require longitudinal data of patterns at different points in time before and during the spread of HIV in a country. Pre-epidemic levels would be necessary to establish the "baseline"; ideally, several pre-epidemic time periods would be necessary to identify trends that could be assumed constant in the absence of the epidemic. Changes in fertility and behavioral patterns outside of the trend could therefore be more plausibly due to HIV.

The first problem is identifying whether there actually are any differences in fertility patterns before and during the different stages of an epidemic. If different aggregate patterns occur before and after the epidemic, then the case is stronger for an effect of HIV on aggregate fertility levels. However, even if no aggregate trends are evident, it may still be the case that HIV impacts fertility. As noted above, aggregate trends may mask individual changes,

particularly in the presence of shifting samples. Discerning conflicting trends at the individual and aggregate levels would therefore require understanding of both sample changes and individual effects.

Examination of changes in the TFR and ASFRs will not provide an indication of whether the change is due to a change in the sample or to a behavioral change in those still living. Without knowledge of the medical characteristics of HIV-positive women, it would be difficult to understand what aspect of any change in fertility is due to behavioral versus biological factors. The only method of estimating the biological factors would be in a scenario in which behavior is constant. It would therefore be necessary first to identify whether behavioral changes are occurring. If no behavior change is evident, then any change in fertility (net of trends attributable to other proximate determinants of fertility) could be attributed to biological mechanisms.

Discerning changes in behavior would require examining variables related to fertility desires and actions at different stages of the AIDS epidemic in a country. The Demographic and Health Surveys (DHS) provide large, high-quality repeated cross-sections of the population that are comparable across countries and time. Perception of a heightened threat of mortality, or of any threat from HIV, could be documented using the DHS survey questions that ask about knowledge of HIV or about deaths from HIV. Changes in desires for children could be estimated via the DHS questions about reproductive intentions.

Availability of methods to alter fertility could come from DHS data as well. The use of contraception provides a measure of availability, but low use may occur in an environment of ready availability. It would therefore be necessary to examine not only use but knowledge of contraceptive methods, as well as unmet need for family planning.

Actions to put fertility desires into effect could be estimated using a number of measures, including changing patterns of use and type of contraception. The outcomes of fertility control measures could also be witnessed via birth spacing. In addition, age at first marriage, prevalence and date of sterilization, and rates of remarriage and divorce could also serve to indicate changes in fertility behaviors (particularly in conjunction with other measures).

If no behavioral responses are evident (net of other trends and confounding factors), then the next step would be to examine fertility-selected deaths from AIDS. In order to discern whether women with high versus low fertility are more likely to die from AIDS, it would be necessary to examine death records by fertility and age. If women who die from AIDS had fertility histories suggesting either higher or lower than average total lifetime fertility (net of other effects on fertility), this would imply that HIV has an impact on the sample. This sampling would therefore affect overall fertility rates, specifically ASFRs and the TFR. One could then create pseudo-fertility patterns for the women who died as if they had lived. Comparison of what fertility would have been had these women not died with observed fertility would then provide a measure of how much fertility-selected deaths affected overall fertility rates.

In the absence of death records with fertility histories, the next best alternative would be examination of death records by age. Without fertility histories, it would be necessary to ascribe rates by age alone. Thus, women age 20-24 who died from AIDS-related illnesses would be assigned the same fertility schedule as women age 20-24 who lived. Fertility trends by age are much more readily available. By construction, this would not have impacts on ASFRs or the TFR but would have impacts on measures of fertility that account for the age structure of the population (like the net and gross reproduction rates). This would be useful in understanding how population growth is affected by HIV/AIDS.

CASE STUDIES

In order to provide some understanding of the trends in fertility preferences, practices, and results in response to HIV, we examine trends in measures from three countries in relation to their HIV epidemics over time. The three countries are Zimbabwe, Uganda, and Burkina Faso. These three countries have witnessed different magnitudes of epidemics occurring at slightly different times. For each country, we examine trends in estimated HIV prevalence; ideal number of children; age at first intercourse, birth, and marriage; sexual activity; contraceptive use; birth spacing; and fertility. These measures are chosen to correspond with many of the factors described in the mechanisms relating HIV to fertility. These measures also largely reflect the traditional proximate determinants of fertility (contraceptive, marriage, breastfeeding, and abortion). We do not examine sterilization or abortion, as these factors are not mentioned in the prior literature in relationship to HIV.

The fertility data for these case studies come from 11 Demographic and Health Surveys (DHSs). Zimbabwe and Uganda both have had four surveys, while Burkina Faso has had three. Table 1 provides the dates and sample sizes of the surveys.

Table 1: Dates and sample sizes of DHS data used

Zimbabwe	**1988/1989**	**1994**	**1999**	**2005/2006**
Number of observations	4,201	6,128	5,907	8,907
Uganda	**1988/1989**	**1995**	**2000/2001**	**2006**
Number of observations	4,730	7,070	7,246	8,531
Burkina Faso	**1992/1993**	**1998/1999**	**2003**	
Number of observations	6,354	6,445	12,477	

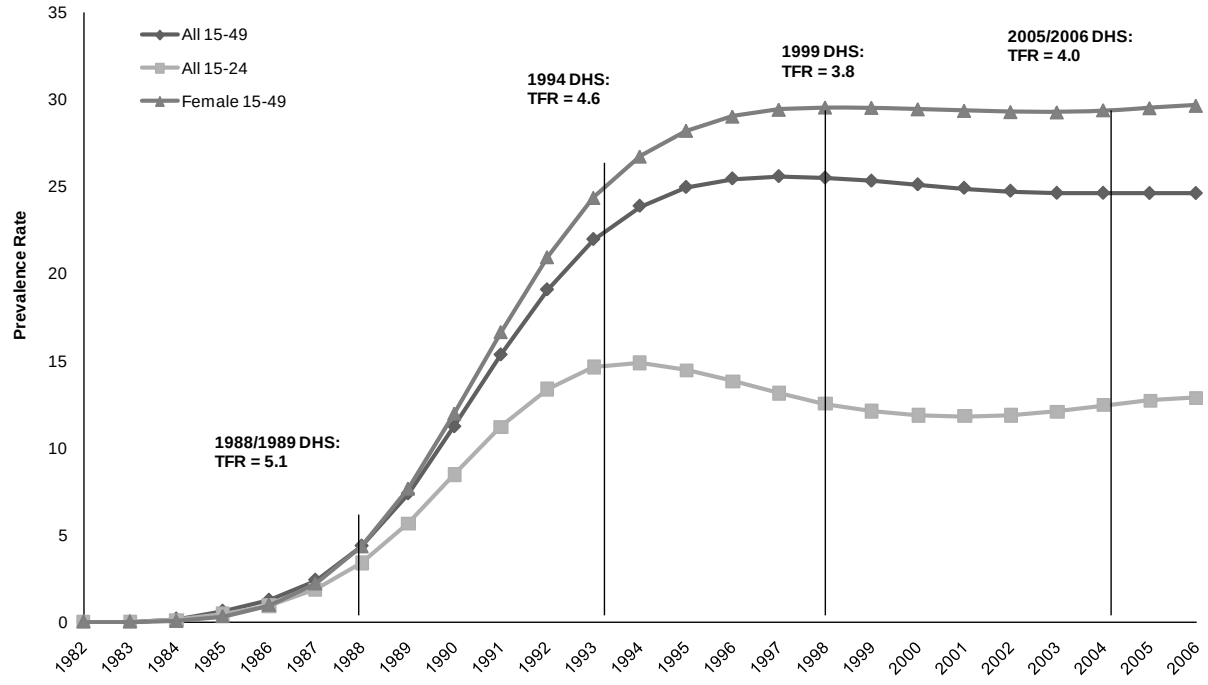
Zimbabwe

1. Trends in HIV prevalence and fertility rates

Zimbabwe has witnessed a severe HIV/AIDS epidemic, with HIV prevalence rates climbing to nearly 30 percent of women. Figure 2 shows estimated prevalence rates between 1982 and 2006 for all people age 15-49, all people age 15-24, and women age 15-49. Prevalence appears to have leveled off at a very high rate. The figure also shows the dates of the four DHS surveys for Zimbabwe, to illustrate the dates of the fertility data. Fertility is relatively high in Zimbabwe, but not the highest of the sub-Saharan African countries. Matching the TFRs reported in the four DHS surveys with the strength of the epidemic, we see that TFR declined between 1988 and 1999, only to level off or even rise in 2005/2006.[1] This slowing of fertility decline in the face of rising HIV prevalence illustrates the possible relationship between the HIV epidemic and fertility trends.

[1] These TFRs are calculated by the authors using the 12 months before the survey. The method of calculation is different from that outlined in the *Guide to DHS Statistics* (Rutstein and Rojas 2006) that is used to calculate official DHS statistics. In that text, TFRs are calculated using the three years prior to each DHS survey.

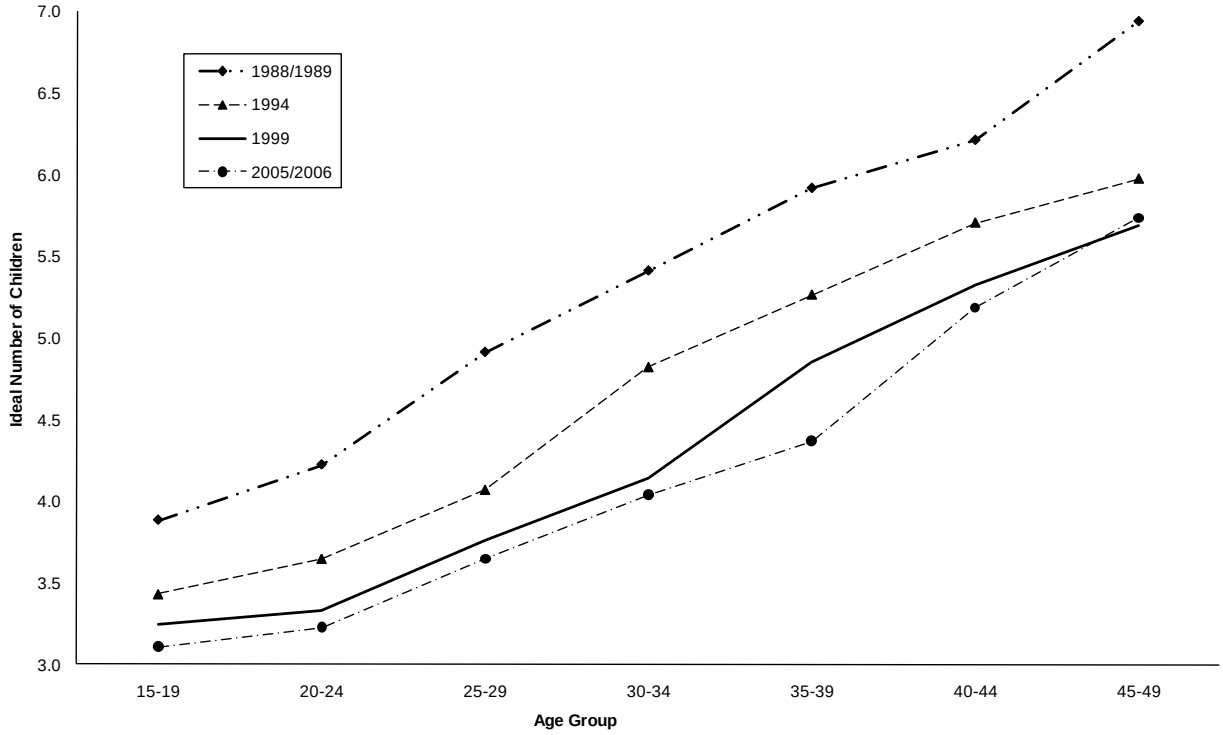
Figure 2: Zimbabwe: Estimated HIV prevalence rates for all people aged 15-49, women aged 15-49, and all people aged 15-24, 1982-2006, with TFRs at dates of DHS surveys



2. Trends in fertility desires

The first variable to examine in order to discern whether HIV had some impact on fertility in Zimbabwe is the number of desired children. The stated ideal number of children that women cite in the DHS surveys for Zimbabwe is declining for all ages between 1988 and 2006 (Figure 3). As is evident, the ideal number of children increases with respondents' age, suggesting that women adjust their ideal number depending on how many children they already have. The decline between 1999 and 2005/2006 appears smaller than the prior declines. The overall average falls from 4.9 children in 1988/1989 to 3.9 in 1999, but then only drops to 3.8 in 2005/2006. This suggests that the decline in the number of children women say that they would like is slowing, concurrent with the time that HIV remains constant at a high level in the country.

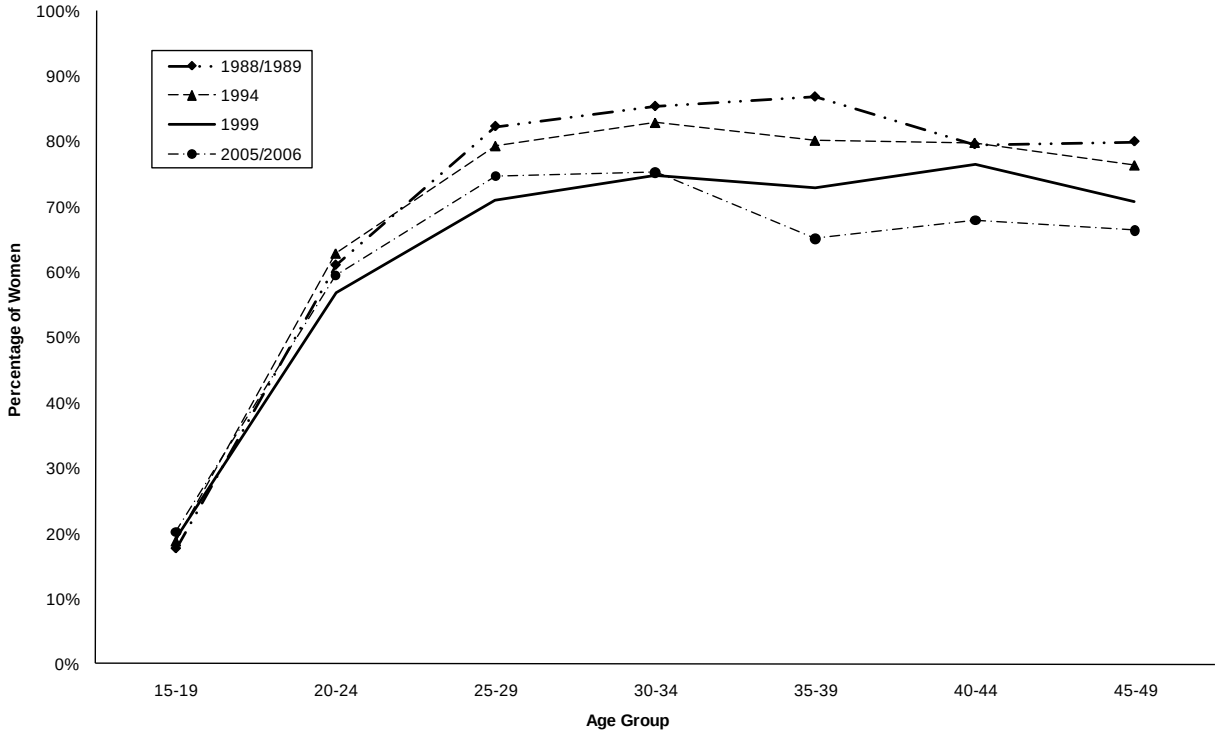
Figure 3: Trend in ideal number of children, by age group, Zimbabwe1988-2006



3. Trends in fertility action: marital status, sexual activity, contraceptive use, and birth spacing

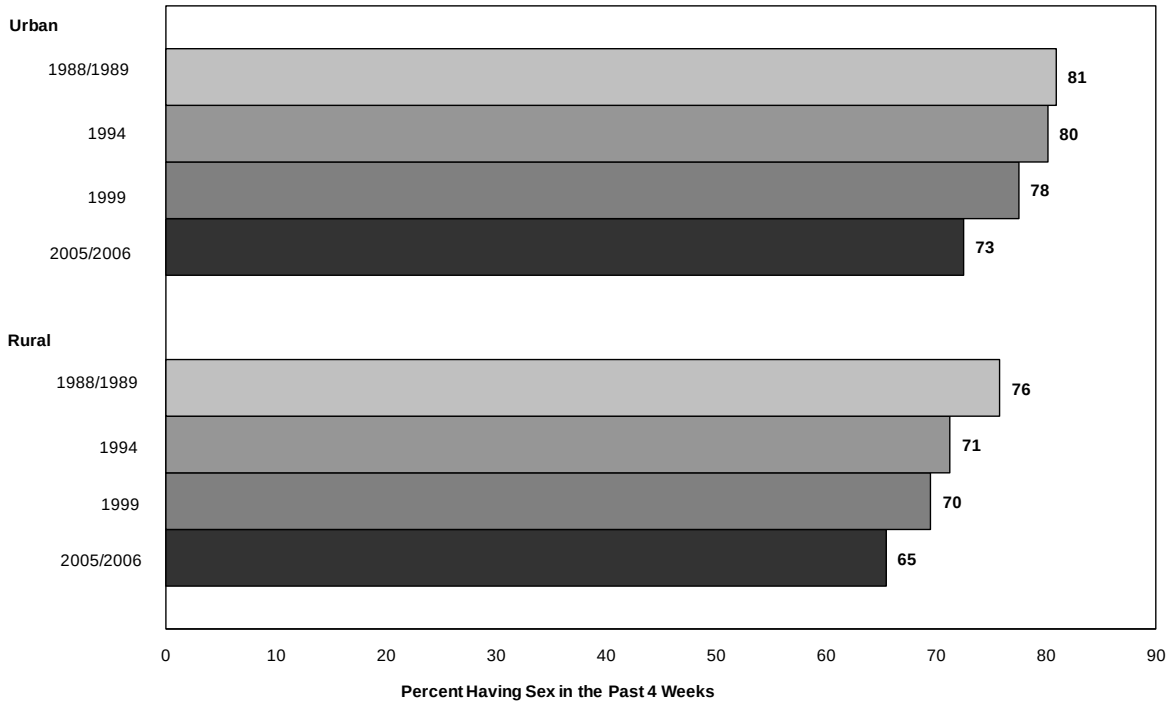
To understand whether women are changing their fertility practices, we examine several measures. The percentage of women who are married can provide an indication of reproductive activity and availability of sexual partners. Figure 4 shows trends in the percentage of women married, by age group. These measures drop over time and then remain fairly constant between 1999 and 2005/2006. Between 1991 and 1994, the overall percentage of women age 15-49 married drops from 61% to 56%, but then remains constant at 56% until 2005/2006. This could reflect changes in reproductive behavior, or it could reflect something else, like a changing age structure of the population, reduction in possible marriage partners (possibly due to mortality from the epidemic), or avoidance of remarriage.

Figure 4: Trends in percentage of women who are currently married, by age group, Zimbabwe 1988-2006



One method of reducing fertility and lessening the probability of contracting HIV is by having less sex. Figure 5 shows the percentage of women who have had sexual intercourse in the four weeks before the survey, by urban and rural status. These fall over time for both groups. This could be due to a behavioral shift, or changes in the availability of partners.

Figure 5: Trends in sexual activity among urban versus rural women, Zimbabwe 1988-2006



Figures 6 and 7 show trends in contraceptive use. Modern contraception constitutes the majority of use, and trends in its use are increasing over time for most surveyed groups. The only declining use of modern methods occurs in 2005/2006 for sexually active 15-to-19-year olds (Figure 6) and sexually active urban women (Figure 7). A mechanism that can contribute both to lower fertility levels and reduced HIV prevalence is correct and consistent condom use. Figure 7 shows the percentage of sexually active women in urban versus rural locations who report current condom use. Noticeably, these numbers are very low; the highest is 3.1% for urban women in 1999. In the time period that the HIV epidemic has leveled off, condom use declines to even lower levels. This suggests that changes in condom use are not playing a particularly strong role in trends related to HIV and fertility over the survey period.

Figure 6: Trends in current use of contraception among sexually active women by age, Zimbabwe 1988-2006

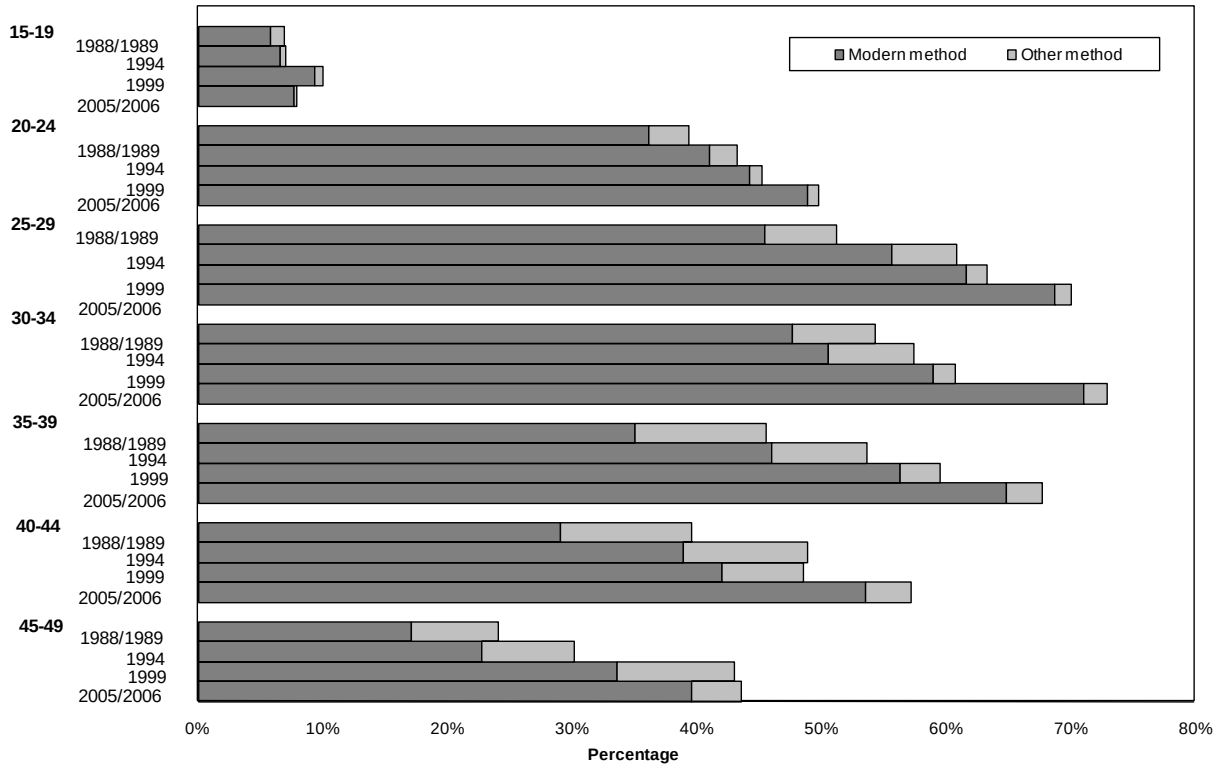
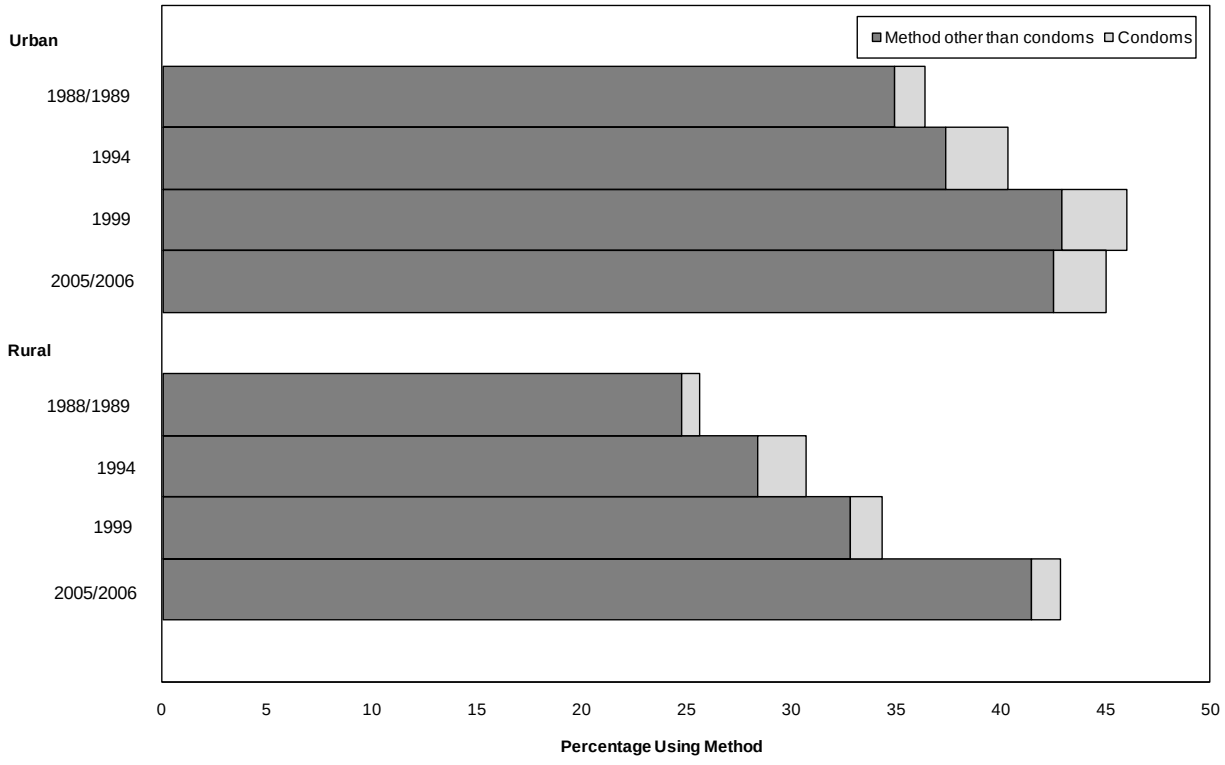
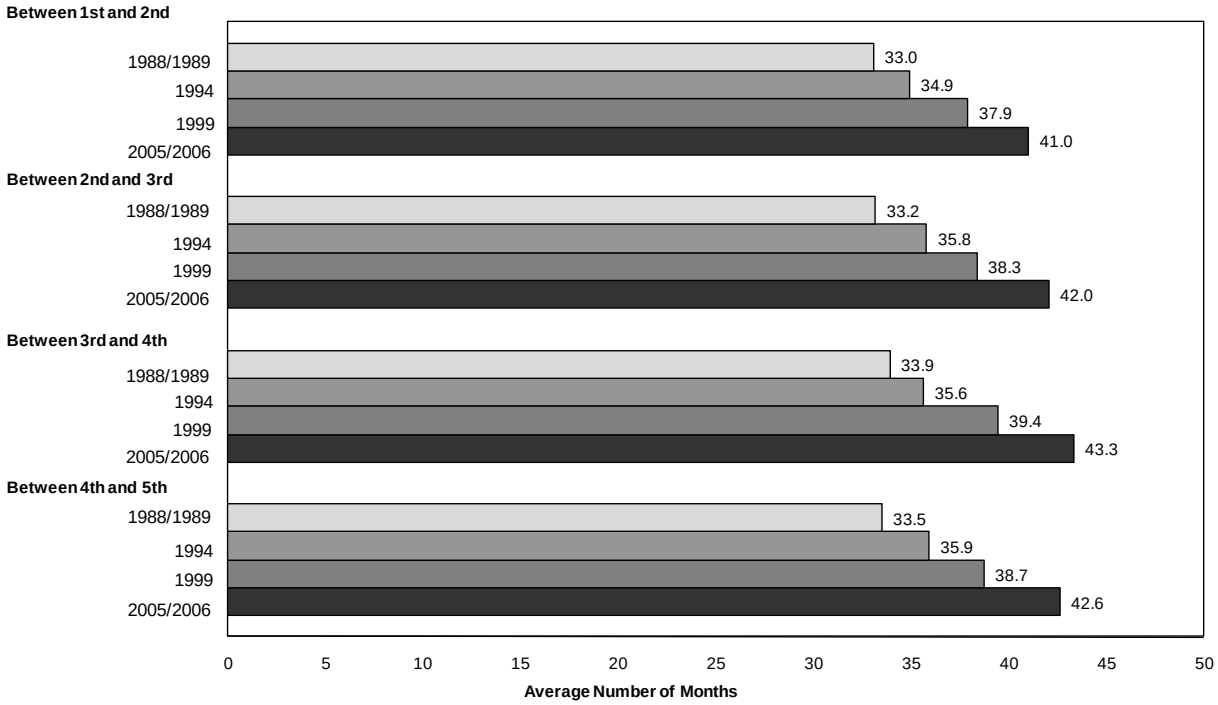


Figure 7: Trends modern contraceptive use among sexually active urban versus rural women, Zimbabwe 1988-2006



Finally, to understand whether women are initiating behaviors suggesting a "speeding up" of fertility, we examine birth spacing (Figure 8). For all parities shown, birth spacing is increasing over time. This suggests the opposite of acceleration. With the trends in fertility and contraceptive use, these trends in birth spacing suggest that contraception is being used to control spacing.

Figure 8: Trends in number of months between births, by parity, Zimbabwe 1988-2006



4. Summary of Zimbabwe

We have examined these measures in order to indicate fertility trends. Examination of the trends in Zimbabwe provides mixed evidence as to the cause of the fertility decline stalling. On the one hand, there are many indicators that suggest that fertility should continue to decline. Sexual activity has declined, and contraceptive use is up for most groups except for people age 15-19

and urban women. Birth spacing is increasing. On the other hand, there are indicators that could suggest a stall in the fertility transition. Ideal number of children and the percentage married both slow their declines. Contraceptive use falls or remains constant for the 15-19 age group. Urban modern method use falls. Condom use falls from low to even lower levels.

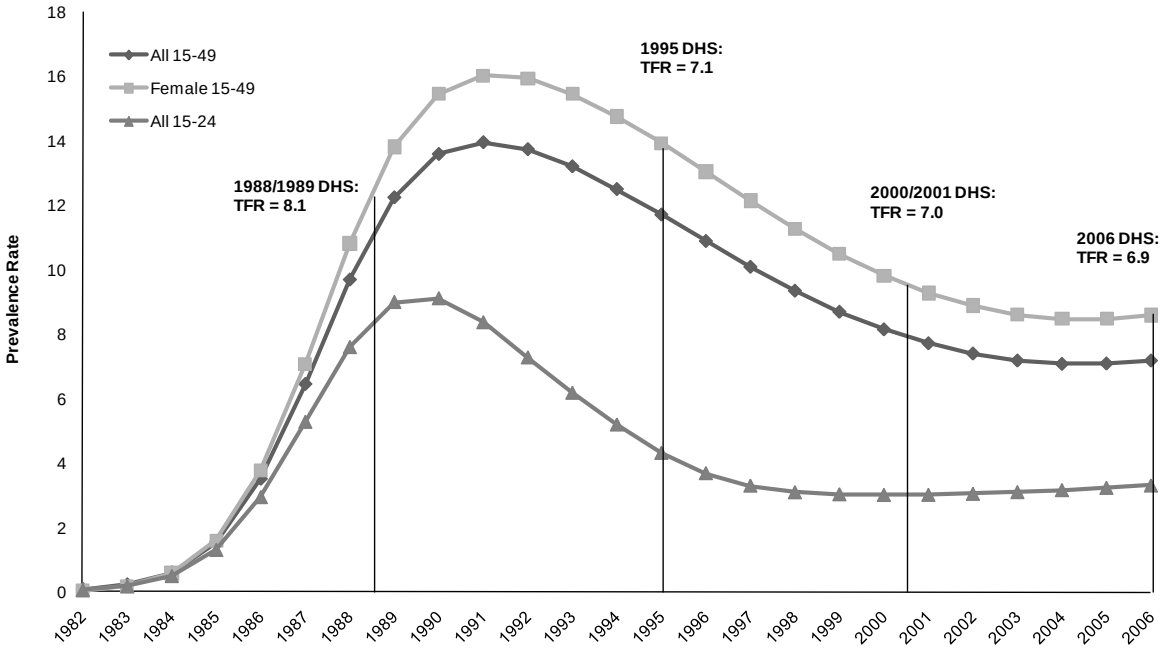
Overall, these different trends suggest that there are some behavioral changes contributing to the stall in the fertility transition. Taken together, the trends suggest that women are attempting to avoid HIV (by having less sex, increasing age at first intercourse), but still are deciding to have many children, as evidenced by stalling declines in stated ideal number of children and the TFR. The heightened contraceptive use may be related to birth spacing rather than limiting births.

Uganda

1. Trends in HIV prevalence and fertility rates

Uganda's epidemic has shown a different trend than Zimbabwe's and has a different course. Figure 9 shows the estimated progression of the epidemic in the country, with HIV prevalence for women reaching 16% at its peak. As in Zimbabwe, the decline in the TFR apparently slows with the leveling off of the AIDS epidemic. Uganda's very high TFR of 8.1 in 1988/1989 falls to 7.1 by 1995, but then only drops to 6.9 by 2006.

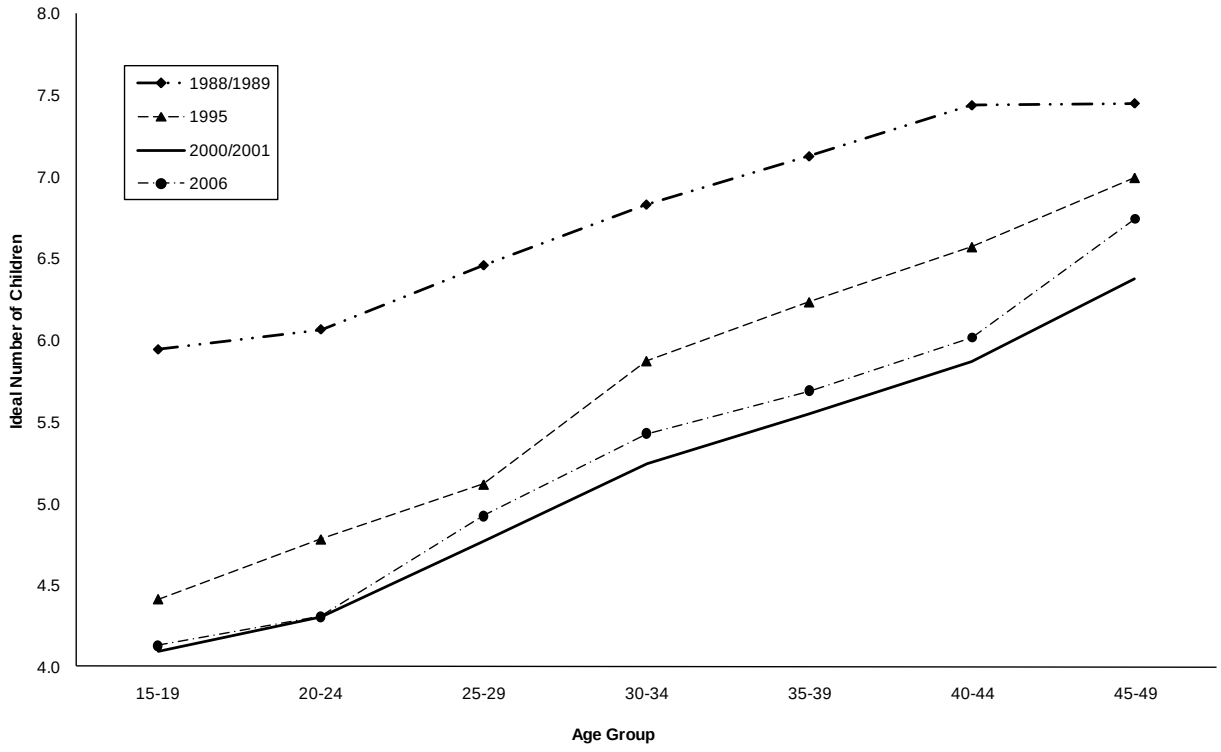
Figure 9: Uganda: Estimated HIV prevalence rates for all aged 15-49, women aged 15-49, and all aged 15-24, 1982-2006, with TFRs at dates of DHS surveys



2. Trends in fertility desires

Again as in Zimbabwe, the stated ideal number of children slows its decline with the slowing of the decline in the TFR (Figure 10). This measure appears to drop a great deal between 1988/1989 and 1995, after which the decline is less marked; the ideal number of children even appears to have grown between 2000/2001 and 2006. From an overall average of 6.5 children in 1988/1989, this drops to 4.8 in 2000/2001, but then remains constant until 2006.

Figure 10: Trends in stated ideal number of children, by age group, Uganda 1988-2006



3. Trends in fertility action: marital status, sexual activity, contraceptive use, and birth spacing

Marriage rates for all women show a fluctuating pattern in Uganda (Figure 11). Between 1988/1989 and 1995 the percentage of women who are married increases for all age groups, from an overall percentage of 54% to 64%. After this increase, however, the overall percentage married drops to 45% in 2000/2001, and then rises again to 49% in 2006. These fluctuations could be the result of lack of partners, social programs to prevent HIV, or other factors. Examination of this measure by age shows that in 2006 women over age 24 are more likely to be currently married than their 2000/2001 counterparts.

Figure 11: Trends in percentage of women who are currently married, by age group, Uganda 1988-2006

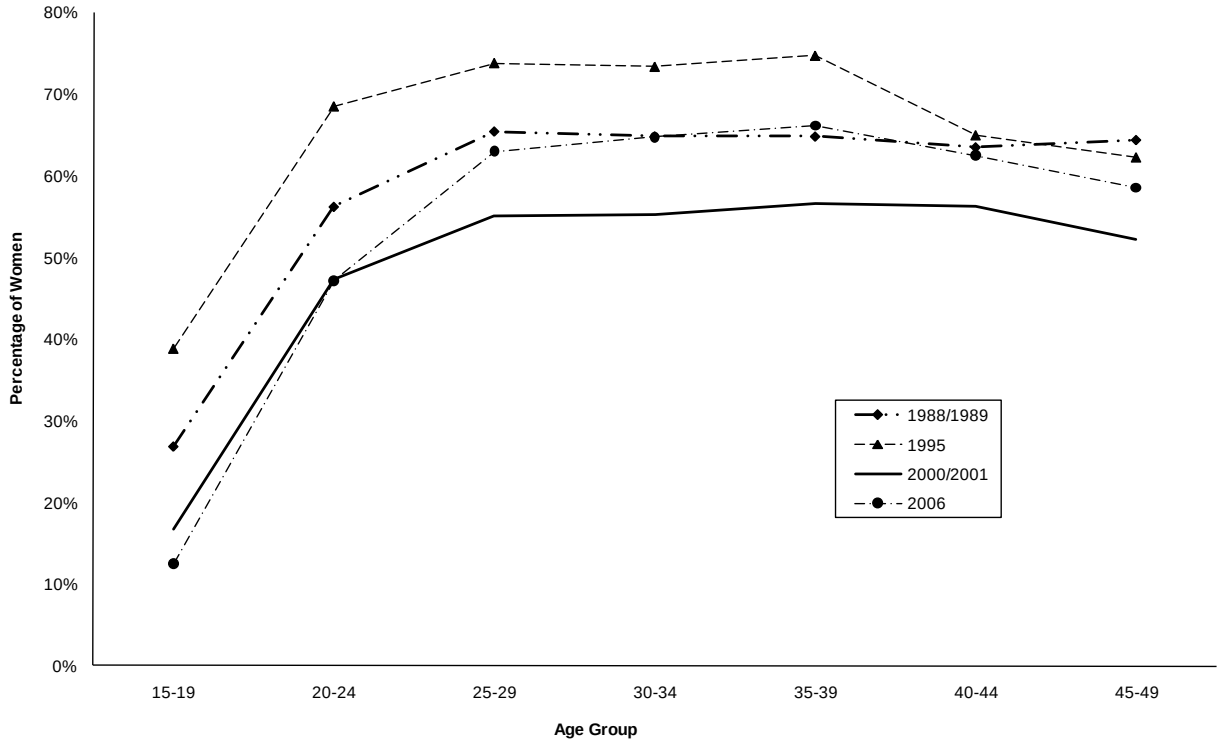
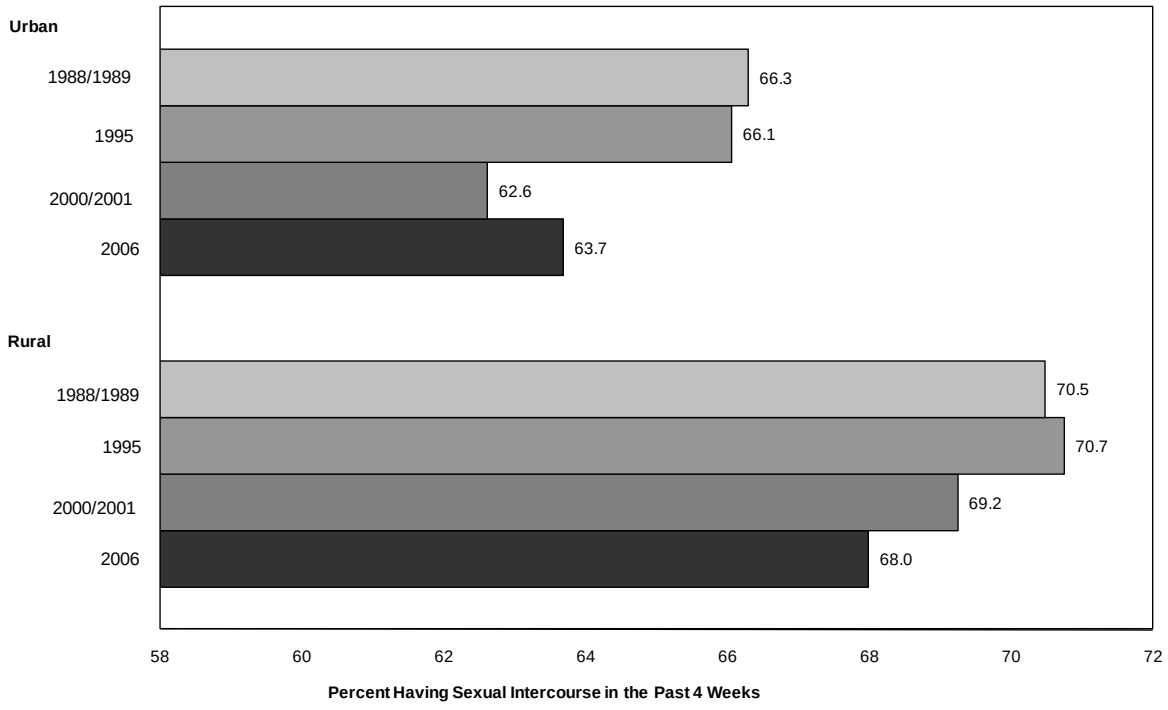


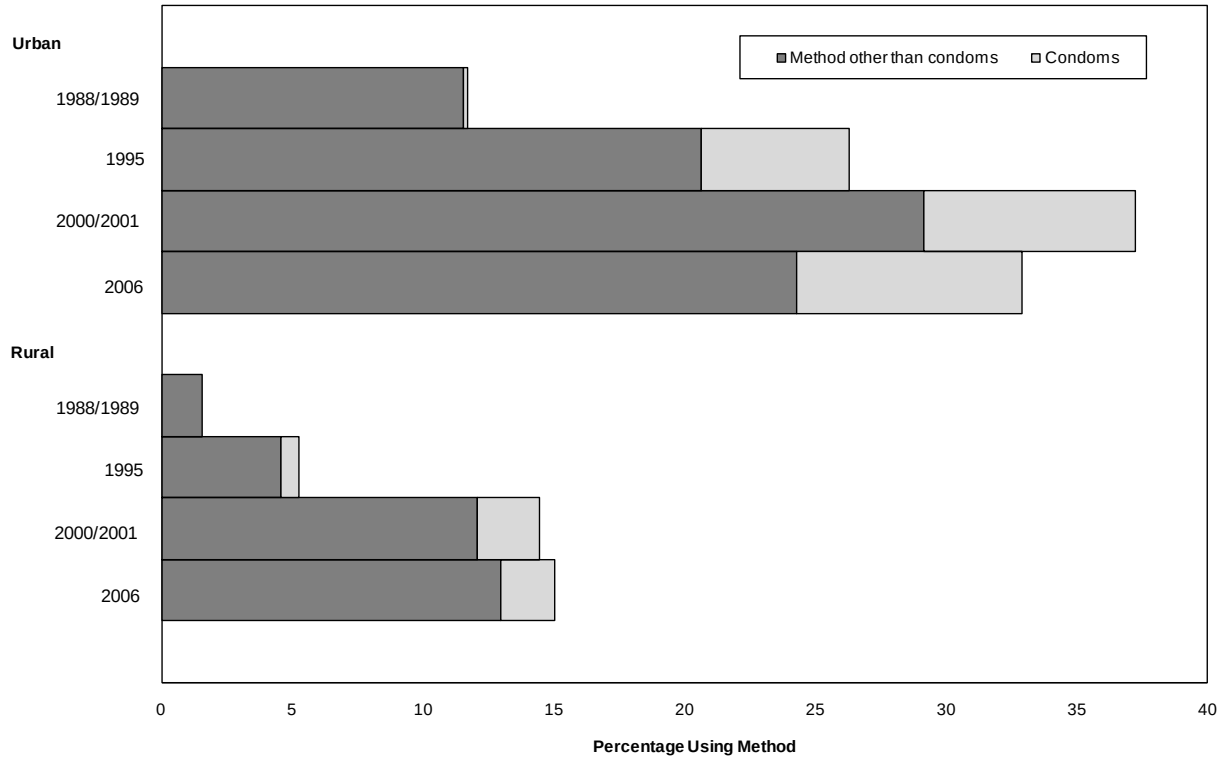
Figure 12 shows trends in the percentage of women by urban or rural status who have had sexual intercourse in the four weeks before the survey. Percentages are noticeably different by urban and rural status, with rural percentages falling over time and urban percentages falling and then remaining steady.

Figure 12: Trends in sexual activity among urban versus rural women, Uganda 1988-2006



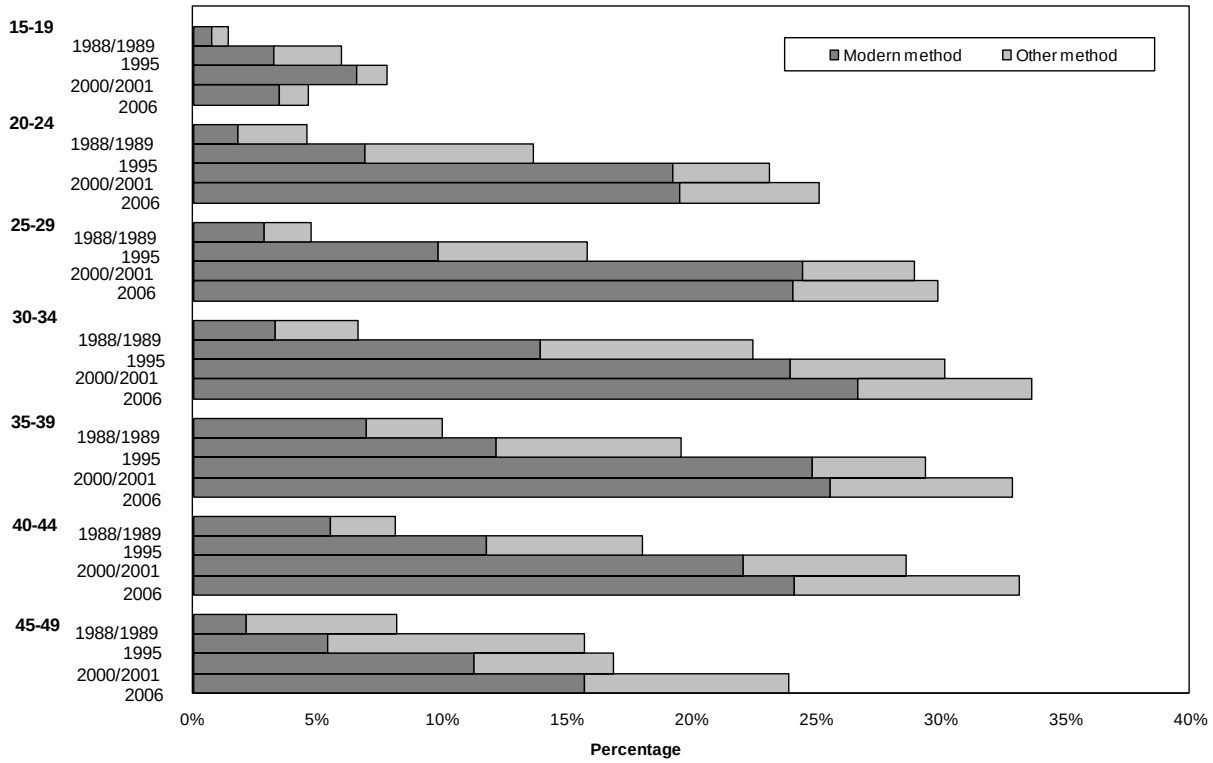
Modern contraceptive use is growing steadily in Uganda, but traditional methods are still common (Figure 13 and 14). Modern contraceptive use more than doubled between 1995 and 2000/2001, after which it levels off at 15% of women of reproductive age. Two age groups (15-19 and 25-29) see a decline or stalling of modern method use among sexually active women between 2000/2001 and 2006. Further, modern contraceptive use declines for sexually active urban women between 2000/2001 and 2006 (from 37% to 33%), much like the pattern in Zimbabwe. Condom use among sexually active women (Figure 13), after seeing a remarkable increase between 1988/1989 and 2000/2001 now remains constant for urban women, at 8.6%, and falls to 2.1% for rural women.[2]

Figure 13: Trends modern contraceptive use among sexually active urban versus rural women, Uganda 1988-2006



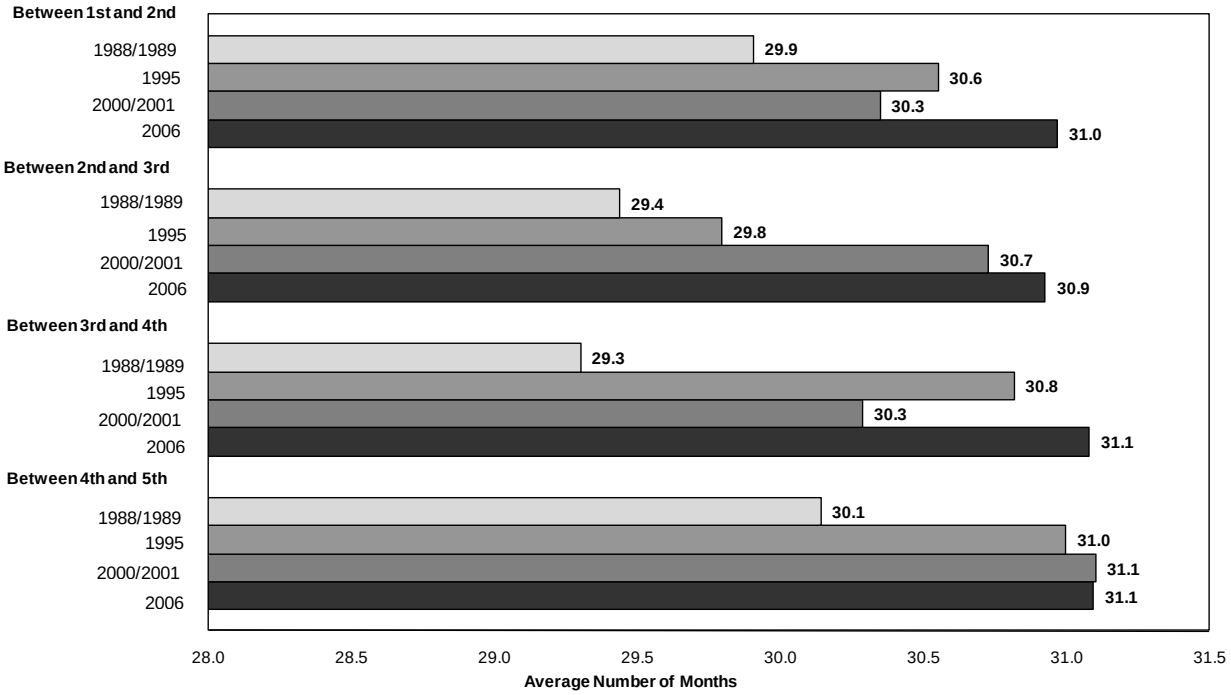
[2] The condom recall in Uganda occurred in 1994, and thus the effect would have been captured in the 1995 DHS.

Figure 14: Trends in current use of contraception among sexually active women by age, Uganda 1988-2006



Finally, birth spacing in Uganda (Figure 15) follows a somewhat fluctuating pattern, but appears to have leveled off in its increase between 2000/2001 and 2006.

Figure 15: Trends in number of months between births, by parity, Uganda 1988-2006



4. Summary for Uganda

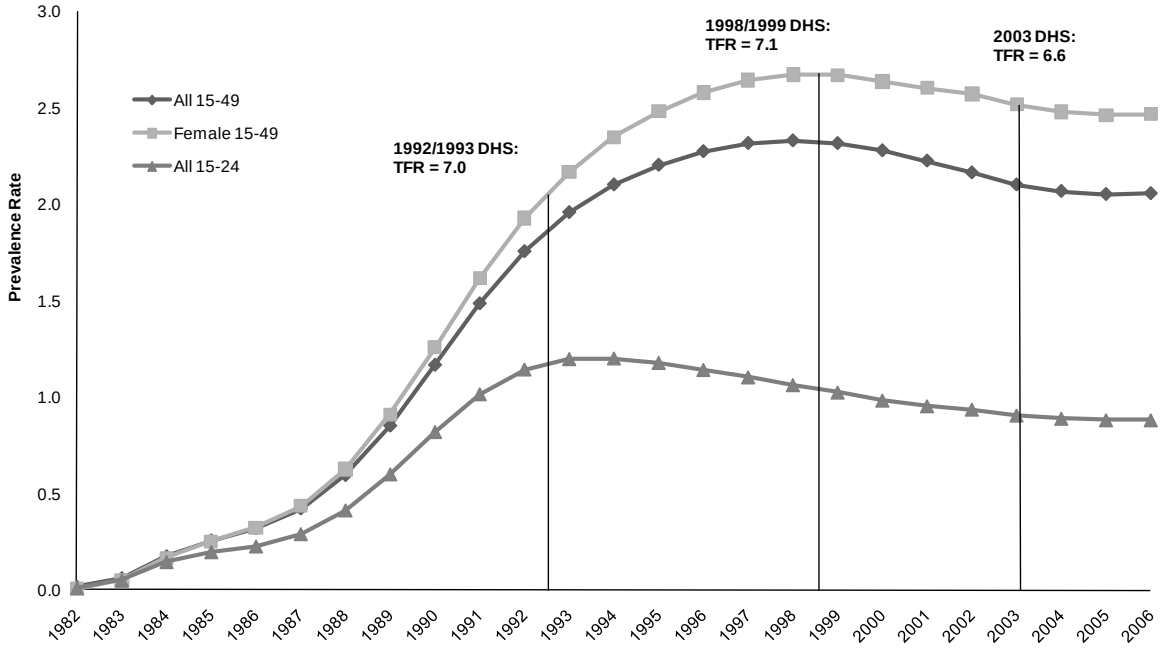
While Uganda shows some similar patterns to Zimbabwe, it also shows marked differences. Uganda sees declines or stalls in contraceptive use, which helps to explain this country's stall in fertility decline. This is coupled with stalls in trends in other measures, including marriage rates, percent sexually active, and fertility preferences. If a similarity exists between Uganda and Zimbabwe, it appears to be behavioral changes to prevent HIV, while taking steps to maintain high fertility.

Burkina Faso

1. Trends in HIV prevalence

Compared with Zimbabwe and Uganda, Burkina Faso's HIV epidemic has been less severe (Figure 16). The estimated peak of the epidemic occurred in 1998, with a highest estimated HIV prevalence of 2.7% for women. This epidemic, since it was less severe, may therefore show different patterns than those in Zimbabwe and Uganda. In comparison to the TFRs in the other two countries, Burkina Faso's TFR fell after HIV prevalence stopped rising. Fertility in Burkina Faso is also among the highest in the world; at the height of the HIV epidemic, the TFR was 7.1 births per woman.

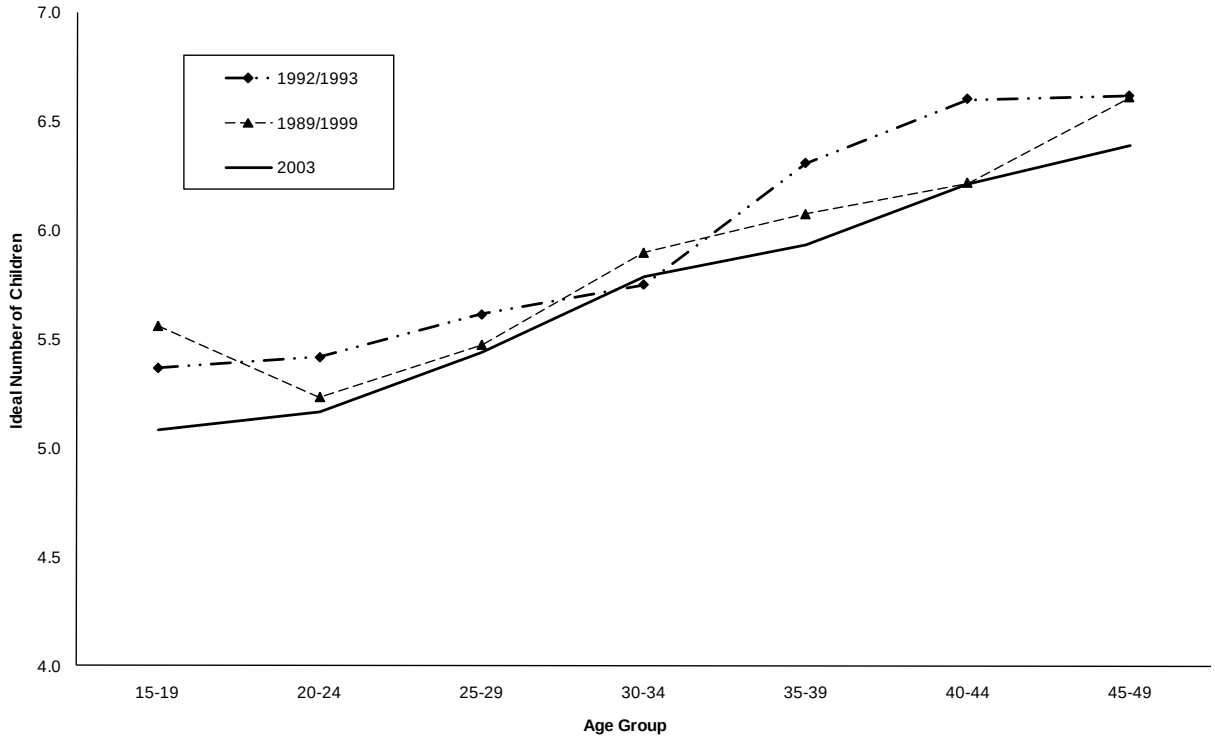
Figure 16: Burkina Faso: Estimated HIV prevalence rates, for all aged 15-49, women aged 15-49, and all aged 15-24, 1982-2006, with TFRs at dates of DHS surveys



2. Trends in fertility desires

Women's stated ideal number of children in Burkina Faso has not changed much over time (Figure 17). This reflects the relative lack of change in Burkina Faso's TFR.

Figure 17: Trends in stated ideal number of children, by age group, Burkina Faso 1992-2003



3. Trends in fertility action: marital status, sexual activity, contraceptive use, and birth spacing

The percentage of women married at certain ages shows a steady decline (Figure 18). Also, sexual activity is higher in the urban than rural areas of Burkina Faso, and the percent having sex in the four weeks before the survey have increased or remained constant between 1992/1993 and 2003 (Figure 19). Modern contraceptive use increases steadily over time for all groups examined and all age groups (Figure 20 and 21). Additionally, condom use is becoming more prevalent, with rates much higher than those in Zimbabwe and Uganda (Figure 20). Finally, birth spacing is also increasing (Figure 22), and is increasing the same amount for all parities up to the 5^{th}.

Figure 18: Trends in percentage of women who are currently married, by age group, Burkina Faso 1992-2003

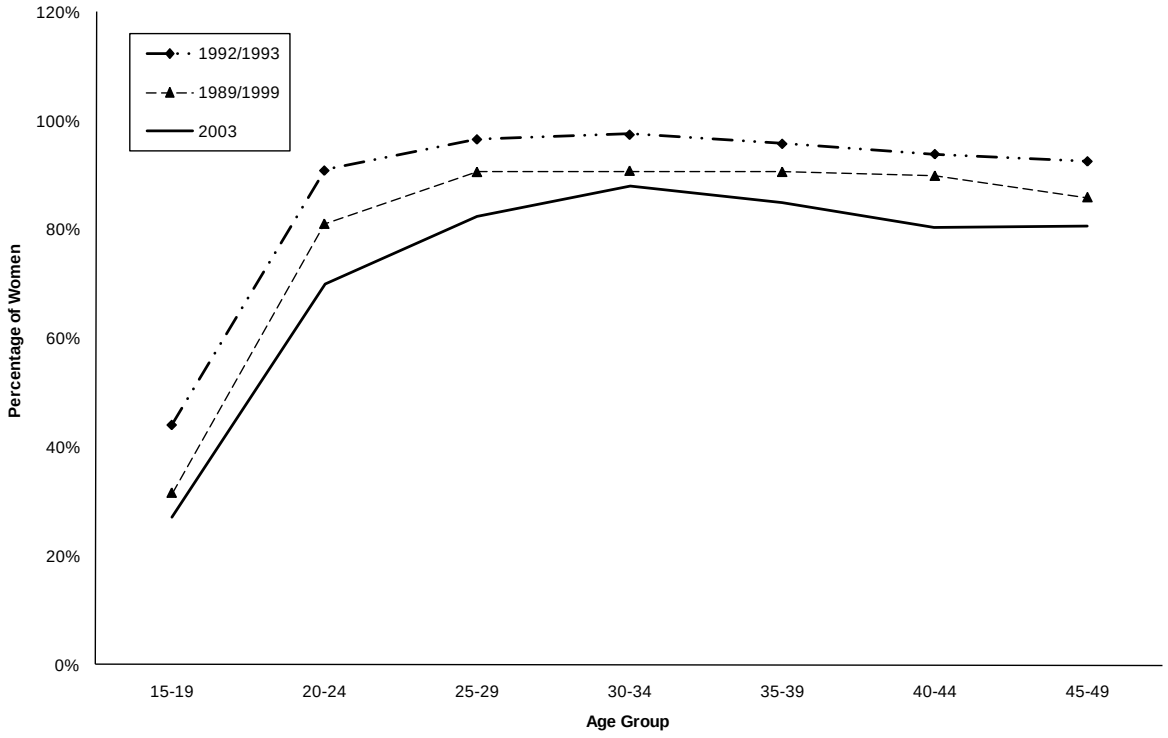


Figure 19: Trends in sexual activity amount urban versus rural women, Burkina Faso 1992-2003

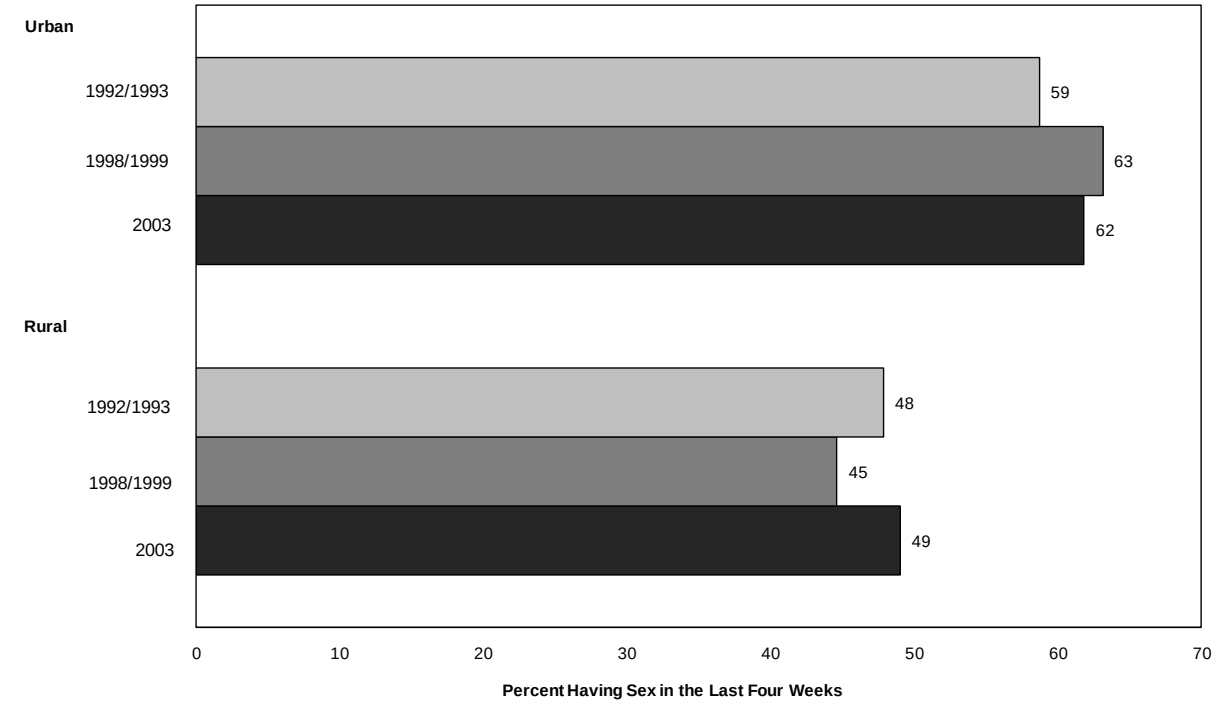


Figure 20: Trends modern contraceptive use among sexually active urban versus rural women, Burkina Faso 1992-2003

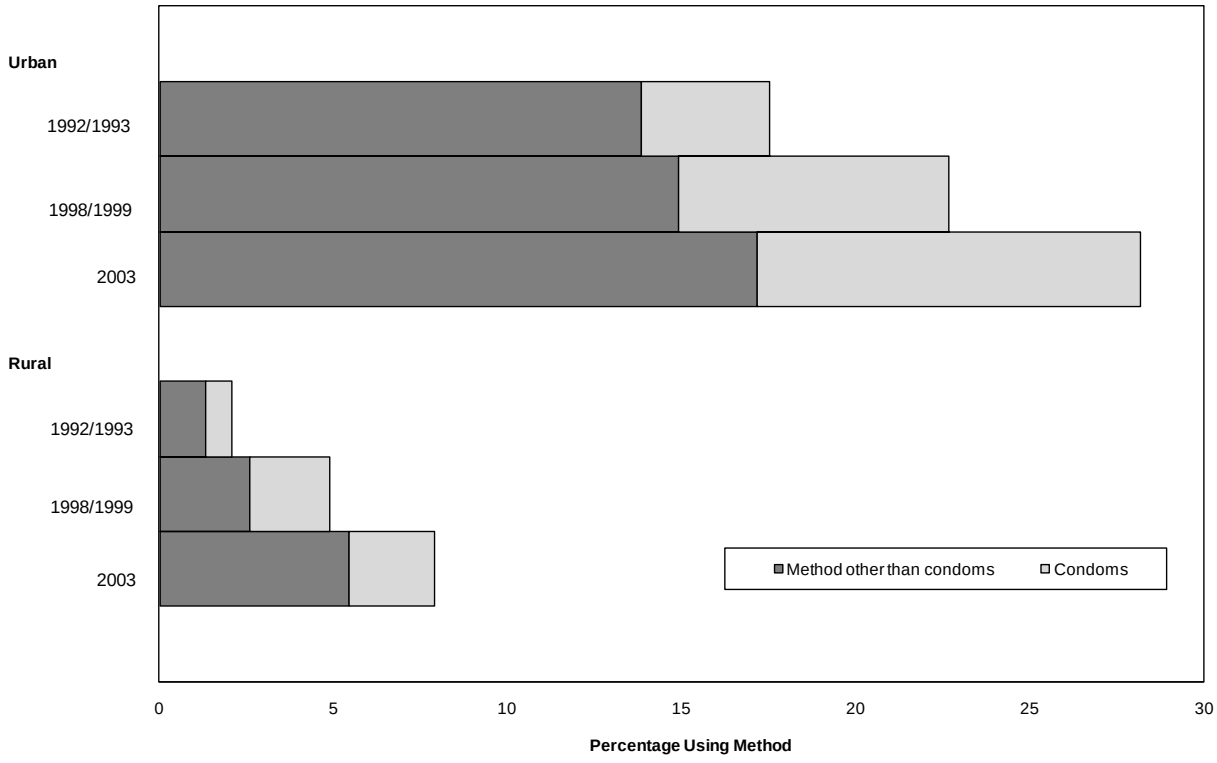


Figure 21: Trends in current use of contraception among sexually active women by age, Burkina Faso 1992-2003

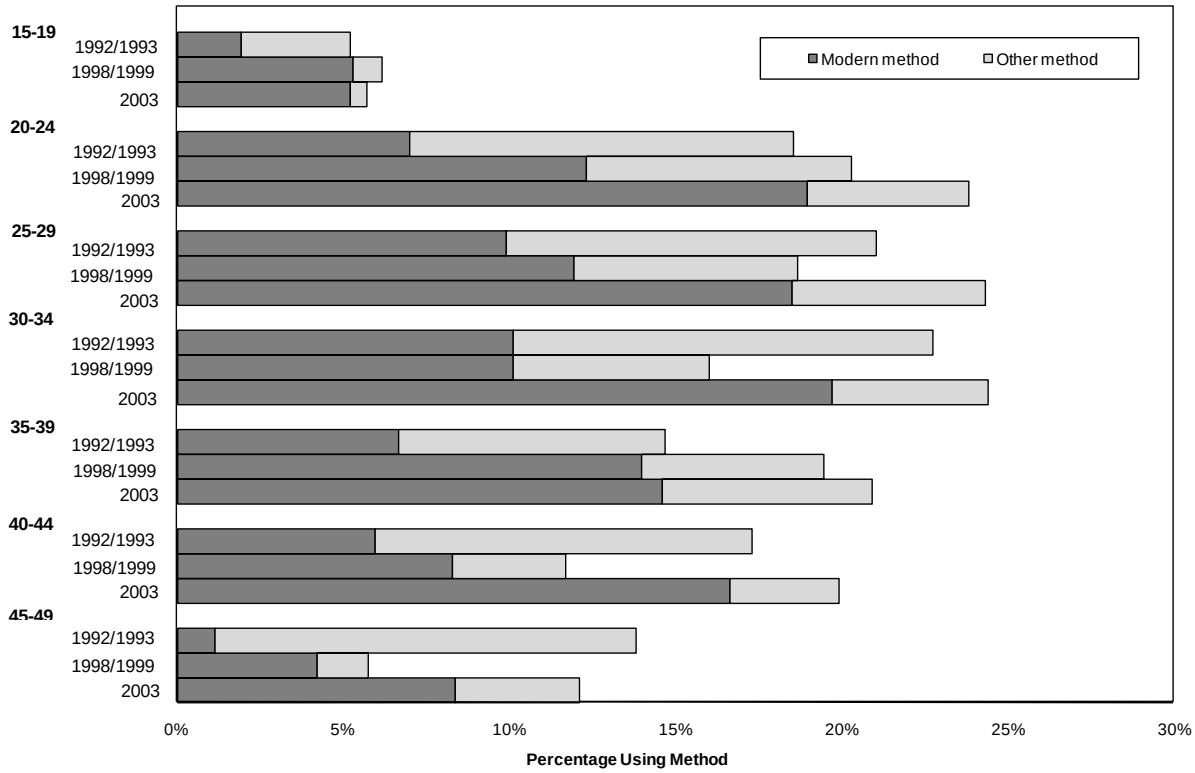
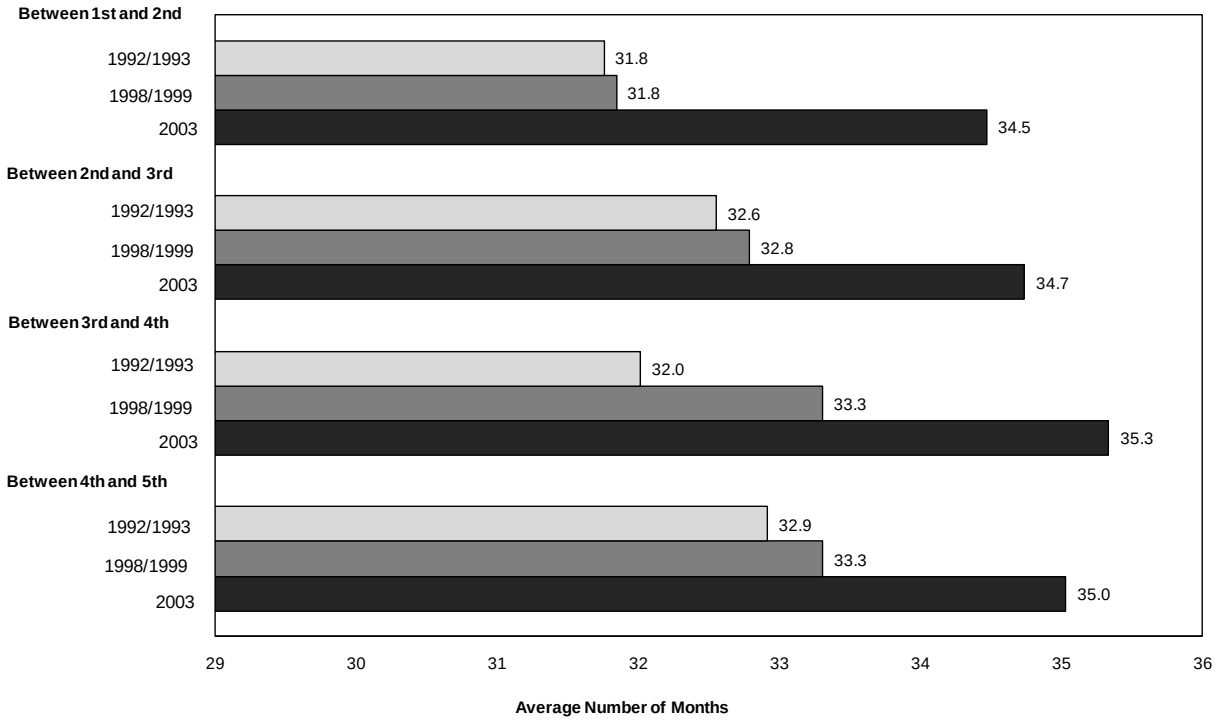


Figure 22: Trends in number of months between births, by parity, Burkina Faso 1992-2003



4. Summary for Burkina Faso

In many ways, Burkina Faso appears not to be experiencing a fertility transition, regardless of the HIV epidemic. While there are trends in the various measures suggesting a movement to lower fertility, most of the changes are small. The exception is in the use of modern contraceptive methods, which rises steeply. This increased contraceptive use may reflect stronger desires to space births rather them limit them. As described above, an increase in HIV prevalence may elicit changes in fertility desires and behaviors only if it is discernible as a threat. In the context of high mortality, an HIV rate of 2% may not be causing out-of-the-ordinary morbidity or mortality levels in Burkina Faso.

DISCUSSION

Examination of trends in these three countries shows suggestive patterns of fertility stalling in the countries with HIV epidemics that have reached HIV prevalence rates over 10%. Trends in Zimbabwe and Uganda suggest that fertility behaviors are changing during the epidemic. Burkina Faso does not experience the same effects as the other two countries; this could indicate that this country's HIV epidemic is not severe enough to causes changes in fertility.

The patterns we discuss certainly do not fully explain the links between HIV and fertility. However, the trends in Zimbabwe and Uganda (and their lack in Burkina Faso) suggest that the HIV epidemic may play a part in fertility patterns. The reduction or lack of increase in contraceptive use, particularly among the urban populations, suggests that women may be trying to have more children. This theory is supported by the lack of decline in the ideal number of children, and the slowing declines in fertility rates. While Uganda appears to have a straightforward decline in contraceptive use that could explain the lack of fertility decline, Zimbabwe's patterns are more complex. Zimbabwe may be experiencing a process in which women attempt to avoid HIV while having many children; they may do so by confining sex to marriage. Their contraceptive use may be to space births, rather than to limit childbearing.

CONCLUSIONS

This paper has investigated the mechanisms by which HIV can lead to changes in fertility. Examining three different sub-Saharan countries, we have attempted to describe the trends in patterns of behavior surrounding fertility in relation to HIV prevalence. From this analysis we can posit several theories and suggestions for future analysis.

First, more detailed HIV data would be necessary to explore trends according to age, urban/rural status, and region. If individuals respond to the threat of HIV contraction, then more specific indications of their perceptions are necessary to more clearly mimic what individuals witness in their daily lives.

Second, if women with HIV are less likely to be able to conceive or to carry children to term, then this suggests that fertility rates would decline as HIV becomes more prevalent. Observing that fertility rates are not declining suggests that uninfected women are having more children than they would otherwise have had, which compensates for the lower fertility of HIV-positive women.

Third, women may be having more children deliberately to make sure that a specific number live to adulthood, or they may be replacing children who die. This study has not explored this possibility.

Fourth, while changes in the population age structure will not affect certain fertility measures, they may still have important ramifications for fertility behaviors related to the HIV epidemic. For example, age-specific fertility rates will not depend on the proportion of the population at that age, but relative ages may have a bearing on partner availability and choice.

Finally, these conclusions are all preliminary and require far more rigorous analysis. The threat of HIV may work differently in different subpopulations, and only in the context of high

HIV prevalence rates. Analyses simultaneously controlling for the various fertility determinants would enable understanding of the relative importance of the various factors at different stages of the epidemic.

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