Births and HIV Status in Agincourt, Rural South Africa, 2010

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Abstract

Research from across sub-Saharan Africa shows lower fertility among HIV+ compared to HIV- women in the same age groups (except among women in their teens), largely explained by selection into earlier sexual activity among HIV+ young women. We use HIV prevalence data from the Agincourt Health and Socio-Demographic Surveillance System to examine differences in the likelihood of having a birth by HIV status among reproductive-aged women, and the sexual risk behaviors that may be associated with both HIV status and fertility. Results show lower likelihood of birth among HIV+ compared to HIV- women, except for women in their 20s, and significantly more risk behaviors among HIV+ women. However, the association between HIV+ women in their 20s and a higher likelihood of birth is robust to these influences. Changing fertility and marriage patterns, high HIV prevalence among women in their 20s, and condom use by HIV+ women may explain these differences.

Keywords: HIV/AIDS, fertility, birth, South Africa, antiretroviral therapy

Introduction

The general consensus from studies investigating HIV-attributable fertility differences in sub-Saharan Africa is that HIV positive women have significantly lower fertility than HIV negative women (Carpenter et al., 1997; Gray et al., 1998; Lewis et al., 2004; Magadi and Agwanda, 2010; Terceira et al., 2003; Zaba and Gregson, 1998). However, evidence suggests that this patterns reverses at the youngest ages, such that HIV positive women in their teens (15-19) have higher fertility than HIV negative women in the same age group (Carpenter et al., 1997; Lewis et al., 2004; Zaba and Gregson, 1998). HIV-related fertility differentials have been attributed to volitional factors, such as selection for earlier sexual debut (Lewis et al., 2004; Magadi and Agwanda, 2010; Zaba and Gregson, 1998), lower contraceptive use (Gray et al., 1998), and marital instability among HIV positive women (Magadi and Agwanda, 2010); as well as biological factors, such as increased risk of pregnancy loss due to HIV/AIDS (Gray et al., 1998). The effect of HIV on fertility is thought to be greater in low-contraceptive use populations because of earlier ages at sexual debut and higher fertility on average, but even in high-contraceptive use populations, such as Zimbabwe, HIV-attributable differences in fertility have been found (Terceira et al., 2003).

Most of the studies examining the effect of HIV on fertility were conducted in the late 1990s and early 2000s when antiretroviral therapy (ART) to treat HIV infection was not widely available (see Magadi and Agwanda, 2010 for an important exception). Today approximately 7.6 million individuals living in Africa are using ART and countries in Southern and Eastern Africa have undergone particularly rapid expansion in use, more than doubling the number of people using treatment between 2006 and 2012 (UNAIDS, 2013). Expansions in ART may rekindle fertility desires among HIV positive women (Maier et al., 2009), and thus contribute to higher fertility among HIV positive women using treatment (Myer et al., 2010), although some studies have found no discernable effect (e.g., Maier et al., 2009).

This study examines the relationship between HIV and fertility among women of reproductive age living in the Agincourt Health and Socio-Demographic Surveillance System (Agincourt or Agincourt HDSS) in rural South Africa in 2010. This area is characterized by high HIV prevalence and contraceptive use, low total fertility, and limited availability of ART until very recently. These conditions motivate a fresh look at the relationship between HIV and fertility, whether and how this association varies by women's ages, and whether ART use is associated with fertility among HIV positive women. Developing a clear understanding of these relationships is important because the fertility of untreated HIV positive women is associated with AIDS orphanhood and childhood HIV infection. In South Africa alone 410,000 children are living with HIV and 2.5 million children have been orphaned due to AIDS (UNAIDS, 2013). Second, fertility is a major determinant of population growth. Developing accurate population forecasts in high HIV prevalence countries requires precise information about the impact of HIV on both fertility and mortality. Finally, reproductive health providers would benefit from a clear understanding of how the fertility patterns and family planning needs of HIV positive women and their partners might diverge from those who are HIV negative, especially in areas where treatment has become available only recently and family planning is not well integrated with HIV care (Askew and Berer, 2003; Maharaj and Cleland, 2005).

Methods

Study Context

South African national fertility levels have been falling for at least a decade (Statistics South Africa, 2013) and Agincourt is no exception. The total fertility rate (TFR) in Agincourt was around 3.5 in 1993 and fell to around 2.4 in 2010 (Garenne et al., 2007; Williams et al., 2013). This reduction in overall fertility has been driven primarily by a significant decline in fertility by former Mozambican refugees (Williams et al., 2013) who make up around one-third of the area's population (Kahn et al.

2012). Their TFR dropped from above 5.0 in 1993 to below 3.0 by 2010 while native South Africans in the area have evinced a stall in fertility decline since around 1996 (Williams et al., 2013). Fertility patterns in Agincourt are generally representative of fertility patterns of Blacks in rural areas across South Africa, with high adolescent fertility and postponement of higher order births (Sennott, 2013; Sennott et al., 2014; Timaeus and Moultrie, 2008; Williams et al., 2013). High levels of contraceptive use facilitate long periods of birth postponement (Cooper et al., 2007; Timaeus and Moultrie, 2008). According to South African Demographic and Health Survey (DHS) data, 61% of women in rural areas were using contraception in 2003 (SADHS 2007). However, some studies have shown that younger and unmarried women still face barriers in accessing effective contraception in South Africa (Cooper et al., 2004; Ehlers, 2003; Wood and Jewkes, 2006).

Rural South Africa also has extremely high HIV prevalence. In the Agincourt HDSS, HIV prevalence is highest among women of reproductive age. The prevalence peaks among women aged 35-39 at 46%, compared to a site-wide prevalence of around 24% among all women aged 15 and up (Gómez-Olivé et al., 2013). Nationally, HIV prevalence is estimated at 10% (Statistics South Africa, 2013) with a rate of 21% among women (Rehle et al., 2010). Although ART became available from a private clinic in Agincourt in 2007, it only became more widely available at public health centers in 2010, the year of our study.

Data

The Agincourt HDSS currently incorporates approximately 107,500 individuals in 19,500 households in 30 villages in the Agincourt sub-district of the Ehlanzeni District in Mpumalanga Province, South Africa (www.agincourt.co.za). The Agincourt HDSS was established in 1992 to provide reliable population-based information to support the reorganization of the country's health system and the development of district health systems after the end of apartheid (Kahn et al., 2012). The baseline census was conducted among individuals in 20 contiguous villages, chosen because they were rural and had limited access to public services, poor quality of available health care, and a large population of Mozambican refugees displaced by the Mozambican civil war (Kahn et al., 2012; Tollman et al., 1999). In 2007 an additional 7 villages were added to the study site, chosen because they comprised the catchment area of a new privately-funded health clinic that was established to provide ART prior to the national rollout of treatment in 2010 (Kahn et al., 2012). Three more villages were added in the beginning of 2013 but are not included in the current analysis.

Data on vital events, including births, deaths, union (marital) status, and in- or out-migrations are collected annually and this information is collected routinely from new in-migrants. The dependent variable in this analysis is having a birth in 2010. Maternity histories – including the dates of birth and death and other information for all children a woman had born – were initially collected at the baseline interview and are updated annually to include all pregnancies and births that have occurred since the previous census.

The main predictor variable in this analysis is a woman's HIV status. Population-based HIV testing was implemented in Agincourt in 2010/2011 as part of an HIV/NCD study. The sample of 7,428 women and men in the HIV/NCD study were offered HIV testing and assessed for a number of sexual risk behaviors (described below). The sample, which was stratified by age (15 and above) and gender, was selected from a pool of 34,413 permanent residents (defined as living in the site for 6-12 months of the previous year) in 21 villages in the Agincourt HDSS.

Socio-demographic control variables were gathered prospectively through the annual Agincourt HDSS census. All variables are measured in 2010 unless noted below. Age is divided into four categories: teens (15-19), 20s, 30s, and 40s. Women in their 30s are the reference group because the largest proportion of this group (5.9%) had a birth in 2010 compared to women from other age groups. We include two measures of prior fertility: parity, which is a continuous measure of the total number of live births a woman had prior to 2010; and whether a woman had a recent birth (in 2008 or 2009). Data on education was collected in 1992, 1997, 2002, and 2006. Education is measured as the highest level reported and categorized into none; primary (1-8 years); some secondary (9-11 years); and completed secondary (12 or more years). Current marital status is classified as: never married, married (formal union), cohabiting (informal union), divorced or separated, and widowed. We include two measures of household socioeconomic status (SES). Household assets were collected in 2001, 2003, 2005, and 2007 and include information about the household's power sources, modern appliances, and livestock. We use the most recent measurements of these items combined into an index of household socioeconomic status, categorized into quintiles. Additionally, we include an indicator of whether the household head was female as a proxy for household poverty (Woolard, 2002). We include two indicators that reflect the burden of HIV/AIDS for the woman and her household: whether there was a recent HIV/TB death in the household (in 2008 or 2009), and whether a woman's child died in the previous five years (2005-2009). Finally, we include a self-reported measure of ART use, collected as part of the HIV/NCD study in 2010. Multiple imputation using all independent variables was performed to include cases missing values on household socioeconomic status (n=10); marital status (n=3); education (n=2); and living in a female-headed household (n=16). Excluding cases with missing values on these variables did not change the study results.

We also investigate several risk factors associated with HIV and fertility based on previous research that has shown fertility differentials by HIV to be, in part, attributable to selection for earlier sexual debut (Lewis et al., 2004; Zaba and Gregson, 1998). Retrospective data on sexual behavior were collected in 2010/2011 as part of the HIV/NCD study. We examine: age at first sex; whether a woman had been forced to have sex; whether the first sex was forced[1]; number of sexual partners in the last 24 months; total number of lifetime sexual partners; whether the respondent

[1] The two items on forced sex were not asked of women under age 18; therefore, they are excluded from the model examining births in 2010 by HIV status, socio-demographic characteristics, and sexual risk behaviors (Table 4).

reported more than one ongoing sexual relationship; condom use with the most recent sexual partner; whether the respondent had ever had unprotected sex with someone she knew to be HIV positive; and the age difference between a respondent and her most recent sexual partner.

Analysis

The analytic sample comprises 1,869 women age 15-49 who were tested for HIV in 2010/2011 as part of the HIV/NCD study. We present descriptive statistics for HIV positive and negative women alongside the population of women aged 15-49 who were permanent residents in Agincourt in 2009, using *Chi Square and t tests* to test for significant differences by HIV status (negative vs. positive) and between the HIV/NCD sample and the larger Agincourt population of women permanent residents. We analyze differences in fertility by HIV status using logistic regression models to predict births in 2010 and present a series of models. Model 1 includes HIV status and age. Model 2 adds interactions between HIV and age categories because of the strong finding that HIV positive women have lower fertility except in the youngest age group (15-19) (see Carpenter et al., 1997; Lewis et al., 2004; Zaba and Gregson, 1998). Model 3 adds the socio-demographic control variables. Model 4 adds an indicator of whether a respondent was using ART in 2010 because of research from South Africa that suggests that ART use may be associated with higher fertility among HIV positive women (Myer et al., 2010). We use *Chi Square* and *t tests* to test for significant differences in risk behaviors that might help to explain possible fertility differences among HIV positive and negative women. Finally, we estimate a logistic regression model including all covariates from Model 3 and the significant sexual risk behaviors to examine whether the associations between HIV, age, and the odds of a birth in 2010 remain significant after accounting for possible selection factors.

Results

Table 1 includes descriptive statistics from 2010 for women of reproductive age in the HIV/NCD sample who tested HIV negative and positive; those who were included in the sample but refused testing; and the full female reproductive-age population of permanent residents in the Agincourt HDSS in 2009. Column 2 shows the level of significance for differences between HIV positive and negative women, and column 6 shows the level of significance for differences between the HIV/NCD sample and the population of women permanent residents aged 15-49 in Agincourt. Turning first to differences by HIV status, around 5% of women in each category had a birth in 2010, with no significant differences by HIV status. There are significant differences in the age composition of women by HIV status: women who tested HIV negative were more likely to be younger (15-19) whereas women who tested positive who were likely to be older (30-39). Around 94% of women who were tested for HIV had received some education and levels were similar regardless of HIV status. There were significant differences in marital status by HIV status: HIV negative women were more likely to be married and HIV positive women were more likely to be widowed, separated, and divorced. Additionally, HIV positive women's households had lower SES on average and were more often headed by women. HIV positive women had significantly higher parity in 2010, although a higher proportion of HIV negative women had a recent birth (not significant). Significantly more HIV positive women's households had experienced HIV/TB deaths in the past two years and child deaths in the past five years compared to HIV negative women's households. Around 23% of women who tested HIV positive reported currently using ART.

The HIV/NCD sample differed significantly from the full Agincourt population of reproductive-age women in several ways. The HIV/NCD sample had significantly more women aged 30 and above and was less educated on average, with a significantly higher proportion of women with no education and a lower proportion of women with some secondary education. Women in the HIV/NCD sample were also significantly more likely to be married or cohabiting and a higher proportion of women in the sample had been widowed compared to the full population of reproductive-age women in Agincourt. Women in the HIV/NCD sample had significantly lower household SES and were more likely to live in female-headed households. Finally, women in the HIV/NCD sample were significantly less likely to be living in households with a recent HIV/TB death (15.4%) compared to the full Agincourt sample (17.5%).

[TABLE 1 ABOUT HERE]

Table 2, Model 1 presents results from a baseline model predicting births in 2010 controlling for age. The results show no significant differences by HIV status but one difference by age: women in their 40s were significantly less likely than women in their 30s to have a birth in 2010 (OR=0.23, $p<0.001$). Model 2 adds an interaction term between age and HIV status. The main effect for HIV status is now significant and negative and the main effect for HIV negative women in their 20s is marginally significant ($p<0.10$). The interaction between being HIV positive and aged 20-29 is significant and positive. These results shows that the odds of having a birth in 2010 were significantly lower for HIV negative women, except for women in their 20s, who had almost 4 times the odds of having a birth than an HIV negative woman in her 20s. Model 3 adds socio-demographic control variables. The strong positive association between being HIV positive and aged 20-29 and having a birth in 2010 remains significant, although the main negative effect for HIV status drops to marginal significance ($p<0.10$). Having a birth in 2010 is significantly and positively associated with having some secondary education (marginal, $p < 0.10$) and parity ($p < 0.05$). The two measures of household SES are negatively associated with the likelihood of having a birth in 2010, but only marginally significant ($p<0.10$). Having had a birth in the previous two years is negatively associated with the odds of having a birth in 2010, which is what we would expect given the long birth intervals in South Africa (Timaeus and Moultrie, 2008). Model 4 includes an indicator of whether a woman reported using ART. All of the significant relationships from Model 3 retain their associations in Model 4. The relationship between ART use and the odds of having a birth in 2010 is positive but not significant. Even after including ART use in the model, women in their 20s who are HIV positive remain significantly more likely to have a birth in 2010 than HIV negative women in the same age group.

[TABLE 2 ABOUT HERE]

Table 3 presents statistical tests for differences in sexual risk behavior by HIV status. Panel 2 shows test results for differences between HIV positive and negative women in their 20s because of the higher fertility among HIV positive women in this age group. Turning to Table 3, Panel 1 the average age at first sex was around 17 for women regardless of HIV status. Significantly more HIV positive women reported having more than one ongoing sexual relationship (3.7% compared to 1.4% among negative women). Women had an average of 1 sexual partner in the past 24 months with HIV positive women reporting slightly more partners (marginally significant); additionally, the number of lifetime sexual partners was significantly higher among HIV positive women (3.1 compared to 2.0 among HIV negative women). HIV positive women were significantly more likely to report always using condoms with their most recent sexual partner (22.8%), whereas HIV negative women were significantly more likely to report never using condoms with their most recent sexual partner (66.1%). More HIV positive women reported experiencing forced sex (18.4% compared to 13.5%, marginally significant). HIV positive women were also significantly more likely to report that they had unsafe sex with someone they knew was HIV positive (4.0% compared to <1%) or that they did not know whether this had happened (5.8% compared to 2.2%). Finally, significantly more HIV positive women had tested positive for other STIs compared to HIV negative women (15.9% compared to 8.0%).

Table 3, Panel 2 shows several significant differences between HIV positive and negative women in their 20s. HIV positive women in this age group experienced sexual debut at a slightly younger age on average (17.1 compared to 17.4) than HIV negative women ($p<0.05$). This echoes previous studies that reported that selection for an earlier age at sexual debut was partly responsible for the higher fertility rates among HIV teen women (15-19) (Lewis et al., 2004; Zaba and Gregson, 1998). HIV positive women in their 20s were also significantly more likely to have more than one ongoing sexual partnership and a greater number of sexual partners in the past 24 months and over their lifetime. HIV positive women in their 20s were significantly more likely to report always using condoms compared to HIV negative women and less likely to report never using condoms. HIV positive women in this age group were significantly more likely to have tested positive for other STIs (14.8% compared to 6.8%) and had slightly older partners (by half a year on average) than HIV negative women in their 20s (marginally significant).

[TABLE 3 ABOUT HERE]

Table 4 presents results from a logistic regression model predicting births in 2010 by HIV status, socio-demographic characteristics, and sexual risk behaviors. The only risk factor associated with having a birth in 2010 was inconsistent condom use with the most recent sexual partner (marginally significant), which increased the odds of a birth. Notably, the higher odds of births among HIV positive women in their 20s compared to HIV negative women in their 20s persist despite the inclusion of sexual risk behaviors that might help explain this association, such as the age at sexual debut.

[TABLE 4 ABOUT HERE]

Discussion

These results highlight significant relationships between HIV status and births in rural northeastern South Africa. Our results show that HIV negative women overall had lower odds of having a birth compared to HIV positive women of all age groups, with one exception. We found that HIV positive women in their 20s were significantly more likely to have a birth compared to their HIV negative counterparts. As suggested previously (e.g., Lewis et al., 2004; Zaba and Gregson, 1998), some of these differences are likely associated with significant differences in sexual risk behaviors. In our study, HIV positive women in their 20s had significantly lower ages at first sex (although the difference on average was small), a higher number of lifetime sexual partners, were more likely to have had unprotected sex with someone they knew was HIV positive, and had higher rates of co-infection with other STIs.

Interestingly, we found that HIV positive women were significantly more likely to report always using condoms with their most recent sexual partner compared to HIV negative women (regardless of age). This is important because condom use is closely associated with the risks of both HIV transmission and pregnancy. One explanation for this difference may be the widespread disapproval of condom use in marriage and cohabiting relationships in South Africa (Maharaj and Cleland, 2004). In our sample, significantly fewer HIV positive women were married or cohabiting compared to HIV negative women (26.7% versus 38.2%, respectively, $X^2 = 26.7$, $p < 0.001$), which might help explain their higher likelihood of condom use. It may also be that more frequent condom use among HIV positive women and lower use among HIV negative women reflects the fact that women were aware of their HIV status prior to being tested in Agincourt, likely because of antenatal testing. HIV counselors in sub-Saharan Africa often encourage condom use among those who test HIV positive, which may result in some women abandoning more effective birth control methods for preventing pregnancy, such as hormonal contraceptives (Crankshaw et al., 2014). Thus, although condoms reduce the risk of HIV transmission, they may increase the risk of pregnancy among women who are not using other forms of contraception (especially if used inconsistently or improperly). Indeed, inconsistent condom use (using condoms "sometimes") was positively associated with having a birth in 2010. The measures of other forms of contraception in the Agincourt HDSS are limited to women who have been pregnant or had a child. Among the women in our sample who fit these characteristics, just over one third report using modern contraception (35% of those always, sometimes, or never using condoms, and 39% of those using condoms most of the time). For HIV positive women, 35% of women who always using condoms, 50% of those using condoms most of the time, 32% of those using condoms sometimes, and 27% of those who never use condoms report dual method use. Despite the limitations of these measures, they are relatively consistent with results from another study from South Africa that found 33% of the women sampled had ever used dual contraceptive methods (Morroni et al., 2006). Given the high rate of unwanted pregnancies and HIV in South Africa (Cooper et al., 2007; Manzini, 2001; Morroni et al., 2006; Pettifor et al., 2005), future research on HIV counseling and family planning efforts in the local area would help to better understand women's knowledge of dual method use, their motivations for using (or not using) dual contraceptive methods, and their access to and use of contraceptives prior to their first pregnancy.

South Africa's median age at first sex (18) has remained relatively stable over time (SADHS 2007). Yet, the median age at first marriage is on the rise (Statistics South Africa, 2010; Hosegood et al., 2009), which means that young people generally have longer periods of time during which they are having sex and must protect themselves from both HIV infection and unwanted pregnancy. An earlier age at sexual debut – which we found among HIV positive women in their 20s compared to HIV negative women in their 20s – further increases this window of time. As noted above, we also found differences in marriage by HIV status with fewer HIV positive women currently married – both because more of these women were never-married but also because more of these women were widowed, separated, and divorced. Studies from sub-Saharan Africa have found associations between union instability and a positive HIV status (e.g., Boileau et al., 2009). Although we cannot speculate on the direction of the relationship between HIV status and singlehood in Agincourt, these results suggest that HIV status is closely associated with the timing and extent of women's sexual experiences both inside and outside of marriage.

Our results echo earlier studies that documented lower fertility among HIV negative women (Lewis et al., 2004; Zaba and Gregson, 1998). However, our results are unique in that we find significant differences in births among women in their 20s by HIV status whereas earlier work from around sub-Saharan Africa found higher fertility rates among HIV positive women in their teens (15-19) (Lewis et al., 2004; Zaba and Gregson, 1998). Why the difference? It is likely that a combination of factors is responsible for our unique finding, including the postponement of first marriage in South Africa until the late 20s and higher levels of marital instability among HIV positive women compared to HIV negative women (e.g., Magadi and Agwanda, 2010). Our ability to draw clear conclusions about this association is limited by the small number of women aged 15-19 who tested HIV positive (n=17, 6.7% among women aged 15-19). However, the HIV/NCD study found that HIV prevalence in this age group was much lower than among other age groups at 5.5% (compared to 27.0% among women aged 20-24 and 37.8% among women aged 25-29) (Gómez-Olivé et al., 2013), suggesting that the percentage of HIV positive women aged 15-19 in our sample is generally consistent with the pattern of HIV prevalence among teen women in the Agincourt site.

Higher fertility among HIV positive women in their 20s is potentially problematic for several reasons. Fertility among untreated HIV positive women increases the risk of vertical transmission to the child and may result in AIDS orphanhood (UNAIDS, 2013). Additionally, insofar as some of the higher fertility among HIV positive women in their 20s is unintended, this suggests a continued lack of integration between HIV and family planning services in rural South Africa (Askew and Berer, 2003). Higher fertility among young HIV positive women may also contribute to high rates of maternal mortality due to AIDS (Garenne et al., 2008), especially if women are unaware of their status or are untreated.

Our analysis has some limitations. First, information about HIV status is only available in Agincourt in 2010-2011. This limits our ability to look at long term changes in fertility patterns by

HIV status as the AIDS epidemic has progressed and before and after ART became available. Second, although our sample of HIV positive women is sufficiently large (n=631), we lose statistical power once we start disaggregating by age and multiple other socio-demographic characteristics. Third, information about births is collected annually in Agincourt. This may result in an underestimation of pregnancies because it may miss those that end in stillbirths, miscarriages, or abortions between census rounds. For this reason we focus on births rather than pregnancies. Nonetheless, pregnancies among HIV positive women with advanced infections are associated with fetal loss (Gray et al., 1998); thus, our focus on births may underestimate some of the differences in reproductive experiences among HIV positive and negative women. Despite these limitations, our data are unique in linking information about HIV status to longitudinal data on socio-demographic characteristics collected since 1992. Additionally, the Agincourt site is characterized by extremely high rates of HIV, changing fertility and marriage patterns, and the recent availability of ART, providing a compelling context in which to examine these relationships.

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Table I: Descriptive Statistics for Respondents in 2010 (% or mean, sd)

Variables		HIV/NCD Sample HIV-		HIV+	Untested	Total		Agincourt Population
Birth in 2010		5.5		5.6	4.7	5.5		4.8
Age								
	15-19	19.0	***	2.7	3.8	13.0	***	25.0
	20-29	30.6		30.1	37.7	30.8	***	37.0
	30-39	28.2	***	43.6	37.7	33.6	***	21.8
	40-49	22.2		23.6	20.8	22.5	***	16.2
Education								
	None	5.5		6.9	0.9	5.7	***	4.1
	Primary	27.6		25.0	12.3	25.9		24.9
	Secondary	37.7		38.4	31.1	37.6	***	41.1
	Tertiary	29.3		29.8	55.7	30.8		29.9
Marital status								
	Never married	49.2		50.4	59.4	50.2	***	63.9
	Married	32.0	***	18.9	28.3	27.7	***	19.0
	Cohabiting	12.3		13.0	8.5	12.3	***	9.7
	Widowed	3.3	***	10.8	1.9	5.6	***	3.1
	Separated/Divorced	3.2	***	7.0	1.9	4.3		4.3
Household SES quintiles		3.2(1.4)	***	2.9(1.4)	3.8(1.3)	3.2(1.4)	***	3.3(1.4)
Female household head		34.7	***	54.0	41.5	41.2	**	38.6
Parity		2.2(2.2)	*	2.4(1.9)	1.8(1.5)	2.2(2.1)	***	1.6(1.9)
Recent birth (2008-2009)		18.7		16.6	16.0	17.9		18.2
Household HIV/TB Death (2008-2009)		12.8	***	20.5	15.1	15.4	**	17.5
Child death (2005-2009)		1.9	***	6.2	2.8	3.3		2.8
Previously tested for HIV		78.6		78.7	N/A	74.4		N/A
Using ART		N/A		22.9	N/A	22.9		N/A
N		1,241		628	106	1,975		8,646

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

Table II: Logistic Regression Models Predicting Births in Agincourt in 2010

Variables		Model 1 OR		Model 2 OR		Model 3 OR		Model 4 OR	
HIV positive		1.02		0.49	*	0.54	+	0.46	+
Age									
	15-19	0.94		0.72		1.38		1.58	
	20-29	0.99		0.56	+	0.87		1.14	
	30-39	1.00		1.00		1.00		1.00	
	40-49	0.23	***	0.16	**	0.11	***	0.13	**
HIV * Age									
	15-19			1.89		1.51		1.78	
	20-29			4.36	**	3.92	**	4.31	**
	30-39			1.00		1.00		1.00	
	40-49			2.87		2.86		2.82	
Education									
	None					1.00		1.00	
	Primary					4.04		4.14	
	Secondary					5.61	+	5.79	+
	Tertiary					5.47		5.60	
Marital status									
	Never married					1.00		1.00	
	Married					1.14		1.14	
	Cohabiting					0.99		0.99	
	Widowed					1.92		1.92	
	Separated/Divorced					1.42		1.43	
Household SES quintiles						0.85	+	0.86	+
Female household head						0.60	+	0.60	+
Parity						1.23	*	1.23	*
Recent birth						0.29	*	0.29	**
Recent HIV/TB death						1.11		1.11	
Recent child death						0.49		0.45	
Using ART								1.70	
Pseudo Chi2		0.025		0.037		0.077		0.079	
N		1,869		1,869		1,869		1,869	

*** p<0.001, ** p<0.01, * p<0.05, + p<0.10

Table III: Significance Tests for Differences in Risk Behaviors by HIV Status and Age

Variables	HIV positive Mean(sd) or %	HIV negative Mean(sd) or %		n	HIV positive*20s Mean(sd) or %	HIV negative*20s Mean(sd) or %		n
Age at first sex	17.6(0.09)	17.6(0.07)		1,776	17.1(0.15)	17.4(0.10)	*	557
>1 ongoing sexual relationship	3.7	1.4	**	1,869	7.4	2.1	**	569
Number of sexual partners (24 months)	1.1(0.03)	1.0(0.01)	+	1,776	1.3(0.04)	1.1(0.02)	**	557
Number of lifetime sexual partners	3.1(0.08)	2.0(0.04)	***	1,868	3.1(0.12)	2.4(0.08)	***	568
Condom use with most recent partner								
Always	22.8	11.3	***	1,634	21.9	12.3	**	545
Most of the time	2.9	4.3		1,634	2.7	4.2		545
Sometimes	17.6	18.3		1,634	24.1	23.2		545
Never	56.7	66.1	***	1,634	51.3	60.3	*	545
Forced sex[a]	18.4	14.5	+	1,597	13.9	16.4		547
Forced first sex[a]	15.8	13.5		1,717	13.3	15.6		554
Unsafe sex with HIV positive partner								
No	90.2	97.4	***	1,776	93.1	96.2		557
Yes	4.0	0.4	***	1,776	1.6	1.1		557
Don't know	5.8	2.2	***	1,776	5.3	2.7		557
Tested positive for STIs	15.9	8.0	***	1,869	14.8	6.8	**	569
Age difference with most recent partner	5.4(0.24)	5.3(0.16)		1,453	5.1(0.33)	4.6(0.21)	+	520
N	628	1,241		1,869	189	380		569

*** p<0.001, ** p<0.01, p<0.05, + p<0.10

[a] This item was not asked of women under age 18.

Table IV: Logistic Regression Models Predicting Births in 2010 by HIV Status and Risk Behaviors

Variables		OR	
HIV positive		0.60	
Age			
	15-19	2.04	
	20-29	0.87	
	30-39	1.00	
	40-49	0.16	**
HIV * Age			
	15-19	1.33	
	20-29	3.14	*
	30-39	1.00	
	40-49	1.25	
Education			
	None	1.00	
	Primary	2.76	
	Secondary	3.05	
	Tertiary	2.95	
Marital status			
	Never married	1.00	
	Married	0.97	
	Cohabiting	0.76	
	Widowed	3.40	+
	Separated/Divorced	0.62	
Household SES quintiles		0.81	*
Female household head		0.63	+
Parity		1.19	+
Recent birth		0.24	***
Recent HIV/TB death		1.09	
Recent child death		0.38	
Using ART		2.10	
Age at first sex		1.05	
>1 ongoing sexual relationship		0.80	
Number of sexual partners (24 months)		0.61	
Number of lifetime sexual partners		0.98	
Condom use with most recent partner			
	Always	1.00	
	Most of the time	2.41	
	Sometimes	2.02	+
	Never	1.66	

Unsafe sex with HIV positive partner	
No	1.00
Yes	1.73
Don't know	1.75
Tested positive for STIs	1.42
Age difference with most recent partner	0.96
Pseudo Chi2	0.094
N	1,453

*** p<0.001, ** p<0.01, * p<0.05, + p<0.10