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**The Role of Partner Reduction and Faithfulness in HIV Prevention in
Sub-Saharan Africa: Evidence from Cameroon, Rwanda, Uganda, and Zimbabwe**

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ABSTRACT

Objectives. We examine patterns of multiple sexual partnerships and partner faithfulness among men, women, and cohabiting couples in four countries in sub-Saharan Africa and assess the association between these behaviors and the risk of HIV infection.

Methods. Our data are from nationally-representative surveys conducted during 2004-2006 in Cameroon, Rwanda, Uganda, and Zimbabwe that included HIV testing of adult men and women, using blood specimens analyzed with standard laboratory and quality control procedures. Men and women in a marital/cohabiting union who reported never having had sex with any person other than their current partner(s) are defined as lifetime faithful. Men and women in a marital/cohabiting union who ever had sex with a person other than current their partner(s) but not in the previous 12 months are defined as recently faithful. Lifetime and recent mutual faithfulness among cohabiting couples are similarly defined. Data are analyzed using descriptive and multivariate statistical methods after adjusting for potential confounding factors.

Results. Multiple sexual partnerships are common in sub-Saharan Africa. In all four countries considered, the adjusted odds of being HIV-infected increase with the number of lifetime sexual partners and decrease with the level of spousal faithfulness. Similarly, in couples where the partners are not mutually faithful, either or both partners are more likely to be HIV-infected than in couples where both partners are lifetime faithful. Our study finds that men report having more lifetime partners and being less faithful to their spouse(s) than women report.

Conclusions. Having fewer lifetime sexual partners and being faithful to spousal partner(s) are strongly associated with reduced risk of HIV infection. Thus, in addition to promoting abstinence until marriage and condom use, especially in higher-risk sex, HIV prevention programs should focus more on promoting partner reduction and partner faithfulness, especially for men.

KEYWORDS: faithfulness, multiple sexual partnerships, partner reduction, HIV, AIDS, sub-Saharan Africa.

INTRODUCTION

In epidemics driven mainly by heterosexual transmission, as in sub-Saharan Africa, behavior change remains the key to preventing the transmission and spread of HIV (Epstein 2007; Shelton et al. 2004). For several years, HIV prevention programs that focus on behavior modification have been dominated by the “ABC” model, a set of prescriptions centered on three behaviours: “A” – Abstinence from sexual activity and delayed sexual initiation among youth; “B” – Being faithful to a single partner and having fewer sexual partners; and “C” – Condom use, correctly and consistently, especially for higher-risk sex (Green 2003; USAID 2006). However, much of the discussion surrounding HIV prevention has focused on abstinence or condom use—the “A” and the “C”—while the “B” behavior—faithfulness and partner reduction—has been the “neglected middle child” of the ABC promotion approach (Shelton et al. 2004; Epstein 2004).

It is well established that having multiple sexual partners increases the risk of getting infected with HIV and other sexually transmitted infections (STIs) (Shelton et al. 2004; Stoneburner and Low-Beer 2004a; Wilson 2004). A growing body of evidence indicates that reduction of the number of sexual partners and limitation of casual sexual activity played a major role in early declines in HIV prevalence in Uganda in the 1990s (Opio et al. 2008; Green et al. 2006; Kirungi et al. 2006; Okware et al. 2005; Singh et al. 2004; Stoneburner and Low-Beer 2004a, 2004b), and more recently in Zambia, Zimbabwe, Kenya, and in urban areas of Burkina Faso (Gregson et al. 2006; Stoneburner and Low-Beer 2004b; Agha 2002; Bessinger et al. 2003).

In light of this evidence, it has been acknowledged that increased attention should be paid to the links between number of sexual partners, different relationship patterns, especially multiple concurrent relationships, and HIV transmission (Epstein 2007; Halperin and Epstein 2004).

Using data from recent national surveys in four sub-Saharan African countries—Cameroon, Rwanda, Uganda, and Zimbabwe—we examine patterns of multiple sexual partnerships and lifetime and recent partner faithfulness among men, women, and cohabiting couples, and we assess the association between these behaviors and the likelihood of HIV infection. This study builds on a similar analysis conducted for Uganda (Mishra et al. 2009), by including three additional countries at different stages of HIV epidemic.

METHODS

Study Design

Our data are from four nationally-representative demographic and health surveys in Cameroon, Rwanda, Uganda, and Zimbabwe that included HIV testing of adult women and men. The surveys were conducted during 2004-2006. Survey data were collected on behavioral, social, and demographic indicators, and blood samples were obtained for testing for HIV. Respondents provided separate informed consent for interviews and HIV testing.

Testing for HIV was conducted using standard blood collection, testing, and quality-control procedures (Macro International 2007a, 2007b). HIV testing was carried out using two HIV enzyme immunosorbent assays (EIA), based on different antigens. Specimens with equivocal or discordant test results were resolved by Western blot testing. For quality control, all positive specimens and a sample of negative specimens (usually 5%) were re-tested at a different laboratory using the same testing algorithm. Individual HIV test results were anonymously linked to survey information through bar codes. Further details of the survey design and implementation are provided in the individual country reports (INS [Cameroun] et Macro International 2004; MOH [Uganda] and ORC Macro 2006; INSR [Rwanda] and ORC Macro 2006; CSO [Zimbabwe] and Macro International 2007).

Survey and HIV testing protocols were cleared by the Institutional Review Board of Macro International (a U.S. institution responsible for providing technical assistance for conducting DHS and AIS surveys worldwide) and approved by the local governments and implementing partners.

Measures

We analyze the association of HIV infection with: 1) lifetime multiple sexual partnerships among men and women who reported ever having had sex; 2) lifetime and recent partner faithfulness among men and women who were in a marital/cohabiting union at the time of the survey; and 3) lifetime and recent mutual faithfulness among cohabiting couples. The analysis is limited to heterosexual relationships.

For all individuals who reported to have ever had sex, we define lifetime multiple sexual partnerships as having had more than one sexual partner during their life.

For individuals who were in a marital/cohabiting union at the time of the survey, we define *lifetime faithfulness*, *recent faithfulness*, and *unfaithfulness* as follows:

- *lifetime faithfulness* as never having had sex with any person other than the current partner—that is, having had only one lifetime sexual partner, the current partner. For men in a polygynous union, lifetime faithfulness is defined as having had the same number of lifetime partners (or fewer) as the current number of wives, and not having had sex with non-spousal partners in the previous 12 months.
- *recent faithfulness* as having had two or more lifetime sexual partners, but not having had sex with a non-spousal partner in the 12 months preceding the survey. For men in a polygynous union, recent faithfulness is defined as having had a greater number of lifetime sexual partners than the current number of wives, but not having had sex with a non-spousal partner in the previous 12 months.
- *unfaithfulness* as having had sex with a non-spousal partner in previous 12 months.

By using linked records for individuals who were in a marital/cohabiting union at the time of the survey, we also are able to classify couples according to levels of mutual faithfulness.

First, we define:

- *lifetime mutually faithful couples* as those where both husband and wife have had only one lifetime partner who was the current spouse at the time of the survey. Among polygynous couples, lifetime mutual faithfulness means that three conditions are satisfied: the wife has had only one lifetime sexual partner; the husband has had the same (or fewer) number of lifetime sexual partners as the current number of wives; and both partners did not have sex with a non-spousal partner during the previous 12 months.
- *recent mutually faithful couples* as those where either spouse has had two or more lifetime sexual partners, but neither spouse had sex with a non-spousal partner in the previous 12 months. Among polygynous couples, recent mutual faithfulness means that either the wife has two or more lifetime sexual partners or the husband has had more lifetime sexual partners than his current number of wives, and that neither spouse had sex with a non-spousal partner in the previous 12 months.
- *unfaithful couples* as couples who were neither lifetime mutually faithful nor recently mutually faithful.

Second, we define faithfulness among couples by grouping them into five exclusive categories: 1) lifetime mutually faithful (as in the previous grouping); 2) husband lifetime faithful but not wife; 3) wife lifetime faithful but not husband; 4) both spouses only recently mutually faithful; and 5) both partners not lifetime faithful (although one could have been recently faithful).

Analysis

The number of men age 15-49 included in the analysis (i.e., who were interviewed in households selected for HIV testing) ranges from 4,406 in Rwanda to 7,832 in Uganda, and the corresponding number of women ranges from 5,362 in Cameroon to 9,891 in Uganda. The number of cohabiting couples included in the analysis spans from 2,001 in Cameroon to 4,085 in Uganda (Table 1).

We analyze the data using both descriptive and multivariate statistical methods. For men and women who ever had sex, multivariate regression models are fitted to analyze the association between: 1) HIV infection and the number of lifetime sexual partners; 2) HIV infection and lifetime and recent faithfulness, limitedly to respondents currently in union. Controls include age, education level, marital union, regular media exposure, alcohol use in the previous 12 months, knowledge of own HIV status, household wealth status, occupation, ethnicity, religion, urban/rural residence, duration in the current place of residence, and geographical region. Among unfaithful men and women, we compare associations with HIV separately for those who used condoms with their non-spousal partner and those who did not.

For currently married cohabiting couples, we examine the association between faithfulness and the likelihood of one or both partners being HIV-infected. Controls include the wife's age, the age difference between the husband and the wife, the wife's education, the education gap between the husband and the wife, union type, duration in union, household wealth status, urban/rural residence, and geographical region.

All analyses were performed using STATA 9.0 (Stata Corporation 2005), accounting for complex survey design and incorporating sampling weights.

RESULTS

Prevalence of Multiple Sexual Partnerships and Faithfulness among Individuals and Couples

The prevalence of multiple sexual partnerships varies considerably among the four countries studied. Men, on average, report more lifetime sexual partners than women report. Among respondents who ever had sex, the mean number of lifetime sexual partners ranges from 3.0 in Rwanda to 14.5 in Cameroon for men, and from 1.5 in Rwanda to 3.4 in Cameroon for women (Table 1).

Concerning faithfulness, in all four countries considered women currently in union appear more likely to practice lifetime faithfulness with their marital/cohabiting partner than do men. The percentage reporting lifetime faithfulness ranges from 37% in Cameroon to 76% in Rwanda for women, and from 9% in Cameroon to 35% in Rwanda for men.

In all four countries, men are more likely to practice recent faithfulness than lifetime faithfulness. The percentage reporting to have been recently faithful to their current spouse/partner ranges from 52% in Cameroon to 74% in Zimbabwe. On the contrary, only in Cameroon and Uganda are women more likely to practice recent faithfulness than lifetime faithfulness, while in Rwanda and Zimbabwe the opposite is true.

Table 1. Percentage distribution of men and women* age 15-49 by number of lifetime sexual partners and partner faithfulness, and percentage distribution of cohabiting couples* by couple faithfulness.

	Cameroon	Rwanda	Uganda	Zimbabwe
Men				
Number of lifetime sexual partners				
0	17.8	30.9	18.4	26.5
1	8.9	26.5	12.5	14.3
2	7.9	17.6	14.2	13.6
3	8.2	11.8	12.8	12.3
4+	57.2	13.1	42.1	33.4
Number of respondents interviewed	4,805	4,406	7,832	6,768
Average number of lifetime sexual partners, among those who ever had sex	14.5	3.0	6.9	5.5
Number of respondents who ever had sex	3,974	3,049	6,354	4,896
Partner faithfulness				
Lifetime faithful	9.1	35.4	12.9	16.3
Recent faithful	52.1	61.5	68.7	73.5
Unfaithful	38.8	3.0	18.3	10.1
Number of respondents currently in union	2,209	2,066	4,122	3,067
Women				
Number of lifetime sexual partners				
0	12.3	31.3	13.6	20.8
1	31.5	47.7	36.4	52.4
2	17.8	14.7	23.5	16.9
3	14.2	4.4	14.0	6.1
4+	24.3	1.8	12.5	3.9
Number of respondents interviewed	5,362	5,750	9,891	8,881
Average number of lifetime sexual partners, among those who ever had sex	3.4	1.5	2.3	1.6
Number of respondents who ever had sex	4,744	3,920	8,550	7,012
Partner faithfulness				
Lifetime faithful	36.7	76.0	43.9	71.4
Recent faithful	48.3	23.6	53.4	26.9
Unfaithful	15.0	0.4	2.7	1.7
Number of respondents currently in union	3,343	2,761	6,319	5,123
Couples				
Mutual faithfulness (DEFINITION 1)				
Lifetime faithful	8.4	31.6	10.0	16.0
Recent faithful	64.6	65.6	72.0	75.3
Unfaithful	27.1	2.8	18.0	8.7
Mutual faithfulness (DEFINITION 2)				
Lifetime mutually faithful	8.4	31.6	10.0	16.0
Husband lifetime faithful, not wife	2.6	5.6	2.6	4.8
Wife lifetime faithful, not husband	34.6	46.5	35.9	55.6
Both only recently faithful	34.7	15.6	39.1	20.6
Both not lifetime faithful (one could be recent faithful)	19.7	0.8	12.5	3.0
Number of couples	2,001	2,155	4,085	2,569

* In households selected for HIV testing.

Among cohabiting couples, in all four countries recent mutual faithfulness is more common than lifetime mutual faithfulness. Couples where both partners have remained faithful to each other in the previous 12 months represent the majority of all couples surveyed—65% in Cameroon and in Rwanda, 72% in Uganda, and 75% in Zimbabwe. In all four countries, however, this majority consists of couples where only the wife but not the husband has been lifetime faithful, as well as those where both spouses have been faithful only in the preceding 12 months. For example in Cameroon, in only 3% of couples the husband has been lifetime faithful, not the wife, compared with 35% of couples where the wife has been lifetime faithful, not the husband (Table 1).

Association between Multiple Sexual Partnerships, Partner Faithfulness, and HIV Infection for Individuals and Cohabiting Couples

1. Association between multiple sexual partnerships and HIV serostatus for individuals:

Overall, HIV prevalence among men and women age 15-49 ranges from 2.3% of men and 3.6% of women in Rwanda to 14.5% of men and 21.1% of women in Zimbabwe. HIV prevalence among cohabiting couples ranges from 3.9% in Rwanda to 27.9% in Zimbabwe (Table 2).

The number of lifetime sexual partners has a strong correlation with HIV prevalence in all four countries considered: For both men and women, HIV prevalence increases monotonically with the number of lifetime partners. HIV prevalence among men who report having four or more lifetime partners is 4 to 12 times HIV prevalence among men who report only one lifetime partner. HIV prevalence among women who report having four or more lifetime partners is 3 to 5 times HIV prevalence among women who report only one lifetime partner.

Table 2. HIV prevalence by number of lifetime sexual partners and partner faithfulness for men and women age 15-49 and cohabiting couples.

	Cameroon	Rwanda	Uganda	Zimbabwe
Men				
Number of lifetime sexual partners				
0	1.0	0.2	0.2	2.7
1	0.5	1.2	1.0	6.5
2	2.3	2.9	3.0	14.8
3	3.5	3.0	5.7	18.0
4+	5.9	8.0	8.4	25.2
Total	4.1	2.3	5.0	14.5
Number of respondents tested for HIV	4,672	4,360	7,515	5,848
Partner faithfulness				
Lifetime faithful	1.1	1.4	1.7	8.0
Recent faithful	4.6	4.7	6.8	26.1
Unfaithful	7.6	5.7	9.2	19.1
Total	5.4	3.5	6.8	23.1
Number of respondents currently in union who were tested for HIV	2,161	2,090	3,973	2,593
Women				
Number of lifetime sexual partners				
0	0.7	0.8	0.8	3.9
1	2.7	3.0	3.9	18.1
2	8.2	8.1	8.6	37.1
3	8.7	10.8	10.7	41.5
4+	12.4	14.3	18.9	46.5
Total	6.8	3.6	7.5	21.1
Number of respondents tested for HIV	5,227	5,656	9,391	6,947
Partner faithfulness				
Lifetime faithful	2.0	2.0	3.1	15.1
Recent faithful	8.4	5.5	8.0	32.4
Unfaithful	10.3	9.4	9.0	39.6
Total	6.2	2.8	5.9	20.2
Number of respondents currently in union who were tested for HIV	3,506	2,716	5,977	4,027
Couples*				
Mutual faithfulness (DEFINITION 1)				
Lifetime faithful	0.9	1.6	2.2	12.3
Recent faithful	6.1	5.1	7.8	31.4
Unfaithful	12.0	5.4	11.5	21.4
Mutual faithfulness (DEFINITION 2)				
Lifetime mutually faithful	0.9	1.6	2.2	12.3
Husband lifetime faithful, not wife	8.2	4.6	4.2	32.1
Wife lifetime faithful, not husband	4.1	4.4	5.6	25.2
Both only recently faithful	8.2	7.4	9.8	42.6
Both not lifetime faithful (one could be recent faithful)	13.3	4.8	13.7	36.7
Total	7.4	3.9	8.1	27.9
Number of couples	2,027	2,171	4,000	2,005

* HIV prevalence for couples is defined as either or both partners being HIV positive.

Independently of age and other potentially confounding factors, the odds of being HIV-infected among men who have ever had sex are about 2 to 3 times greater among those who have had two lifetime partners, and about 3 to 5 times greater among those who have had four or more lifetime partners compared with those who have had one (Table 3). This relationship holds true in all four countries considered. The association between HIV infection and multiple lifetime sexual partnerships is similar among women. In addition, except for men in Cameroon, these findings are all statistically significant.

Table 3. Multivariate regression analysis of the association between HIV infection and the number of lifetime sexual partners among men and women age 15-49 who ever had sex: unadjusted and adjusted* odds of HIV infection (95% confidence intervals and p-values in parentheses)

	Cameroon		Rwanda		Uganda		Zimbabwe		
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	
	OR (95%CI; p-value)	OR (95%CI; p-value)	OR (95%CI; p-value)	OR (95%CI; p-value)	OR (95%CI; p-value)	OR (95%CI; p-value)	OR (95%CI; p-value)	OR (95%CI; p-value)	
Men									
Number of lifetime sexual partners									
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	4.42 (0.79, 24.47; .089)	3.19 (0.56, 18.19; .191)	2.57 (1.35, 4.89; .004)	1.86 (0.97, 3.58; .063)	3.21 (1.47, 7.00; .003)	2.34 (1.02, 5.33; .044)	2.50 (1.53, 4.08; .000)	1.92 (1.16, 3.16; .011)	
3	6.76 (1.31, 34.96; .023)	4.02 (0.76, 21.22; .101)	2.61 (1.30, 5.26; .007)	1.84 (0.91, 3.72; .092)	6.10 (2.96, 12.56; .000)	4.15 (1.93, 8.93; .000)	3.16 (2.11, 4.75; .000)	2.37 (1.56, 3.61; .000)	
4+	11.54 (2.49, 53.43; .002)	4.42 (0.92, 21.22; .064)	7.49 (4.24, 13.24; .000)	4.03 (2.20, 7.41; .000)	9.39 (4.81, 18.32; .000)	4.64 (2.26, 9.50; .000)	4.85 (3.32, 7.10; .000)	3.07 (2.01, 4.70; .000)	
Number of respondents who ever had sex	3,794	3,769	2,985	2,914	5,956	5,790	3,763	3,707	
Women									
Number of lifetime sexual partners									
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
2	3.24 (2.15, 4.87; .000)	2.68 (1.80, 3.99; .000)	2.88 (2.06, 4.02; .000)	2.00 (1.36, 2.95; .000)	2.29 (1.81, 2.90; .000)	2.12 (1.64, 2.74; .000)	2.66 (2.30, 3.08; .000)	2.29 (1.94, 2.72; .000)	
3	3.42 (2.29, 5.13; .000)	2.40 (1.58, 3.64; .000)	3.98 (2.51, 6.31; .000)	2.80 (1.67, 4.70; .000)	2.96 (2.28, 3.83; .000)	2.27 (1.66, 3.11; .000)	3.20 (2.47, 4.14; .000)	2.52 (1.92, 3.32; .000)	
4+	5.12 (3.55, 7.37; .000)	3.23 (2.18, 4.79; .000)	5.47 (3.06, 9.79; .000)	2.98 (1.51, 5.86; .002)	5.73 (4.41, 7.44; .000)	4.15 (3.04, 5.68; .000)	3.93 (2.93, 5.28; .000)	2.89 (2.12, 3.95; .000)	
Number of respondents who ever had sex	4,544	4,384	3,881	3,794	8,044	7,664	5,927	5,849	

* Controls include age, education, marital union, regular media exposure, alcohol use in the previous 12 months, knowledge of own HIV status, household wealth status, occupation, ethnicity, religion, urban/rural residence, duration in the current place of residence, and geographical region.

2. Association between faithfulness and HIV serostatus for individuals:

For men and women who were in a marital/cohabiting union at the time of the survey, lifetime faithfulness is associated with a lower prevalence of HIV across all four countries considered (Table 2). HIV prevalence is lowest among those who have been lifetime faithful and, except for men in Zimbabwe, highest among those who have been recently unfaithful. The magnitude of the difference between lifetime faithful and unfaithful individuals overall is higher for men than for women, although without a consistent pattern across the four countries.

Controlling for potentially confounding factors, the odds of being HIV-infected are 3 to 4 times greater among unfaithful men and women, and 2 to 4 times greater among recently faithful men and women, than among those who have been lifetime faithful (Table 4). The adjusted association between HIV infection and recent faithfulness is always statistically significant, except for men in Cameroon. The adjusted association between being unfaithful and being HIV-positive is not statistically significant for men in Cameroon or for both men and women in Rwanda, which is mainly due to a small numbers of cases in the unfaithful category.

Table 4. Multivariate regression analysis of the association between HIV infection and partner faithfulness among men and women age 15-49 currently in union: unadjusted and adjusted* odds of HIV infection (95% confidence intervals and p-values in parentheses)

	Cameroon		Rwanda		Uganda		Zimbabwe		
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	
	OR (95%CI; p-value)	OR (95%CI; p-value)	OR (95%CI; p-value)	OR (95%CI; p-value)	OR (95%CI; p-value)	OR (95%CI; p-value)	OR (95%CI; p-value)	OR (95%CI; p-value)	
Men									
Partner faithfulness									
Lifetime faithful	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Recent faithful	4.21 (0.86, 20.57; .076)	2.18 (0.42, 11.33; .352)	3.49 (1.85, 6.59; .000)	2.33 (1.18, 4.59; .015)	4.16 (2.05, 8.45; .000)	2.54 (1.23, 5.23; .012)	4.08 (2.70, 6.16; .000)	3.93 (2.56, 6.01; .000)	
Unfaithful	7.18 (1.47, 34.91; .015)	3.90 (0.74, 20.67; .109)	4.27 (1.21, 15.05; .024)	2.89 (0.60, 13.95; .187)	5.80 (2.73, 12.30; .000)	3.95 (1.81, 8.66; .001)	2.73 (1.64, 4.55; .000)	2.97 (1.72, 5.12; .000)	
Used condom	7.50 (1.51, 37.19; .014)	4.17 (0.78, 22.28; .095)	14.91 (1.37, 162.44; .027)	1.39 (0.10, 19.82; .806)	4.26 (1.88, 9.66; .001)	2.69 (1.15, 6.27; .022)	3.44 (1.25, 9.48; .017)	2.97 (1.19, 7.42; .020)	
Did not use condom	6.78 (1.35, 33.96; .020)	3.68 (0.67, 20.34; .135)	3.87 (0.99, 15.22; .052)	3.21 (0.65, 15.77; .151)	7.72 (3.45, 17.29; .000)	5.42 (2.35, 12.50; .000)	2.67 (1.54, 4.60; .000)	2.97 (1.68, 5.23; .000)	
Number of respondents currently in union	2,101	2,092	2,013	2,001	3,919	3,842	2,268	2,239	

(Cont'd)

Table 4 – cont'd

	Cameroon		Rwanda		Uganda		Zimbabwe	
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
	OR (95%CI; <i>p</i> -value)	OR (95%CI; <i>p</i> -value)	OR (95%CI; <i>p</i> -value)	OR (95%CI; <i>p</i> -value)	OR (95%CI; <i>p</i> -value)	OR (95%CI; <i>p</i> -value)	OR (95%CI; <i>p</i> -value)	OR (95%CI; <i>p</i> -value)
Women								
Partner faithfulness								
Lifetime faithful	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Recent faithful	4.53 (2.78, 7.39; .000)	2.73 (1.66, 4.49; .000)	2.92 (1.84, 4.64; .000)	2.65 (1.58, 4.46; .000)	2.73 (2.11, 3.52; .000)	2.67 (1.95, 3.67; .000)	2.69 (2.27, 3.20; .000)	2.84 (2.36, 3.41; .000)
Unfaithful	5.64 (3.25, 9.80; .000)	2.94 (1.56, 5.54; .001)	5.24 (0.64, 42.79; .122)	2.58 (0.26, 25.88; .420)	3.09 (1.62, 5.88; .001)	2.42 (1.20, 4.86; .013)	3.69 (2.42, 5.63; .000)	3.74 (2.37, 5.91; .000)
Used condom	4.46 (2.14, 9.29; .000)	2.37 (1.02, 5.54; .045)	dropped	dropped	2.90 (1.19, 7.11; .020)	1.70 (0.64, 4.51; .290)	3.34 (1.07, 10.42; .038)	3.83 (1.19, 12.36; .025)
Did not use condom	6.37 (3.53, 11.51; .000)	3.27 (1.68, 6.38; .000)	6.89 (0.83, 57.14; .074)	3.04 (0.28, 32.72; .359)	3.28 (1.53, 7.03; .002)	3.36 (1.47, 7.65; .004)	3.75 (2.38, 5.91; .000)	3.73 (2.30, 6.04; .000)
Number of respondents currently in union	3,209	3,098	2,707	2,640	5,999	5,756	4,312	4,254

* Controls include age, education, marital union, regular media exposure, alcohol use in the previous 12 months, knowledge of own HIV status, household wealth status, occupation, ethnicity, religion, urban/rural residence, duration in the current place of residence, and geographical region.

Among married respondents who were unfaithful to their marital/cohabiting partner in the previous 12 months, using a condom at last sex with the non-spousal partner is associated with a lower likelihood of being HIV-infected in two of the four countries (in Uganda and Rwanda for men, and in Cameroon and Uganda for women). However, the associations between condom use with non-spousal partner and the likelihood of HIV infection are not statistically significant in any of these cases.

3. Association between mutual spousal faithfulness and HIV infection for cohabiting couples:

In cohabiting couples, lifetime faithfulness of both spouses is associated with the lowest HIV prevalence (i.e., one or both spouses being HIV-infected) across all four countries considered. In three of the four countries HIV prevalence then rises among recently faithful couples and is highest among unfaithful couples (Table 2). In Zimbabwe, however, recently faithful couples have higher HIV prevalence than couples where either or both partners were unfaithful in the previous 12 months. The unadjusted association between couple faithfulness and HIV risk is statistically significant in all cases, except for unfaithful couples in Rwanda.

This association between degrees of faithfulness and prevalence of HIV remains after controlling for age and other potentially confounding factors in multivariate statistical analyses (Table 5, definition 1). The adjusted odds of either or both partners being HIV-infected in cohabiting couples are 2 to 3 times greater among recently faithful couples, and 2 to 4 times greater among unfaithful couples, than among lifetime mutually faithful couples. However, some of the adjusted associations are not statistically significant, which is mainly due to a small sample size in the unfaithful category.

Focusing on more detailed combinations of each spouse's faithfulness behavior within couples, we see no clear pattern of association between one or both partners being HIV-infected and whether the wife was lifetime faithful but not the husband, or whether the husband was lifetime faithful but not the wife. However, the proportion with one or both partners HIV-infected increases for couples where both partners were only recently faithful, and is highest among couples where both partners were not lifetime faithful, except in Rwanda (Table 2).

In multivariate analyses (Table 5, definition 2), it remains true and statistically significant that lifetime mutually faithful couples have the lowest adjusted odds of having one or both partners who are HIV infected. In three of the four countries, the likelihood of one or both partners being HIV-infected is greater among couples where the wife was lifetime faithful but not husband than among couples where the husband was lifetime faithful but not the wife. In two of the four countries (Rwanda and Zimbabwe) the adjusted odds of being HIV-infected are highest among couples where both partners were only recently faithful, and in the other two countries (Cameroon and Uganda) they are highest among couples where both partners were not lifetime faithful.

Table 5. Multivariate regression analysis of the association between HIV infection* and faithfulness among cohabiting couples: unadjusted and adjusted odds of HIV infection (95% confidence intervals and p-values in parentheses)**

	Cameroon		Rwanda		Uganda		Zimbabwe		
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	
	OR	OR	OR	OR	OR	OR	OR	OR	
	(95%CI; <i>p</i> -value)	(95%CI; <i>p</i> -value)	(95%CI; <i>p</i> -value)	(95%CI; <i>p</i> -value)	(95%CI; <i>p</i> -value)	(95%CI; <i>p</i> -value)	(95%CI; <i>p</i> -value)	(95%CI; <i>p</i> -value)	
DEFINITION 1									
Mutual faithfulness									
Lifetime faithful	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Recent faithful	7.25 (1.69, 31.19; .008)	2.39 (0.53, 10.75; .255)	3.33 (1.76, 6.30; .000)	1.94 (0.98, 3.86; .059)	3.77 (1.71, 8.30; .001)	2.82 (1.26, 6.35; .012)	3.26 (2.19, 4.86; .000)	2.69 (1.72, 4.21; .000)	
Unfaithful	15.29 (3.47, 67.29; .000)	4.03 (0.88, 18.43; .073)	3.53 (0.88, 14.08; .075)	2.52 (0.58, 10.85; .216)	5.84 (2.54, 13.40; .000)	3.85 (1.62, 9.18; .002)	1.94 (1.12, 3.35; .018)	1.58 (0.86, 2.89; .138)	
Number of couples	1,995	1,995	2,085	2,085	3,924	3,909	1,842	1,842	

(Cont'd)

Table 5 – cont'd

	Cameroon		Rwanda		Uganda		Zimbabwe		
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	
	OR (95%CI; <i>p</i> -value)	OR (95%CI; <i>p</i> -value)	OR (95%CI; <i>p</i> -value)	OR (95%CI; <i>p</i> -value)	OR (95%CI; <i>p</i> -value)	OR (95%CI; <i>p</i> -value)	OR (95%CI; <i>p</i> -value)	OR (95%CI; <i>p</i> -value)	
DEFINITION 2									
Mutual faithfulness									
Lifetime mutually faithful	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Husband lifetime faithful, not wife	10.08 (1.77, 57.40; .009)	3.21 (0.53, 19.30; .203)	2.99 (1.13, 7.90; .027)	1.42 (0.42, 4.76; .573)	1.97 (0.56, 6.94; .293)	1.57 (0.43, 5.76; .496)	3.37 (1.78, 6.37; .000)	1.97 (1.04, 3.71; .036)	
Wife lifetime faithful, not husband	4.83 (1.08, 21.66; .040)	2.48 (0.54, 11.40; .245)	2.86 (1.45, 5.66; .003)	2.02 (0.98, 4.15; .057)	2.67 (1.20, 5.98; .017)	2.40 (1.05, 5.45; .037)	2.41 (1.59, 3.64; .000)	2.46 (1.52, 3.98; .000)	
Both only recently faithful	10.02 (2.28, 44.09; .002)	2.57 (0.54, 12.17; .233)	4.95 (2.45, 10.01; .000)	2.32 (1.00, 5.38; .051)	4.86 (2.18, 10.84; .000)	3.79 (1.63, 8.78; .002)	5.30 (3.46, 8.10; .000)	4.98 (2.92, 8.50; .000)	
Both not lifetime faithful (one could be recent faithful)	17.22 (3.92, 75.67; .000)	4.18 (0.89, 19.60; .069)	3.10 (0.36, 26.73; .303)	1.27 (0.10, 15.47; .853)	7.13 (3.05, 16.63; .000)	5.15 (2.08, 12.75; .000)	4.12 (2.08, 8.17; .000)	3.44 (1.62, 7.28; .001)	
Number of couples	1,992	1,992	2,085	2,085	3,923	3,908	1,842	1,842	

* HIV prevalence for couples is defined as either or both partners being HIV positive.

** Controls include the wife's age, the age difference between the husband and the wife, the wife's education, the education gap between the husband and the wife, union type, duration in union, household wealth status, urban/rural residence, and geographical region.

DISCUSSION

Multiple sexual partnerships remain common in sub-Saharan Africa, with men having more lifetime partners than women have and being less faithful to their spouse(s). Unfaithful behaviour increases the risk of HIV infection. In all four countries studied, the likelihood of being HIV-infected increases with the number of lifetime sexual partners and decreases with the level of faithfulness to a spousal partner. Similarly, in couples where the partners are not mutually faithful, either or both partners are more likely to be HIV-infected than in couples where both partners are lifetime faithful to each other.

Several measurement issues must be kept in mind when considering these findings. First and foremost, our analysis is based on reported behavior of individual faithfulness, and thus our findings may be biased to the extent that men and women differentially misreport their behavior. In addition, for many HIV-positive adults the infection may have occurred before the behaviors reported in the survey, which would bias some of the associations that we identify between recent faithfulness and HIV infection. Finally, due to sample size limitations, we were not able to examine if couples' mutual faithfulness is associated with the likelihood of concordance or discordance on HIV status within couples.

Despite these limitations, our findings indicate a consistent and strong association between the risk of HIV infection and the extent to which partners remain faithful to each other or have multiple sexual partnerships. These findings reinforce the need to strengthen HIV prevention programs that encourage the reduction of the number of sexual partners and promote faithfulness within marital/cohabiting partners. To date, programs promoting individual behavior change have focused more on encouraging youth to abstain and delay sexual initiation and on promoting condom use, especially in higher-risk sex. Yet the evidence of a close link between

levels of partner faithfulness and HIV infection, as well as number of partners and HIV infection is powerful. Programs promoting partner reduction and faithfulness need to focus especially on men, because men appear to have more lifetime sexual partners than women have and to have more non-spousal sexual partners than women have.

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