

# The Social Legacy of AIDS: Fertility Aspirations Among HIV-Affected Women in Uganda

Rachel C. Snow, ScD, Massy Mutumba, RN, MPH, Kenneth Resnicow, PhD, and Godfrey Mugenyi, MD

Before the availability of antiretroviral therapy (ART) in Africa, women infected with HIV not only had reduced fecundability,<sup>1-4</sup> but also reduced fertility aspirations as many women, men, and health providers were opposed to continued childbearing by persons infected with HIV.<sup>5-7</sup> Qualitative studies reported that HIV-positive women were generally anxious to prevent conception,<sup>5,6</sup> and a majority of both men and women were planning fewer children because of AIDS.<sup>8</sup> In one study, only 10% of HIV-positive home-based care clients reported that they wanted more children.<sup>9</sup> Fertility aspirations varied by context and location,<sup>5,10,11</sup> but they were diminished by the perceived risk of perinatal transmission,<sup>5,11</sup> fear of dying and leaving children behind,<sup>8,12</sup> and by the previous death of a child,<sup>8,13</sup> and weighed against the underlying desire for children and the need to avoid childlessness or cement a relationship.<sup>6,8,10</sup> An early study in pretreatment Rwanda, for example, described a marginal decline in pregnancies among HIV-positive women, shaped in part by health fears, but also by whether women had achieved a desired fertility norm.<sup>14</sup>

As access to ART increased, several studies documented a rebound in fertility desires.<sup>15,16</sup> This included a 2005–2006 study of 501 HIV-positive women in Mbarara, Uganda (the same location as the current study), which found fertility desires positively associated with use of ART, and inverse to the World Health Organization (WHO) stage of illness.<sup>15</sup> In South Africa, Cooper et al. reported that HIV-positive patients (without access to care) felt that access to therapy for the prevention of mother-to-child transmission and ART would lead them to reconsider having children<sup>13</sup>; in 2009 the same authors modeled these effects, reporting that use of ART restored fertility desires among HIV-positive women, but not HIV-positive men.<sup>16</sup> Rebounding fertility desires were subsequently borne out by a documented increase in the incidence of pregnancy after ART across multiple African countries.<sup>17</sup>

**Objectives.** We investigated the impact of HIV status on fertility desires in Uganda.

**Methods.** We surveyed 1594 women aged 18 to 49 years visiting outpatient services at Mbarara Regional Hospital, from May through August 2010. Of these, 59.7% were HIV-positive; 96.4% of HIV-positive women were using antiretroviral therapy (ART). We used logistic regression models to examine relationships between HIV status and fertility desires, marital status, household structure, educational attainment, and household income.

**Results.** Among married women, HIV-positive status was significantly associated with a lower likelihood of desiring more children (27.7% vs 56.4% of HIV-negative women;  $\chi^2 = 39.97$ ;  $P < .001$ ). The difference remained highly significant net of age, parity, son parity, foster children, education, or household income. HIV-positive women were more likely to be poor, unmarried, single heads of household, in second marriages (if married), living with an HIV-positive spouse, and supporting foster children.

**Conclusions.** We found a strong association between positive HIV status and lower fertility aspirations among married women in Uganda, irrespective of ART status. Although the increasing availability of ART is a tremendous public health achievement, women affected by HIV have numerous continuing social needs. (*Am J Public Health.* 2013;103:278–285. doi:10.2105/AJPH.2012.300892)

Yet, even where ART is widely available, the lingering social consequences of endemic HIV can be significant, and may reduce the desire for children. A recent study comparing the fertility desires of HIV-positive to HIV-negative women in South Africa, in a context of widely available ART, reported significantly lower fertility aspirations among women with HIV-positive status, irrespective of ART use.<sup>18</sup> We theorized that the observed association in South Africa is shaped, in part, by individual and household legacies of the HIV/AIDS epidemic, such as the increased burden of caring for AIDS orphans<sup>5</sup>; more female-headed households<sup>19</sup>; increased rates of divorce, widowhood, and second marriages<sup>12,19,20</sup>; HIV-related illness among family members<sup>21,22</sup>; and the decline in household livelihoods.<sup>23-25</sup> Several of these factors are known to curtail fertility desires.<sup>5,8,13,23,26,27</sup>

We undertook the present study in Uganda to examine the impact of women's HIV status on their desire for future children, in a

context of widely available ART, a sustained AIDS epidemic, and exceptionally high fertility norms (i.e., total fertility rate of 6.7<sup>28</sup>), even for the continent of Africa.

Uganda was among the first countries in Africa to experience a high and generalized HIV epidemic, with an estimated adult prevalence of more than 30% in the early 1990s.<sup>29</sup> The epidemic declined precipitously in the past decade, to an adult prevalence of 6.4% in 2009,<sup>30</sup> because of a combination of reduced incident infections, and high HIV-related mortality in the early years of the epidemic.<sup>31,32</sup>

The context of widely available ART, a sustained AIDS epidemic, and high fertility norms enabled us to examine not only whether HIV status differentiates women in terms of fertility aspirations, but also whether such an association is explained, in part, by the social legacies of AIDS such as having an HIV-positive spouse, lower household income, widowhood or second marriage, the presence of foster children, or having an HIV-positive child in the household.

## METHODS

We collected survey data from 1597 women aged 18 to 49 years attending outpatient clinics from May through August 2010 at Mbarara Regional Referral Hospital in Uganda. Participants were identified in the waiting rooms of 2 clinical services: the immune suppression service, serving HIV-positive men and women, and the general outpatient department, serving all patients for nonacute conditions. To facilitate comparison, our recruitment target was 40% to 60% HIV-positive women. We monitored self-reported HIV status among the enrolled participants on a rolling basis, and adjusted recruitment in the 2 clinics accordingly.

Mbarara Regional Referral Hospital is a public 260-bed hospital located in southwestern Uganda, approximately 260 kilometers from Kampala, the capital city. The hospital also functions as a teaching hospital for Mbarara University of Science and Technology Medical School. The immune suppression service clinic was established in 1998, and is currently 1 of 3 HIV treatment centers in Mbarara municipality. The clinic serves approximately 13 000 patients, 65% of whom are female. Given the hospital's status as a regional referral hospital, the outpatient department receives more than 1000 patients each week.

### Data Collection

This was a cross-sectional, facility-based study; trained patient trackers approached women in the waiting rooms, and assessed their eligibility to participate in the study, based on whether they self-reported having had a previous HIV test (test outcome was not asked at recruitment). All recruited patients then proceeded to an adjoining research area for their interviews. All women aged 18 to 49 years who had ever been tested for HIV were eligible to participate in the study. We chose a lower age limit of 18 years because this is the age of majority in Uganda, when a person can provide consent. Eligibility was not limited to any residential location. Patients were given 1 kilogram of sugar or a bar of soap for their participation.

Piloting and refinement of the survey instrument and recruitment procedures included an initial 210 interviews at the immune

suppression service and outpatient clinics, and 3 extended participatory reviews by the full study team. We appraised and adjusted 4 different components: recruitment, location of interviews, presence of others in the interview rooms, and the content and sequence of the questionnaires; we undertook 3 successive iterations before we finalized process and content. The 210 pilot interviews were not included in the final 1597 interviews.

Five trained Ugandan team members conducted interviews in Runyakore, Luganda, and English, the predominant languages in Mbarara. Women were interviewed for approximately 30 minutes on their reproductive history, fertility desires, contraceptive use and abortion history, sexual and marital relationships, experience of HIV/AIDS, and numerous attitudinal scales regarding HIV and fertility. Data on contraceptive use is reported separately. No identifiable information was collected to ensure anonymity of survey responses; respondents were assigned randomly generated numbers, and interviews were conducted in closed offices to ensure privacy.

### Data Analysis and Statistics

Survey data were coded and entered into ACCESS 2007 (Microsoft, Redmond, WA), in Mbarara within 24 hours of collection, allowing immediate review of entries, and quality control on site. Data were then transferred into SAS version 9.2 (SAS Institute, Cary, NC) for statistical analysis, including descriptive statistics, stratified analyses, and logistic regression.

During piloting it became clear that women did not distinguish between being legally married and living as if married, and, therefore, responses were coded as "married or living with a partner as if married," without distinction of legal marital status. Descriptive statistics are presented for all women irrespective of marital status, allowing us to compare groups by HIV status. However, we restricted the analysis of fertility aspirations, the main outcome of this paper, to women who were "married or living with a partner as if married." This restricted analysis enabled us to examine women's fertility aspirations within the context of an intimate relationship, a state that significantly increases the likelihood that women report wanting more children, whether now or in the future.<sup>16</sup>

Women self-reported HIV status: personal awareness of HIV status is nearly universal among persons attending clinical services in Mbarara Regional Referral Hospital because HIV testing is implemented within the course of routine clinical care in all clinics. Among HIV-positive women, open discussion of CD4 counts is routine, both between patients and their health care providers and among HIV-positive persons. Seventy-six percent of married women reported knowing the HIV status of their partners. We intended to examine the effects of female HIV status on fertility desires while we controlled for her male partner's HIV status. However, the male partners' reported status was highly correlated with the women's status and the discordant cells were too small (only 18 HIV-positive women had an HIV-negative spouse) to allow both variables in the model without concern for collinearity or adequacy of power within cells.

Interest in future childbearing was asked in 2 ways: through a direct question asking "Would you like to have another child/children in the future?" (yes or no); and through a 5-point Likert scale asking women whether they agreed with the statement: "I still want to give birth to more children." We recoded Likert scale responses as yes or no (agree or strongly agree = yes; all others = no), and we ran regression analyses in duplicate using both the direct question responses and the recoded Likert scale responses as the outcome variables; the analyses generated nearly identical outcomes, affirming the internal consistency of the responses. For brevity, we only present the regression results based on women's responses to the direct question.

The principal analysis assessed the desire for future offspring in HIV-positive and HIV-negative married women. Tests of statistical inference used 95% confidence intervals (CIs) of the odds ratio (OR) and the  $\chi^2$  test. To adjust for differences in demographic characteristics and behavior between HIV-positive and HIV-negative women, we estimated ORs by binary logistic regression. Several variables examined in the unadjusted analysis were collinear and, therefore, we selectively excluded them from the multivariate models. For example, spouse's HIV status corresponded to women's HIV status in 70% of the cases reported; therefore, we only included women's HIV status. In the case of collinearity between overall parity (number of

living children) and son parity (having a son), we present separate models with each of these variables. Except for those found to be collinear, we included all covariates of theoretical significance in the multivariate regression models.

Covariates included age (categorical variable), overall parity (continuous variable), son parity (none vs any), foster children younger than 18 years living in the household (none vs any), household income (categorical variable), women's educational attainment (none or any primary vs  $\geq$  any secondary), second marriage (vs first), and presence of an HIV-positive child in the household (yes or no). We assessed goodness of fit by the log-likelihood ratio.

## RESULTS

A total of 1597 women participated in the survey, with high compliance among all women approached. We removed 3 cases for incomplete data, leaving a total sample of 1594 women. Based on self-reported HIV status, 59.7% ( $n = 951$ ) of participants were HIV-positive, and 40.3% ( $n = 643$ ) were HIV-negative. Consistent with recruitment undertaken within a regional referral hospital offering HIV/AIDS care, 96.4% of HIV-positive women were currently taking ART. HIV-positive women were slightly (but significantly) older than HIV-negative women and, therefore, all statistical comparisons between HIV-positive and HIV-negative women presented in Tables 1 and 2 are age-adjusted. Women with HIV had lower educational attainment: only 30% reported more than primary education, whereas nearly half (49.6%) of HIV-negative women had achieved this level of schooling ( $\chi^2[df=1] = 100.2$ ;  $P < .001$ ). HIV-positive women also reported a lower distribution of household income ( $\chi^2[df=1] = 53.4$ ;  $P < .001$ ; Table 1).

### HIV, Marital History, and Household Composition

HIV-positive women were significantly less likely than HIV-negative women to be currently married or living with a partner as if married, even after we controlled for age (53.6% vs 82.1%;  $\chi^2[df=1] = 100.2$ ;  $P < .001$ ), but they were also significantly less likely to have ever entered into marriage (83.4% vs 90.2%, respectively; Mantel-Haenszel age-adjusted

comparison of odds:  $\chi^2[df=1] = 18.6$ ;  $P < .001$ ; Table 1). An ever-married HIV-positive woman had a much higher probability of having been divorced or separated (31.9% vs 18.1%) or widowed (21.2% vs 4.1%), compared with ever-married HIV-negative women ( $\chi^2[df=1] = 88.7$ ;  $P < .001$ ). Among the currently married, HIV-positive women were much more likely than HIV-negative women to be in a second marriage (29.4% vs 15.7%; age-adjusted  $\chi^2[df=1] = 16.3$ ;  $P < .001$ ).

A majority of married women (76% overall), reported knowing the HIV status of their partners: 82.9% of HIV-positive women and 71.2% of HIV-negative women. Of these, 82.5% of HIV-positive women reported that their partners were also HIV-positive, whereas only 4.7% of HIV-negative women believed their partners were positive for HIV. Comparatively few women ( $n = 155$ ), reported having an HIV-positive child of their own in the household, and all of these women were HIV-positive.

The current household composition of women (Table 2) highlights the fact that many HIV-positive women are heading households with dependents. HIV-positive women were almost 4 times more likely to be living in a single-parent household (37.2% vs 10.2%). Correspondingly, a greater proportion of HIV-negative women (78.8%) lived in monogamous (or extended monogamous, i.e., monogamous couples with children plus nonnuclear family members) households, compared with only 50.4% of HIV-positive women.

The average lifetime parity of women with HIV was almost a full child greater than among HIV-negative women, but there was no difference in age-adjusted parity ( $P = .797$ ). Approximately half of all women (54.3%) reported caring for foster children, and this was marginally, but significantly, higher among HIV-positive women (Table 2).

### HIV and Fertility Aspirations

This analysis was restricted to women who were married or living with a partner as if married, and all comparisons between HIV-positive and HIV-negative married women in Table 3 are age-adjusted. The desire for future children was significantly lower among women with HIV relative to HIV-negative women (27.7% vs 56.4%, respectively;  $\chi^2 = 39.97$ ;  $P < .001$ ).

Among pregnant respondents, 36.5% of HIV-positive woman felt their current pregnancy was a "big problem," and another 12.2% a "small problem"; this contrasted sharply with responses among HIV-negative women, for whom only 11% found their current pregnancy a "big problem" and only 8% a "small problem" (age-adjusted  $\chi^2[df=1] = 18.4$ ;  $P < .001$ ). The survey questions did not elaborate on what women meant by "problem."

Married partners of HIV-positive women were significantly less likely to desire more children than partners of HIV-negative women, at least as reported by the women themselves (Table 3). Overall, three quarters of couples agreed on whether to have more children, but agreements were significantly higher among couples including HIV-negative women (81.0% vs 69.3%, respectively). Another notable difference was that couples including HIV-positive women were significantly more likely to agree that they wanted no more children (39.8%) compared with couples including HIV-negative women (23.3%), again, based on women's reports of the partners' desires. HIV-positive women were also significantly more likely to report discordant preferences in which they wanted no more children, but their partner wanted more children (12%, compared with 5.2% among the couples that included HIV-negative women).

Differences in fertility aspirations did not appear to reflect underlying differences in fertility ideals that might have preceded HIV infection. Women were asked to recall their ideal number of sons and daughters before starting a family. The resulting distributions did not differ by HIV status; a majority of both HIV-positive and HIV-negative women reported a desire for 2 sons and 2 daughters (data not shown).

### Predictors of Fertility Aspirations

The log odds of desiring more children are presented in Table 4, with unadjusted odds in the first column, and adjusted odds thereafter. Adjusted models include all covariates listed in the table, unless otherwise noted (as NA). As shown, a woman's HIV-positive status was associated with an almost 70% lower likelihood of desiring more children. Other HIV-related variables, such as having an HIV-positive spouse or a child living with HIV, show similarly strong effects. Likewise, the presence of a foster child younger than 18 years living

**TABLE 1—Age Distribution, Educational Attainment, Marital Status, Marital History, Spousal HIV Status, and Child HIV Status Among HIV-Positive and HIV-Negative Women: Mbarara, Uganda, 2010**

Characteristic	Total (n = 1594), No. (%) or Mean ±SD	HIV-Positive (n = 951), No. (%) or Mean ±SD	HIV-Negative (n = 643), No. (%) or Mean ±SD	$\chi^2(df = 1)^a$	P
<b>Age, y</b>					
≤ 24	364 (23)	113 (12) <sup>a</sup>	251 (39) <sup>a</sup>		
25-29	354 (22)	184 (19)	169 (26)		
30-34	351 (22)	236 (25)	115 (18)		
35-39	242 (15)	194 (20)	48 (8)		
≥ 40	284 (18)	224 (24)	60 (9)		
Mean	31.1 ±7.6	33.3 ±7.2	27.8 ±7		
<b>Educational attainment</b>					
No schooling	182 (11.4)	151 (15.8)	31 (4.8)	57.5	< .001
Some primary	867 (54.4)	558 (58.7)	308 (47.9)		
> primary education	545 (34.2)	242 (25.4)	303 (47.1)		
<b>Monthly household income, UGX</b>					
0-50 000	664 (41.8)	472 (49.8)	192 (29.9)	53.4	< .001
50 001-150 000	448 (28.2)	246 (26.0)	201 (31.3)		
≥ 150 001	478 (30.1)	229 (24.2)	249 (38.8)		
<b>Currently married or living as if married</b>					
Current marriage is a 2nd marriage	1039 (65.1)	510 (53.6)	528 (82.1)	100.2	< .001
First marriage resulted in:	233 (22.5)	150 (29.4)	83 (15.7)	16.3	< .001
Separation or divorce	176 (77.9)	108 (75.0)	68 (82.9)	1.56	.212
Widowhood	50 (22.1)	36 (25.0)	14 (17.1)		
<b>Currently unmarried women</b>					
Of currently unmarried women, how many were:	556 (34.9)	441 (46.4)	115 (17.9)	8.23	.016
Ever separated or divorced	182 (33.4)	145 (33.3)	37 (33.6)		
Ever widowed	142 (26.1)	132 (30.3)	10 (9.1)		
Never married	221 (40.6)	158 (36.3)	63 (57.3)		
<b>Ever-married women</b>					
Of ever-married women, how many were:	1374 (86.1)	793 (83.4)	580 (90.2)	18.6	< .001
Ever separated or divorced	358 (26.1)	253 (31.9)	105 (18.1)	88.7	< .001
Ever widowed	192 (14.0)	168 (21.2)	24 (4.1)		
<b>Spouse's HIV status<sup>b</sup></b>					
HIV-positive	362 (35.2)	344 (68.4)	18 (3.4)	448.4	< .001
HIV-negative	436 (42.4)	73 (14.5)	362 (69.0)		
Don't know	231 (22.5)	86 (17.1)	154 (27.6)		
<b>Women with ≥ 1 child HIV-positive</b>					
Women currently on antiretroviral therapy	155 (9.7)	155 (16)	0 (0)	102.8	< .001
	917 (NA)	917 (96.4)	NA		

Note. NA = not applicable; UGX = Ugandan shillings. The sample size was n = 1594.

<sup>a</sup>We ran a Cochran-Mantel-Haenszel test to generate an age-adjusted  $\chi^2$  comparing women by HIV status.

<sup>b</sup>Spousal (male) HIV status is as reported by women in the survey.

in the household was associated with lower fertility aspirations, and having 1 or more sons was associated with a significant reduction in the desire for children. Consistent with international norms, there was a suppression of fertility aspirations with age and parity. In this study, higher income and education were

associated with a greater interest in having more children.

After we adjusted for all covariates, HIV-positive status remained significantly negatively associated with the desire for more children (HIV-positive vs HIV-negative women: adjusted OR = 0.46; 95% CI = 0.33,

0.65), as was being aged 40 years or older, overall parity (number of living children), and the presence of a foster child in the household. A higher level of income continued to have a positive association with fertility aspirations.

We were interested in the extent to which son preference in Uganda may affect other

**TABLE 2—Household Composition of HIV-Positive and HIV-Negative Women: Mbarara, Uganda, 2010**

Characteristic	Total (n = 1594), No. (%) or Mean SE	HIV-Positive (n = 951), No. (%) or Mean SE	HIV-Negative (n = 643), No. (%) or Mean SE	$\chi^2$ (df = 1) <sup>a</sup>	P
Type of household				100.8	< .001
Single householder (woman alone)	57 (3.6)	35 (3.7)	22 (3.4)		
Single-parent household (woman + children)	279 (17.6)	232 (24.6)	47 (7.4)		
Extended single-parent household (woman + children + other family)	137 (8.6)	119 (12.6)	18 (2.8)		
Monogamous household (woman + husband + children)	705 (44.5)	326 (34.6)	378 (59.2)		
Extended monogamous household (woman + husband + children + other family)	274 (17.3)	149 (15.8)	125 (19.6)		
Other collective household	131 (8.3)	82 (8.7)	49 (7.7)		
No. of birth children in lifetime	3.0 ± 2.0	3.4 ± 2.0	2.5 ± 2.0		.797 <sup>a</sup>
Women providing care for foster children of any age, in or outside the household	866 (54.3)	565 (59.5)	301 (47.0)		.038 <sup>a</sup>
Women with foster children < 18 y living in the household	502 (31.5)	327 (34.4)	175 (27.2)		.453 <sup>a</sup>

<sup>a</sup>Comparison of age-adjusted means or percentages, by HIV status. The sample size was n = 1594.

determinants of fertility aspirations, as this has not been reported previously in Uganda. However, having son parity (having at least 1 son) and overall parity were collinear. Therefore, we present 2 multivariate models, one including overall parity, and the second including son parity (Table 4). Both variables

were positively associated with reduced fertility desires, but son parity had the greater impact (adjusted OR = 0.31; 95% CI = 0.23, 0.44). When we substituted son parity for overall parity, the effect of a woman's age became more significant, suggesting that overall parity was a negative confounder for age.

Income was still positively associated with the desire for more children, although this variable had less impact when we included son parity. The presence of a foster child younger than 18 years in the household was consistently associated with a decline in fertility aspirations, net of all

**TABLE 3—Impact of HIV Status on the Desire for Children in the Future, and Whether a Future or Current Pregnancy Is Regarded as a Problem: Mbarara, Uganda, 2010**

Characteristic	Total (n = 1039), No. (%)	HIV-Positive (n = 510), No. (%)	HIV-Negative (n = 528), No. (%)	$\chi^2$ (df = 1) <sup>a</sup>	P
Women who want more children in future	440 (42.4)	141 (27.7)	298 (56.4)	39.97	< .001
Would pregnancy be a problem? <sup>b</sup>				17.42	< .001
A big problem	351 (53.5)	204 (60.2)	147 (46.5)		
A small problem	96 (14.6)	29 (8.6)	66 (20.9)		
No problem at all	171 (26.1)	83 (24.5)	88 (27.9)		
Cannot get pregnant or not having sexual intercourse	38 (5.8)	23 (6.8)	15 (4.8)		
Currently pregnant	237 (22.8)	74 (14.5)	163 (30.9)		
Is this pregnancy a problem? <sup>c</sup>				18.4	< .001
A big problem	45 (19.0)	27 (36.5)	18 (11.0)		
A small problem	22 (9.3)	9 (12.2)	13 (8.0)		
No problem at all	170 (71.7)	38 (51.4)	132 (81.0)		
Partner wants more children in future	477 (45.9)	175 (34.3)	302 (57.2)	21.2	< .001
Agreement between partners about future children <sup>d</sup>				35.3	< .001
Both want future children	395 (44.6)	120 (29.5)	275 (57.7)		
Both do not want future children	273 (30.9)	162 (39.8)	111 (23.3)		
Discordant woman (no) and man (yes)	74 (8.4)	49 (12.0)	25 (5.2)		
Discordant woman (yes) and man (no)	43 (4.8)	19 (4.7)	23 (4.8)		
Others <sup>e</sup>	100 (11.3)	57 (14.0)	43 (9.0)		

Note. Sample includes only women who are married, or living with someone as if married; statistical comparisons are age-adjusted (n = 1039).

<sup>a</sup>We ran a Cochran-Mantel-Haenszel test to compare the age-adjusted odds of each outcome, by HIV status.

<sup>b</sup>Includes all married, nonpregnant participants (n = 892), of whom 656 answered the question.

<sup>c</sup>Includes all married, currently pregnant participants (n = 237), all of whom answered the question.

<sup>d</sup>Total = 885 couples; HIV-positive = 407 couples; HIV-negative = 477 couples.

<sup>e</sup>Data were not provided on partner's preference for future children.

**TABLE 4—The Unadjusted and Adjusted Log Odds of Wanting More Children in the Future, Including Adjusted Model With Overall Parity, and With Son Parity: Mbarara, Uganda, 2010**

Characteristics	Unadjusted OR (95% CI)	Model With Overall Parity (n = 925), Adjusted <sup>a</sup> OR (95% CI)	Model With Son Parity (n = 938), Adjusted <sup>a</sup> OR (95% CI)
<b>HIV status</b>			
HIV-negative (n = 528; Ref)	1.000	1.000	1.000
HIV-positive (n = 510)	0.295 (0.228, 0.382)	0.461 (0.326, 0.653)	0.474 (0.341, 0.659)
<b>Age, y</b>			
≤ 24 (Ref)	1.000	1.000	1.000
25-29	0.559 (0.394, 0.793)	1.108 (0.722, 1.700)	0.764 (0.513, 1.138)
30-34	0.287 (0.199, 0.414)	0.979 (0.609, 1.573)	0.426 (0.280, 0.649)
35-39	0.124 (0.046, 0.204)	1.193 (0.622, 2.289)	0.276 (0.159, 0.482)
≥ 40	0.071 (0.040, 0.125)	0.346 (0.160, 0.750)	0.098 (0.049, 0.200)
<b>Educational attainment</b>			
Any primary (Ref)	1.000	1.000	1.000
≥ secondary	1.892 (1.453, 2.465)	1.004 (0.709, 1.42)	1.363 (0.984, 1.889)
Parity (continuous)	0.473 (0.425, 0.526)	0.505 (0.439, 0.581)	NA
<b>Son parity (categorical)</b>			
0 (Ref)	1.000	1.000	1.000
≥ 1	0.249 (0.184, 0.337)	NA	0.313 (0.225, 0.435)
<b>Foster child &lt; 18 y in household (categorical)</b>			
0 (Ref)	1.000	1.000	1.000
≥ 1	0.525 (0.399, 0.691)	0.638 (0.450, 0.904)	0.657 (0.472, 0.915)
<b>Household income, UGX</b>			
0-50 000 (Ref)	1.000	1.000	1.000
50 001-150 000	1.430 (1.039, 1.969)	1.306 (0.872, 1.958)	1.109 (0.754, 1.632)
≥ 150 001	1.990 (1.461, 2.711)	2.006 (1.325, 3.036)	1.590 (1.075, 2.354)
<b>Partner HIV status</b>			
HIV-negative (Ref)	1.000	1.000	1.000
HIV-positive	0.249 (0.184, 0.338)	NA	NA
Don't know	0.594 (0.431, 0.820)		
<b>HIV-positive child in household</b>			
No (Ref)	1.000	1.000	1.000
Yes	0.320 (0.190, 0.539)	0.740 (0.387, 1.415)	0.610 (0.324, 1.149)
<b>Current marriage</b>			
First marriage (Ref)	1.000	1.000	1.000
Second marriage	0.602 (0.444, 0.818)	0.987 (0.664, 1.467)	0.805 (0.550, 1.177)

Note. CI = confidence interval; NA = not applicable; OR = odds ratio; UGX = Ugandan shillings. Analysis includes all women currently married or living with someone as if married (n = 1039).  
<sup>a</sup>Adjusted for all variables in the table, unless indicated by NA.

other factors (adjusted OR = 0.68; 95% CI = 0.47, 0.92).

## DISCUSSION

We found that positive HIV status, even in a context of routine access to ART, is associated with a lower likelihood of wanting more children. Kaida et al.<sup>18</sup> documented such an association in South Africa; here we report the same in Uganda.

The magnitude of the observed association between HIV-positive status and fertility desires was slightly greater in South Africa than what we found in Uganda, in both bivariate and multivariate models; this may reflect the higher underlying fertility norms in Uganda. Our sample size was larger, which may explain the greater differentiation by age in our multivariate models, but the overall message of these 2 studies is the same (i.e., that after we

controlled for numerous potential confounding factors such as age, parity, income, and education, HIV-positive status was associated with lower fertility aspirations). In the Kaida et al. study, use of ART did not change that association<sup>18</sup>; in our study, the association was observed despite nearly universal use of ART.

These findings are consistent with results from a recent analysis of Demographic Health Survey data in East African countries, in which

women found to be HIV-positive through Demographic Health Survey–based HIV testing, and who also reported undergoing an HIV test within the past year (and were therefore presumed to be aware of their status), were significantly more likely to report desiring no more children, compared with either HIV-positive women who had not undergone HIV testing in the past year or HIV-negative women.<sup>33</sup>

Examined collectively, data on HIV status and fertility aspirations in Africa suggest a historic progression in the impact of HIV/AIDS on fertility desires. In circumstances of endemic HIV/AIDS without treatment, the data suggest that HIV suppressed fertility aspirations because of realistic fears of child and adult death.<sup>5–10,13,14</sup> Introduction of both access to therapy for the prevention of mother-to-child transmission and ART led to an apparent rebound in fertility desires, documented by differences in fertility between treated and untreated women.<sup>15–17</sup> With increased availability of HIV care, the distinction in fertility desires between those on ART and those not on ART may be eroding, because treated and untreated groups may be equally healthy. Two recent articles support this last possibility, reporting that use or nonuse of ART made no difference in the fertility desires of HIV-positive women in South Africa<sup>18</sup> or Uganda,<sup>34</sup> both countries with widespread availability of HIV care.

Yet, in countries still coping with the consequences of 2 decades of untreated AIDS (e.g., Uganda and South Africa), fertility aspirations may still differ between women with and without HIV because of intrinsic consequences of the infection, including the burden of caring for one's self or an HIV-positive child or spouse, having foster children in the home, or having fewer financial resources because of HIV/AIDS.<sup>18</sup> In our study, each of these factors was significantly associated with lower fertility desires, or of borderline significance in the expected direction, and pregnancy itself was more likely to be characterized as a problem among HIV-positive women. Although foster children cannot necessarily be attributed to AIDS, in a country with high AIDS-related mortality, a significant proportion of these foster children are likely to reflect AIDS-related family deaths, and the burden of caring for AIDS orphans has been shown to curtail fertility.<sup>5</sup>

There is some evidence that having sons reduces the urgency of further childbearing in Africa,<sup>35,36</sup> if less well-documented than in South or East Asia.<sup>37,38</sup> We found that having 1 or more sons lowered fertility aspirations net of other factors, including HIV status.

### Limitations

A limitation of the present study is that HIV status was self-reported. Despite an atmosphere in which many clients were observed freely discussing their HIV status and CD4 counts in waiting rooms, the risk of misclassification is nonetheless real, and raises the possibility that some proportion of those 643 women reporting that they were HIV-negative were, in fact, HIV-positive. If that were the case, the statistical significance of findings reported here would likely represent a conservative estimation of the true differences.

We restricted our analysis of fertility aspirations to women who were married, or living with someone as if married, because it enabled us to examine the effects of parity, first versus second marriage, and spousal effects, within simplified multivariate models. Being in an intimate relationship significantly increases the likelihood that women report desiring more children, whether now or in the future,<sup>16</sup> and, therefore, our subsample likely had higher fertility aspirations than the full sample. However, given that HIV-positive women were less likely to be married in this population, inclusion of all women would likely have magnified the observed association between HIV status and fertility desire.

A finding of lower fertility desires among HIV-positive women, in itself, suggests no unmet need for family planning, but the finding that a third of pregnant HIV-positive women regarded their pregnancy as some form of “serious problem” begs further investigation. The nature of the “problem” needs to be clarified, but especially whether this reflects an unmet need for contraceptive services, ambiguous fertility desires, or differences in conjugal fertility aspirations. Contraceptive prevalence among HIV-positive women is much higher than the general population in Uganda,<sup>13,39</sup> with 82% of HIV-positive women in Mbarara reporting use of a barrier method in the past 3 months, and 28% reporting use of hormonal methods, alone or as dual protection,<sup>39</sup> compared with only 18% of all

Ugandan women reporting current use of modern contraception.<sup>28</sup> Contraceptive needs among HIV-positive women is the focus of an ongoing study in Mbarara.

A further drawback of the current study is that it cannot distinguish which individual conditions are most important to the observed lower fertility desires among HIV-positive women. In her seminal work on women's household labor in Kenya, Watkins documented that even in a context of high social desirability of large families, the burdens of childcare, in and of themselves, heighten women's desire to control and limit fertility.<sup>40</sup> The daily care of HIV-infected family members, even with ART, is considerable,<sup>20,34</sup> and plausibly a deterrent to future childbearing in Mbarara. But HIV-positive women in this study also have lower household incomes, less education, and more dependents. Lesthaeghe has argued that limiting childbirth can be a response to sustained economic hardship,<sup>41</sup> a thesis supported by recent observations from South Africa,<sup>22</sup> where AIDS mortality has heightened women's economic burden. It is plausible that lower fertility desires among HIV-positive women in Mbarara are secondary to economic stress.

### Conclusions

Our findings suggest a strong association between positive HIV status and lower fertility aspirations among married women in Uganda, and this association exists despite almost universal use of ART. Overall, women affected by HIV are coping with lower household incomes, less education, a greater likelihood of divorce or widowhood, and a greater chance that they are the head of household. Their lower desire for children is negatively affected not only by their HIV status, but also by the presence of foster children, lower household income, and lower son parity. Although the increasing availability of ART is a tremendous public health achievement, women most directly affected by HIV have numerous and continuing social needs. ■

### About the Authors

Rachel C. Snow, Massy Mutumba, and Kenneth Resnicow are with the Department of Health Behavior and Health Education, University of Michigan School of Public Health, Ann Arbor. Godfrey Mugenyi is with Department of Obstetrics and Gynecology, Mbarara University of Science and Technology School of Medicine, Mbarara, Uganda.

Correspondence should be sent to Rachel C. Snow, University of Michigan School of Public Health, Department of Health Behavior and Health Education, Ann Arbor, MI 48109 (e-mail: rcsnow@umich.edu). Reprints can be ordered at <http://www.ajph.org> by clicking the "Reprints" link. This article was accepted May 4, 2012.

## Contributors

R. C. Snow and M. Mutumba designed the study and drafted the survey instruments. R. C. Snow oversaw the finalization of instruments, guided the execution and interpretation of the data analysis, and assumed responsibility for drafting and editing the article. M. Mutumba oversaw data collection and data coding in Mbarara, carried out statistical analysis, and contributed to the interpretation of data and editing the article. K. Resnicow contributed to the design of the study and instruments, provided critical advice on the analysis of data, and contributed to editing the article. G. Mugenyi contributed to the overall study design and the execution of the survey, the interpretation of findings, and the editing of the article. All authors read and approved the final version.

## Acknowledgments

We gratefully acknowledge financial support from the following units at the University of Michigan: the Center for Global Health, the Experiential Learning Fund, and the African Studies Center.

We are grateful to Gregory Powers, Lindsey Evans, Joy Kabasindi, Lenard Abesiga, Tegan Ford, Edith Rukundo, Ditty Mutumba, and Nicholas Musinguzi for their contributions to data collection and management.

## Human Participant Protection

Permission to undertake the study was granted by the Faculty of Medicine Research and Ethics Committee and the Institutional Ethics Review Board of Mbarara University of Science and Technology, the University of Michigan Institutional Ethics Review Board, and the Uganda National Council for Science and Technology Institutional Review Committee.

## References

- Ross A, Van der Paal L, Lubega R, Mayanja BN, Shafer LA, Whitworth J. HIV-1 disease progression and fertility: the incidence of recognized pregnancy and pregnancy outcome in Uganda. *AIDS*. 2004;18(5):799–804.
- Lewis JJ, Ronsmans C, Ezeh A, Gregson S. The population impact of HIV on fertility in sub-Saharan Africa. *AIDS*. 2004;18(suppl 2):S35–S43.
- Gray RH, Wawer MJ, Serwada N, et al. Population-based study of fertility in women with HIV-1 infection in Uganda. *Lancet*. 1998;351(9096):98–103.
- Desgrées du Loué A, Msellati P, Yao A, et al. Impaired fertility in HIV-1-infected pregnant women: a clinic-based survey in Abidjan, Cote d'Ivoire, 1997. *AIDS*. 1999;13(4):517–521.
- Rutenber N, Biddlecom AE, Kaona FA. Reproductive decision-making in the context of HIV and AIDS: a qualitative study in Ndola, Zambia. *Int Fam Plann Perspect*. 2000;26(3):124–130.
- Feldman R, Maposhere C. Safer sex and reproductive choice: findings from "Positive Women: Voices and Choices" in Zimbabwe. *Reprod Health Matters*. 2003;11(22):162–173.
- Baylies C. The impact of HIV on family size preference in Zambia. *Reprod Health Matters*. 2000;8(15):77–86.
- Grieser M, Gittelsohn J, Shankar AV, et al. Reproductive decision making and the HIV/AIDS epidemic in Zimbabwe. *J South Afr Stud*. 2001;27(2):225–243.
- McCarragher D, Cuthbertson C, Kung'u D, Otterness C, Johnson L, Magiri G. Sexual behavior, fertility desires and unmet need for family planning among home-based care clients and caregivers in Kenya. *AIDS Care*. 2008;20(9):1057–1065.
- Nakayiwa S, Abang B, Packel L, et al. Desire for children and pregnancy risk behavior among HIV-infected men and women in Uganda. *AIDS Behav*. 2006;10(4 suppl):S95–S104.
- Kirshenbaum SB, Hirky AE, Correale J, et al. "Throwing the dice": pregnancy decision-making among HIV-positive women in four U.S. cities. *Perspect Sex Reprod Health*. 2004;36(3):106–113.
- Ntozi JPM. Impact of HIV/AIDS on fertility in sub-Saharan Africa. *Afr Popul Stud*. 2002;17(1):103–124.
- Cooper D, Harries J, Myer L, Orner P, Bracken H, Zweigenthal V. "Life is still going on"; reproductive intentions among HIV-positive women and men in South Africa. *Soc Sci Med*. 2007;65(2):274–283.
- Allen S, Serufilira A, Gruber V, et al. Pregnancy and contraception use among urban Rwandan women after HIV testing and counseling. *Am J Public Health*. 1993;83(5):705–710.
- Maier M, Andia I, Emenyonu N, et al. Antiretroviral therapy is associated with increased fertility desire, but not pregnancy or live birth, among HIV+ women in an early HIV treatment program in rural Uganda. *AIDS Behav*. 2009;13(suppl 1):28–37.
- Cooper D, Moodley KJ, Zweigenthal V, Bekker LG, Shah I, Myer L. Fertility intentions and reproductive health care needs of people living with HIV in Cape Town, South Africa: implications for integrating reproductive health and HIV care services. *AIDS Behav*. 2009;13(suppl 1):38–46.
- Meyer L, Carter RJ, Katyal M, Toro P, El-Sadr WM, Abrams E. Impact of antiretroviral therapy on incidence of pregnancy among HIV-infected women in sub-Saharan Africa: a cohort study. *PLoS Med*. 2010;7(2):1–11.
- Kaida A, Laher F, Strathdee SA, et al. Childbearing intentions of HIV-positive women of reproductive age in Soweto, South Africa: the influence of expanding access to HAART in an HIV hyperendemic setting. *Am J Public Health*. 2011;101(2):350–358.
- Floyd S, Crampin AC, Glynn JR, et al. The long-term social and economic impact of HIV on the spouses of infected individuals in northern Malawi. *Trop Med Int Health*. 2008;13(4):520–531.
- Hejoaka F. Care and secrecy: being a mother of children living with HIV in Burkina Faso. *Soc Sci Med*. 2009;69(6):869–876.
- Ntozi JPM. Widowhood, remarriage and migration during the HIV/AIDS epidemic in Uganda. *Health Transit Rev*. 1997;7(suppl 1):125–144.
- Gregson S, Mushati P, Nyamukapa C. Adult mortality and erosion of household viability in AIDS-afflicted towns, estates, and villages in Eastern Zimbabwe. *J Acquir Immune Defic Syndr*. 2007;44(2):188–195.
- Naidoo K. Reproductive dynamics in the context of domestic violence and economic insecurity: findings of a South African case study. *J Asian Afr Stud*. 2002;37:376–400.
- Mason NM, Jayne TS, Chapoto A, Myers RJ. A test of the new variant famine hypothesis: panel survey evidence from Zambia. *World Dev*. 2010;38(3):356–368.
- Seeley J, Biraro S, Shafer LA, et al. Using in-depth qualitative data to enhance our understanding of quantitative results regarding the impact of HIV and AIDS on households in rural Uganda. *Soc Sci Med*. 2008;67(9):1434–1446.
- Kidman R, Hanley JA, Subremanian SV, Foster G, Heymann J. AIDS in the family and community: the impact on child health in Malawi. *Soc Sci Med*. 2010;71(5):966–974.
- Heuveline P. Impact of the HIV epidemic on population and household structure: the dynamics and evidence to date. *AIDS*. 2004;18(suppl 2):S45–S53.
- Uganda Demographic and Health Survey. Calverton, MD: Ugandan Bureau of Statistics and Macro International Inc; 2006.
- Epidemiological fact sheets on HIV and AIDS. Update. Geneva, Switzerland: Joint United Nations Programme on HIV/AIDS and World Health Organization; 2008.
- National HIV/AIDS Stakeholders and Services Mapping Report. Kampala, Republic of Uganda: Uganda AIDS Commission; 2009.
- Mbulaitwe SM, Mahne C, Whitworth JAG, et al. Declining HIV-1 incidence and associated prevalence over 10 years in a rural population in south-west Uganda: a cohort study. *Lancet*. 2002;360(9326):41–46.
- Wawer MJ, Serwadda D, Gray RH, et al. Trends in HIV-1 prevalence may not reflect trends in incidence in mature epidemics: data from the Rakai population-based cohort. *AIDS*. 1997;11(8):1023–1030.
- Johnson KB, Akwarab P, Rutstein SO, Bernstein A. Fertility preferences and the need for contraception among women living with HIV: the basis for a joint action agenda. *AIDS*. 2009;23(suppl 1):S7–S17.
- Kipp W, Heys J, Jhangri GS, Alibhai A, Rubaale T. Impact of antiretroviral therapy on fertility desires among HIV-infected persons in rural Uganda. *Reprod Health*. 2011;8:27.
- Beyeza-Kashesy J, Neema S, Ekstrom AM, Kahariza F, Mirembe F, Kulane A. "Not a boy, not a child": a qualitative study on young people's views on childbearing in Uganda. *Afr J Reprod Health*. 2010;14(1):71–81.
- Campbell EK, Campbell PG. Family size, sex preferences and eventual fertility on Botswana. *J Biosoc Sci*. 1997;29(2):191–204.
- Jha P, Kumar R, Vasa P, Dhingra N, Thiruchelam D, Moineddin R. Low male-to-female sex ratio of children born in India: national survey of 1.1 million households. *Lancet*. 2006;367(9506):211–218.
- Hesketh T, Xing ZW. Abnormal sex ratios in human populations: causes and consequences. *Proc Natl Acad Sci U S A*. 2006;103(36):13271–13275.
- Andia I, Kaida A, Maier M. Highly active antiretroviral therapy and increased use of contraceptives among HIV-positive women during expanding access to antiretroviral therapy in Mbarara, Uganda. *Am J Public Health*. 2009;99(2):340–347.
- Watkins SC. Gender and population. In: Blakemore C, Iverson S, eds. *Gender and Society*. Oxford, UK: Oxford University Press; 2000:13–53.
- Lesthaeghe RJ. Social organization, economic crises, and the future of fertility control in Africa. In: Lesthaeghe RJ, ed. *Reproduction and Social Organization in Sub-Saharan Africa*. Berkeley, CA: University of California Press; 1989.