Marriage and the Risk of Incident HIV Infection in Rakai, Uganda

Fred Nalugoda, BStat, MHS, David Guwatudde, BStat, MSc, PhD,† John B. Bwaninka, BStat, MHS,* Fredrick E. Makumbi, BStat, MHS, PhD,*† Tom Lutalo, BStat, MSc,*‡ Joseph Kagaayi, MBChB, MPH,* Nelson K. Sewankambo, MBChB, MMED, MSc,*§ Godfrey Kigozi, MBChB, MPH,* David M. Serwadda, MBChB, MMed, MSc, MPH,*† Xiangrong Kong, PhD,‖ Maria J. Wawer, MHSc, MD, BSc,*‖ Fred Wabwire-Mangen, MBChB, DTM&H, MPH, PhD,† and Ronald H. Gray, BSc, MBBS, DTM&H, MSc, MFCM*‖*

Objective: Studies suggest that the prevalence of HIV is higher among long-term marital/consensual relationships than in the unmarried. We assessed the risk of incident HIV infection by marital status in rural Rakai, Uganda.

Design: Longitudinal data from the Rakai Community Cohort Study between 1999 and 2011.

Methods: We estimated HIV incidence per 100 person years (py) in sexually active individuals aged 15–49 years with a total of 44,179.6 py who were never married (women 2929 py and men 4261 py), currently married or in long-term consensual relationships (currently married women 29,823 py and men 21,299 py) and previously married (women 3563 py and men 1475). Poisson multivariable regression was used to estimate the unadjusted and adjusted incidence rate ratios (IRRs) and 95% confidence intervals (CIs) of HIV acquisition.

Results: The HIV incidence among currently married persons was 0.93/100 py, which was lower than that for the never-married (1.51/100 py) and previously married (2.85/100 py) persons. The risk of HIV acquisition was significantly lower in the currently married compared with that in the never married among women (Adj IRR = 0.26, 95% CI: 0.16 to 0.42), but not among men (Adj IRR = 0.69, 95% CI: 0.31 to 1.52). HIV incidence was lower among first marriages (0.73/100 py) compared with that among second- or higher-order marriages (1.38/100 py). Multiple sex partners significantly increased the risk of HIV acquisition in both women (Adj IRR = 2.53, 95% CI: 1.6 to 3.97) and men (Adj IRR = 1.77, 95% CI: 1.20 to 2.60).

Conclusions: Current marriage especially first-order marriage was associated with a reduced risk of HIV acquisition in women, but not in men, and multiple sex partnerships increased HIV risk for both sexes.

Key Words: marriage, HIV infection, Uganda

(*J Acquir Immune Defic Syndr* 2014;65:91–98)

INTRODUCTION

It is estimated that >2.3 million people are newly infected with HIV every year,[1,2] and most new infections occur in Sub-Saharan Africa, mainly as a result of unprotected heterosexual intercourse. A large proportion of prevalent HIV infections occur among people in long-term marital or consensual relationships, and several studies suggest that marriage is associated with the risk of prevalent HIV, especially in women.[3–11] However, it is unclear whether HIV infection precedes entry into marriage or whether it is a consequence of marriage because differences in the duration of exposures between the unmarried and married states affect the estimated risk of prevalent infection associated with marriage. One Ugandan study found that the risk of incident HIV did not differ between never-married and currently married women but was increased in the previously married.[12,13] We are not aware of other studies that assessed incident HIV by marital status.

Therefore, we investigated the rates of incident HIV infection among never, currently, and previously married individuals and determined whether entry into marriage affected the risk of new HIV infections in rural Rakai district, southwestern Uganda.

Received for publication March 20, 2013; accepted July 23, 2013.

From the *Rakai Health Sciences Program, Entebbe, Uganda; †Makerere University School of Public Health, Kampala, Uganda; ‡Uganda Virus Research Institute, Entebbe, Uganda; §Makerere University College of Health Sciences, Kampala, Uganda; and ‖Department of Epidemiology, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD.

Supported by the National Institutes of Health, Division of Allergy and Infectious Diseases; Bill and Melinda Gates Foundation; Department of the Army, United States Army Medical Research and Material Command Cooperative Agreement, the Henry M. Jackson Foundation; Fogarty International Center/USNIH-AITRP.

F.N., the lead author, contributed to the design and implementation of the study and was responsible for data management, analysis, interpretation, and article development. R.H.G., J.B.B., X.K., F.E.M., F.W-M., D.G., and T.L., contributed to the analysis, interpretation, and article development. D.M.S., M.J.W., N.K.S., J.K., G.K., and R.H.G., contributed to the design, implementation, and article development.

The authors have no conflicts of interest to disclose.

Correspondence to: Fred Nalugoda, BStat, MHS, Rakai Health Sciences Program, PO Box 49, Entebbe, Uganda (e-mail: fnalugoda@rhsp.org).

METHODS

The Rakai district in southwestern Uganda bordering Tanzania and Lake Victoria is a rural area with a population of approximately 470,000, and marriage or long-term cohabitation is almost universal among adults. Marriage is patrilineal because children belong to the father's family and patrilocal because wives move to their husband's place of residence.[14]

Data collected by the Rakai Community Cohort Study between 1999 and 2011 were used for this analysis. The Rakai Community Cohort Study is an open cohort with approximately annual surveys of 14,000 consenting persons aged 15–49 years, resident in 50 communities, and has been ongoing since 1994 and has been described elsewhere.[15,16] In brief, the census before each survey round identifies eligible participants who are then contacted in their homes or invited to attend at central locations ("hubs") for interview and provision of blood for HIV diagnosis. Interviews ascertain information on sociodemographic characteristics, sexual behaviors, and health every 12–18 months using structured questionnaires administered in private by same-sex interviewers. Approximately 95% of persons resident at the time of survey complete interviews and sample collection. The participants were asked whether they had ever married or were in a long-term consensual relationship (henceforth referred to as "married"), and for those who responded affirmatively, their current and previous marital status was ascertained. Persons at the time of interview who were separated, divorced, or widowed were classified as "previously married." Thus, marital status was categorized as never, currently, and previously married at enrollment at the beginning of each time period. Employment status was classified as agriculture, skilled/professional, nonskilled, and other. Data were stratified into 3 study periods each comprising 3 study rounds with varying duration: 2000–2002, 2003–2006, and 2007–2011 to assess temporal trends. Data on marital order (ie, the number of times a person had married) were collected since 2006 and were used to determine the effect of remarriage on HIV infection.

In separate analyses to assess the effects of entry into a first marriage (newly married), never-married persons identified at the beginning of the interval were followed over time to determine whether they became newly married/entered into a first marriage or initiated a long-term consensual relationship during follow-up. We then determined the HIV incidence among newly and never-married individuals during the interval of exposure among newly married and never-married individuals.

HIV diagnosis used 2 enzyme immunoassays confirmed by Western Blot for seroincident cases. HIV incidence was estimated per 100 py of observation in initially uninfected persons assuming that infection occurred at the midpoint between the last negative and first positive HIV tests. Poisson multivariable regression with py as an offset was used to estimate the incidence rate ratios (IRRs) and 95% confidence intervals (95%CIs) of HIV acquisition stratified by gender. Age and education were adjusted for and because there was no significant change in the results they remained in the model because of the epidemiological importance of these covariates to the outcome. Because marital status is likely to be influenced by age, education, and residence, interaction terms between marital status and these covariates were assessed, but no interactions were statistically significant and were excluded from the final analysis. Analyses were conducted in STATA, version 9 (College Station, TX).

RESULTS

Table 1 shows the distribution of participants by sex, marital status categories, and sociobehavioral factors. The majority of the participants were currently married, both among women (82.0%) and men (78.7%), and the population was predominantly rural (35,518/38,441, 92.4%). There were marked differences in the distribution of sociodemographic and behavioral characteristics between never, currently, and previously married persons. The mean interval between survey rounds was approximately 1.5 years, and the retention rate was approximately 75%.

Table 2 shows new HIV cases, person years, and HIV incidence rates stratified by gender, marital status, and sociodemographic covariates. The majority of incident HIV infections in both women (60.7%) and men (71.0%) occurred during follow-up of currently married persons who constituted the majority of observation time (76.1% for women and 74.2% for men). In women, the incidence of HIV among the currently married was 0.86/100 py, which was lower than in the never married (2.29/100 py) and previously married (2.86/100 py). The incidence of HIV in currently married women was lower than in the never- and previously married regardless of time periods, place of residence, age, and educational groups. Among men, the HIV incidence was similar in the never (1.08/100 py) and currently married (0.99/100 py), and both were lower than in the previously married (2.71/100 py), but differentials in male incidence by marital status were not consistent across sociodemographic covariates. For example, among men, during the time period 2002–2006 and those aged 20–24 years, the incidence was lower in the never- than the currently married, although these differences were not statistically significant ($P = 0.12$ and $P = 0.23$, respectively). The HIV incidence among persons in monogamous union was lower and similar for both women (200/25,470.65, 0.79/100 py) and men (202/20,506.23, 0.99/100 py) compared with those in polygamous relationships (106/8915.86, 1.19/100 pyo in women; 57/3992.24, 1.43/100 py in men). However, the HIV incidence in women who reported having multiple sex partners was twice as high (2.35/100 pyo) as those who were in polygamous unions and was not different by union type among men (Table 3).

Table 3 shows the HIV incidence stratified by marital status and risk behaviors. Currently married women had a lower HIV incidence than did the never-married and previously married women irrespective of age at sexual debut, age at marriage, number of sexual partners, and alcohol use before sex. The marital status differentials in HIV incidence were less consistent when stratified by condom use and age differentials between partners. Among men, those currently married had a lower HIV incidence than did the previously

TABLE 1. Percent Distribution of the Number of Participants by Marital Status, Gender, and Sociobehavior Characteristics

	Female						Male					
	Never Married		Currently Married		Previously Married		Never Married		Currently Married		Previously Married	
Characteristics	No Exposed	%	No Exposed	%	No Exposed	%	No Exposed	%	No Exposed	%	No Exposed	%
All	2033/ 24,944	8.15	20,464/ 24,944	82.04	2447/ 24,944	9.81	2850/ 17,946	15.88	14,122/ 17,946	78.7	974/ 17,946	5.4
Study period												
2000–2002	535/ 5829	9.18	4785/ 5829	82.09	509/ 5829	8.73	741/ 4571	16.21	3633/ 4571	79.48	197/ 4571	4.31
2003–2006	727/ 8253	8.80	6699/ 8253	81.17	827/ 8253	10.02	964/ 5689	16.94	4428/ 5689	77.83	297/ 5689	5.22
2007–2011	771/ 10,862	7.10	8980/ 10,862	82.67	1111/ 10,862	1023	1145/ 7686	14.90	6061/ 7686	78.86	480/ 7686	6.25
Place of residence												
Rural	1546/ 20,495	7.54	17,040/ 20,495	83.14	1909/ 20,495	9.31	2277/ 15,023	15.16	11,951/ 15,023	79.55	795/ 15,023	5.29
Semiurban	487/ 4449	10.95	3424/ 4449	72.92	538/ 4449	12.09	573/ 2923	19.60	2171/ 2923	74.27	179/ 2923	6.12
Age (yrs)												
15–19	497/ 1403	35.42	876/1403	62.44	30/1403	2.14	760/811	93.71	48/811	5.92	3/811	0.37
20–24	626/ 5488	11.41	4661/ 5488	84.93	201/ 5488	3.66	1292/ 2761	46.79	1371/ 2761	49.66	98/2761	3.55
25–29	455/ 6193	7.35	5293/ 6193	85.47	445/ 6193	7.35	537/ 3979	13.50	3191/ 3979	80.20	251/ 3979	6.31
30+	455/ 11,860	3.84	9634/ 11,860	81.23	1771/ 11,860	14.93	261/ 10,395	2.51	9512/ 10,395	91.51	622/ 10,395	5.98
Education												
None	49/1826	2.68	1545/ 1826	84.61	232/ 1826	12.71	63/617	10.21	493/617	79.90	61/617	9.89
Primary	828/ 16,095	5.14	13,504/ 16,095	83.90	1763/ 16,095	10.95	1523/ 11,189	13.61	8964/ 11,189	80.11	702/ 11,189	6.27
Secondary and above	1156/ 7023	16.46	5415/ 7023	77.10	452/ 7023	6.44	1264/ 6140	20.59	4665/ 6140	75.98	211/ 6140	3.44
Age at sex debut (yrs)												
<15	522/ 6341	8.23	4995/ 6341	78.77	824/ 6341	12.99	1033/ 3014	34.27	1798/ 3014	59.65	183/ 3014	6.07
15–17	991/ 13,486	7.35	11,263/ 13,486	83.52	1232/ 13,486	9.14	1238/ 7767	15.94	6097/ 7767	78.50	432/ 7767	5.56
18+	520/ 5117	10.16	4206/ 5117	82.20	391/ 5117	7.64	579/ 7345	7.88	6227/ 7345	84.78	359/ 7345	4.89
Age at marriage(yrs)*												
<15	N/A		1295/ 1536	84.31	241/ 1536	15.69	N/A		9/9	100.00	0	0.00
15–17	N/A		8460/ 9450	89.52	990/ 9450	10.48	N/A		476/505	92.48	29/505	5.74
18+	N/A		9873/ 11,004	89.72	1131/ 11,004	10.28	N/A		12,997/ 13,889	93.58	892/ 13,889	6.42
Number of partners in past year												
1	1852/ 23,994	7.72	19,934/ 23,994	83.08	2208/ 23,994	9.20	1542/ 9876	15.61	7837/ 9876	79.35	497/ 9876	5.03
≥2	181/950	19.05	530/950	55.79	239/950	25.16	1308/ 8070	16.21	6285/ 8070	77.88	477/ 8070	5.91
Alcohol use in past year												
Yes	392/ 5081	7.72	3998/ 5081	78.69	691/ 5081	13.60	593/ 6431	9.22	5431/ 6431	84.45	407/ 6431	6.33

(*continued on next page*)

TABLE 1. (*Continued*) Percent Distribution of the Number of Participants by Marital Status, Gender, and Sociobehavior Characteristics

	Female						Male					
	Never Married		Currently Married		Previously Married		Never Married		Currently Married		Previously Married	
Characteristics	No Exposed	%	No Exposed	%	No Exposed	%	No Exposed	%	No Exposed	%	No Exposed	%
No	1641/19,863	8.26	16,466/19,863	82.90	1756/19,863	8.84	2257/11,515	19.60	8691/11,515	75.48	567/11,515	4.92
Condom use in past year†												
Never	94/1942		1716/1942	88.36	132/1942	6.80	22/747	2.95	704/747	92.24	17/747	2.28
Inconsistent	351/6789		5840/6789	86.02	598/6789	8.81	545/4907	11.11	4362/4907	88.90	287/4907	5.85
Consistent	133/469		182/469	38.81	154/469	32.84	313/496	63.10	102/496	20.56	81/496	16.33
Age difference in partners (yrs)												
Same age	1489/20,500		16,933/20,500	82.60	2078/20,500	10.14	2143/14,682	14.60	11,733/14,682	79.91	806/14,682	5.49
1–4	451/3072		2377/3072	77.38	244/3072	7.94	679/2904	23.38	2071/2904	71.32	154/2904	5.30
5+	93/1372		1154/1372	84.11	125/1372	9.11	28/360	7.78	318/360	88.33	14/360	3.89

* Data on baseline participants only.
† For those who ever used.

married for all strata of covariates, and in most cases, never-married men had incidence rates similar to those of currently married men.

The univariate and multivariable analyses are presented in Table 4. Currently married women were at a significantly lower risk of contracting HIV infection compared with the never married (Adj IRR = 0.26, 95% CI: 0.16 to 0.42), but there was no statistically significant difference in the risk of incident HIV between the never-married and previously married women. Among men, there were no statistically significant differences in the risk of incident HIV between the currently married and never married (Adj IRR 0.70, 95% CI: 0.31 to 1.59), but previously married men were at a significantly higher risk of HIV acquisition than were the never-married men (Adj IRR 2.62, 95% CI: 1.13 to 6.13). Multiple sex partners significantly increased HIV risk in both men (Adj IRR = 1.79, 95% CI: 1.20 to 2.65) and women (Adj IRR = 2.30, 95% CI: 1.45 to 3.63). Urban residence was a significant predictor of HIV risk in men (Adj IRR 1.87, 95% CI: 1.20 to 2.92), but not in women (Adj IRR = 1.11, 95% CI: 0.76 to 1.63).

Effect of Entry Into First Marriage and Risk of HIV Infection

HIV prevalence among those women entering into a first marriage was 11.6% (98/848), which was higher than in women who remained unmarried 7.5% (969/12,888, $P < 0.001$). Similarly, men entering into a first marriage had a higher HIV prevalence 5.6% (82/1472) than did men who remained unmarried, 2.1% (341/16,266, $P < 0.001$). Newly married women had a lower incidence of contracting HIV infection (1.67/100 py, 13/780.5 py) compared with women who remained unmarried (2.17/100 py, 73/3369.9 py), but this difference was not statistically significant (Adj IRR 0.77, 95% CI: 0.42 to 1.39). The HIV incidence among newly married men (1.59/100 py, 22/1382.7 py) was higher than in men who remained unmarried (1.07/100 py, 51/4779 py), but this was not statistically significant (Adj IRR = 1.22, 95% CI: 0.72 to 2.07).

Effect of Previous Marriage on the Risk of HIV Infection

HIV incidence among women in their first marriage (0.73/100 py, 111/15, 187 py) was lower than in those who reported second- or higher-order marriages (1.38/100 py, 32/2318.7 py, $P = 0.002$). In men, the incidence was 0.67/100 py (46/6867.4 py) in first-order marriages and 1.06/100 py (57/5383.4 py) in men with ≥2 marriages ($P = 0.013$). With reference to never married, first marriage was significantly protective against HIV infection occurring in women (Adj IRR = 0.32, 95% CI: 0.23 to 0.45) compared with that in men (Adj IRR = 0.67, 95% CI: 0.39 to 1.17) and in persons in second order or higher (Adj IRR = 0.65, 95% CI: 0.42 to 1.01 in women and Adj IRR = 1.23, 95% CI: 0.69 to 2.21 among men). Irrespective of marital order, the incidence of HIV among married women was lower than in women who remained unmarried (2.16/100 py, 73/3373.8 py). Relative to women who had never married, the risk of HIV acquisition was lower in first marriages (Adj IRR = 0.32, 95% CI: 0.23 to 0.45) and in higher-order female marriages (Adj IRR 0.65,

TABLE 2. HIV Incidence Stratified by Marital Status and Sex, by Time Period, and Sociodemographic Characteristics

	Female						Male					
	Never Married		Currently Married		Previously Married		Never Married		Currently Married		Previously Married	
Characteristics	Cases/Py	Rate	Cases/Py	Rate	Cases/Py	Rate	Cases/Py	Rate	Cases/Py	Rate	Cases/Py	Rate
All	67/2928.96	2.29	261/29,822.63	0.86	102/3562.67	2.86	46/4260.73	1.08	211/21,298.52	0.99	40/1475.10	2.71
Study period												
2000–2002	9/609.55	1.48	48/5288.63	0.91	18/565.64	3.18	11/861.76	1.28	36/4110.91	0.88	8/224.91	3.56
2003–2006	24/994.93	2.41	94/9051.76	1.04	29/1120.87	2.59	12/1357.88	0.88	92/6292.66	1.46	8/416.49	1.92
2007–2011	34/1324.48	2.57	119/15,482.23	0.77	55/1876.17	2.93	23/2041.08	1.11	83/10,893.96	0.76	24/833.70	2.88
Place of residence												
Rural	49/2224.39	2.20	203/24,686.11	0.82	75/2762.07	2.72	38/3402.51	1.12	160/17,978.15	0.89	27/1210.71	2.23
Semiurban	18/704.57	2.55	58/5136.51	1.13	27/800.60	3.37	8/858.22	0.93	51/3320.38	1.55	13/264.40	4.92
Age (yrs)												
15–19	10/706.79	1.41	11/1135.25	0.97	2/40.75	4.91	6/1094.46	0.55	0/64.56	0.00	0/5.41	0.00
20–24	25/878.60	2.85	67/6516.55	1.03	19/296.16	6.41	18/1954.75	0.92	27/1963.48	1.38	9/141.92	6.34
25–29	23/656.16	3.51	78/7801.69	1.00	23/637.10	3.61	16/809.95	1.98	65/4701.95	1.38	8/372.16	2.15
30+	9/687.40	1.31	105/14,369.14	0.73	58/2588.66	2.24	6/401.56	1.49	119/14,565.05	0.82	23/955.61	2.41
Education												
None	1/70.02	1.43	20/2230.23	0.90	12/332.02	3.61	0/91.43	0.00	13/728.73	1.78	1/95.36	1.12
Primary	29/1186.91	2.44	166/19,501.54	0.85	77/2536.14	3.04	32/2302.86	1.39	154/13,452.36	1.14	33/1074.37	3.07
Secondary and above	37/1672.03	2.21	75/8090.86	0.93	13/694.51	1.87	14/1866.39	0.75	44/7117.47	0.62	6/305.37	1.96

95% CI: 0.42 to 1.01). However, in men, HIV risk did not differ significantly by marital order when compared with that in the never married.

DISCUSSION

We found that the incidence of HIV was significantly lower in currently married women relative to that in the never married, and entry into a first marriage did not significantly affect HIV incidence relative to women who remained unmarried. For men, HIV incidence was comparable in the currently married and never-married groups. HIV incidence was the highest for both men and women who had experienced marital dissolution, although the risk for women was attenuated after adjustment for risk behaviors.

These findings are consistent with previous Rakai data that the incidence of HIV is higher among persons who were not currently married,[17] but they are in contrast with previous reports suggesting that marriage constitutes a risk for prevalent HIV.[3,7–10] However, HIV prevalence is a cumulative measure and cannot account for the differentials in the duration of exposure to the risk of HIV in each marital state. Because the interval between sexual debut and marriage is relatively short in Rakai (~2.1 years for women and 5.2 years for men), compared with the mean duration of marriage in this population (~9.0 years for women and 9.4 years for men), cumulative HIV prevalence is invariably lower before marriage than during marriage because of the shorter duration of exposure. Nevertheless, because of the longer duration of marital state, 60.7% of female incident infections and 71.0% of male infections occurred among the currently married. The mechanism whereby marriage may be protective from incident HIV for women is unknown, but it is noteworthy that fewer married women reported ≥2 sex partners in the past year (2.7%), whereas ≥2 partners were frequently reported by the never (8.7%) and previously married women (10.6%). In contracts, among men, multiple partnerships were frequent and comparable among the never, currently, and previously married (43.5%, 44.7%, and 48.6%, respectively, Table 3). Thus, differentials in the number of sex partners by marital status may protect married women, but there were no comparable differentials observed among men.

However, HIV prevalence was higher among men and women who had entered into a first marriage than those remaining unmarried, which possibly reflects previous high-risk behaviors among the newly married before the initiation

TABLE 3. HIV Incidence Stratified by Marital Status and Gender, by Risk Behaviors

	Female						Male					
	Never Married		Currently Married		Previously Married		Never Married		Currently Married		Previously Married	
Characteristics	Cases/Py	Rate	Cases/Py	Rate	Cases/ Py	Rate	Cases/ Py	Rate	Cases/Py	Rate	Cases/ Py	Rate
All	67/2928.96	2.29	261/ 29,822.63	0.86	102/ 3562.67	2.86	46/ 4260.73	1.08	211/ 21,298.52	0.99	40/ 1475.10	2.71
Age at sex debut (yrs)												
<15	17/792.36	2.15	91/7163.46	1.27	36/ 1184.78	3.04	14/ 1591.40	0.88	29/ 2774.87	1.04	9/ 274.36	3.28
15–17	35/1407.37	2.49	134/ 16,371.87	0.82	52/ 1801.61	2.89	19/ 1840.07	1.03	115/ 9179.62	1.25	20/ 655.69	3.05
18+	15/729.23	2.06	36/6287.30	0.57	14/ 576.28	2.43	13/ 829.25	1.57	67/ 93,344.04	0.72	11/ 545.05	2.02
Age at marriage (yrs)*												
<15	N/A		30/1845.32	1.62	10/ 347.00	2.88	N/A		0/11.95	0.00	0/0.00	NA
15–17	N/A		95/12,151.91	0.78	39/ 1426.13	2.73	N/A		12/ 714.54	1.68	1/43.73	2.29
18+	N/A		127/ 14,427.96	0.88	51/ 1648.14	3.09	N/A		188/ 19,495.64	0.19	36/ 1345.93	2.67
Number of partners in past year												
1	56/2674.05	2.09	242/ 29,014.60	0.83	77/ 3221.36	2.39	18/ 2307.33	0.78	78/ 11,768.31	0.66	17/ 758.20	2.24
≥2	11/254.91	4.32	19/808.03	2.35	25/ 341.31	7.32	28/ 1953.40	1.43	133/ 9530.22	1.40	23/ 716.91	3.21
Alcohol use in past year												
Yes	14/514.91	2.72	55/5314.83	1.03	27/ 924.59	2.92	17/ 813.60	2.09	98/ 7490.53	1.31	16/ 561.35	2.85
No	53/2414.06	2.20	206/ 24,507.79	0.84	75/ 2638.08	2.84	29/ 3447.12	0.84	113/ 13,807.99	0.82	24/ 913.75	2.63
Condom use in past year†												
Never	3/166.50	1.80	15/2942.01	0.63	3/ 226.64	1.32	1/42.01	2.38	8/ 1264.86	0.63	1/30.05	3.33
Inconsistent	24/597.12	4.02	84/10,050.81	0.83	34/ 1012.50	3.56	11/ 981.39	1.12	66/ 7813.43	0.84	17/ 493.89	3.44
Consistent	1/231.69	0.43	4/315.26	1.27	3/ 256.48	1.17	4/ 551.90	0.72	2/179.75	1.11	3/ 143.78	2.09
Age difference in partners (yrs)												
Same age	48/2075.01	2.31	210/ 24,393.49	0.86	79/ 2985.38	2.65	31/ 3121.23	0.99	176/ 17,689.34	0.99	33/ 1217.21	2.78
1–4	18/703.43	2.56	33/3679.01	0.90	16/ 373.28	4.29	13/ 1100.01	1.18	32/ 3144.89	1.02	7/ 238.96	2.93
5+	1/150.52	0.66	18/1750.13	1.03	7/ 204.01	3.43	2/39.48	5.07	34/ 464.30	0.65	0/18.93	0.00

* Data on baseline participants only.
† For those who ever used.

of observation. However, the incidence of HIV was not significantly different between those entering a first marriage and those who remained unmarried suggesting that entry into marriage per se did not increase risk. Other risk factors for contracting HIV, such as multiple sex partners, alcohol consumption, and urban residence, were consistent with that in previous findings.[10,13,18–20] In addition, the finding of a higher HIV incidence among persons in second- or higher-order marriages than those in their first marriages is consistent with the higher incidence observed in persons who experienced marital dissolution before remarriage.

The strategy of Abstinence, Be faithful, and use of condoms may be difficult to practice within marriage, because a woman's status often depends on childbearing, making abstinence, and condom use in marriage culturally inappropriate.[7] In many societies, multiple sexual partners are

TABLE 4. Unadjusted and Adjusted HIV Incident Rate Ratios Stratified by Gender

	Female		Male	
	Unadjusted IRR (95% CI)	Adjusted IRR (95% CI)	Unadjusted IRR (95% CI)	Adjusted IRR (95% CI)
Marital status				
Never married	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)
Currently married	0.43* (0.33 0 to 55)	0.26* (0.16 to 0.42)	0.96 (0.71 to 1.30)	0.70 (0.31 to 1.59)
Previously married	1.37† (1.02 to 1.84)	0.85 (0.50 to 1.44)	2.52* (1.68 to 3.78)	2.62† (1.13 to 6.13)
Age (yrs)				
15–19	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)
20–24	0.93 (0.64 to 1.37)	1.61 (0.66 to 3.93)	2.17† (1.04 to 4.54)	2.89 (0.67 to 12.36)
25–29	0.94 (0.64 to 1.37)	2.04 (0.84 to 5.00)	2.6.0‡ (1.27 to 5.34)	2.45 (0.53 to 11.42)
30+	0.67† (0.46 to 0.97)	1.45 (0.60 to 3.50)	1.52 (0.75 to 3.09)	2.61 (0.57 to 11.89)
Education				
Never	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)
Primary	0.95 (0.68 to 1.34)	1.09 (0.59 to 2.02)	0.89 (0.53 to 1.51)	2.42 (0.59 to 9.99)
Secondary and above	0.94 (0.66 to 1.36)	1.07 (0.54 to 2.12)	0.51† (0.29 to 0.88)	1.30 (0.30 to 5.65)
Age at sexual debut				
<15	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)
15–17	0.69* (0.57 to 0.83)	0.77 (0.54 to 1.10)	1.16 (0.86 to 1.56)	1.48 (0.88 to 2.48)
18+	0.53* (0.41 to 0.70)	0.69 (0.44 to 1.09)	0.73 (0.53 to 1.01)	1.07 (0.60 to 1.94)
Number of partners				
One	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)
≥2	3.54* (2.72 to 4.62)	2.30* (1.45 to 3.63)	2.05* (1.64 to 2.56)	1.79‡ (1.20 to 2.65)
Alcohol consumption				
Yes	1.30† (1.05 to 1.61)	1.47 (0.81 to 2.64)	1.65* (1.33 to 2.05)	0.67 (0.30 to 1.49)
No	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)
Condom use				
Never	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)
Inconsistent	1.78‡ (1.18 to 2.69)	1.70† (1.07 to 2.70)	1.20 (0.68 to 2.14)	0.96 (0.49 to 1.89)
Consistent	1.60 (0.77 to 3.20)	0.82 (0.34 to 1.96)	1.31 (0.59 to 2.92)	0.84 (0.31 to 2.25)
Age difference in partners (yrs)				
Same age	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)
1–4	1.23 (0.94 to 1.60)	1.47 (0.99 to 2.20)	1.06 (0.79 to 1.44)	1.22 (0.79 to 1.88)
5+	1.08 (0.72 to 1.61)	1.13 (0.65 to 1.95)	0.88 (0.36 to 2.13)	0.40 (0.05 to 2.95)
Area of residence				
Rural	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)
Semiurban	1.38‡ (1.12 to 1.70)	1.11 (0.76 to 1.63)	1.61* (1.25 to 2.07)	1.87‡ (1.20 to 2.92)

* $P < 0.001$.
† $P < 0.05$.
‡ $P < 0.01$.

condoned for men, whereas women are expected to remain faithful,[21,22] and unprotected sex with extramarital partners is a risk factor for contracting HIV infection.[17,23–28] Wide age disparities between spouses (eg, >10-year age difference) could contribute to risk if younger women marry older men who are more likely to be infected, and age disparities could reduce a woman's ability to negotiate safer sex behaviors such as condom use increasing the risk of HIV infection.[14,29,30] It is programmatically important to determine subgroups of the population most at risk to target intervention.

These findings have implications for the targeting of HIV prevention initiatives. If as suggested by these and other data,[28] HIV incidence is the highest in never-married women and previously married persons of both genders, interventions should be targeted on these subpopulations most at risk of acquisition.

In summary, in this rural Ugandan society, currently married women were at a decreased risk of incident HIV compared with the never-married ones or those who had experienced marital dissolution.

ACKNOWLEDGMENTS

The authors thank the staff of the Rakai Health Sciences Program; the RCCS study participants, the Rakai District Directorate of Health services, and the Director, Uganda Virus Research Institute for supporting this study.

REFERENCES

1. *UNAIDS Report on the Global AIDS Epidemic, 2010*. Available at: www.unaids.org/documents/20101123_globalreport_em.pdf; pages 16, 26, and 30. Accessed September 14, 2013.

2. *UNAIDS Progress Report on the Global HIV/AIDS Response, 2011*. Available at: www.unaids.org/en/media/unaids/contentassets/documents/unaidspublication/2011/20111130_UA_Report_en.pdf; pages 24–26. Accessed September 14, 2013.
3. *UNAIDS Annual Report, 2010*. Available at: http://data.unaids.org/pub/Report/2010_annual_report_en.pdf; page 30. Accessed September 14, 2013.
4. *Millennium Development Goals Report for Uganda 2010 Special*. Available at: http://mail2.unfpa.or.ug/pub/Reports/2010MDGReportUG.pdf; page 28. Accessed September 14, 2013.
5. *UNPFA State of the World Population Report, 2004*: www.unfpa.org/swp/2004/pdf/en_swp04.pdf; pages 64–65. Accessed September 14, 2013.
6. Clark S. Early marriage and HIV risks in Sub-Saharan Africa. *Stud Fam Plann.* 2004;35:149–160.
7. Bledsoe C. The politics of AIDS, condoms, and heterosexual relations in Africa: recent evidence from the local print media. In: Handwerker WP, ed. *Births and Power: Social Change and the Politics of Reproduction*. Boulder, CO: Westview Press; 1990. pp. 197–223.
8. Kelly RJ, Gray RH, Sewankambo NK, et al. Age differences in sexual partners and risk of HIV-1 infection in rural Uganda. *J Acquir Immune Defic Syndr.* 2003;32:446–451.
9. Pettifor AE, Straten A, Dunbar MS, et al. Early age of first sex: a risk factor for HIV infection among women in Zimbabwe. *AIDS*. 2004;18:1435–1442.
10. Nunn AJ, Kengeya-Kayondo JF, Mulder DW, et al. Risk factors for HIV-1 infection in adults in a rural Ugandan community: a population study. *AIDS*. 1994;8:81–86.
11. Dunkle KL, Stephenson R, Karita E, et al. New heterosexually transmitted HIV infections in married or cohabiting couples in urban Zambia and Rwanda: an analysis of survey and clinical data. *Lancet.* 2008;371:2183–2191.
12. Zablotska IB, Gray RH, Serwadda D, et al. Alcohol use before sex and HIV acquisition: a longitudinal study in Rakai, Uganda. *AIDS*. 2006;20:1191–1196.
13. de Walque D, Kline R. The association between remarriage and HIV infection in 13 Sub-Saharan African countries. *Stud Fam Plann.* 2012;43:1–10.
14. Meekers De, Calves AN. Main girlfriends, girlfriends, marriage and money: the social context of HIV risk behavior in Sub-Saharan Africa. *Health Transit Rev.* 1997;7(suppl):361–375.
15. Hirsch JS, Wardlow H, Smith DJ, et al. *The Secret, Love, Marriage and HIV 2009*. Nashville, TN: Vanderbilt University Press; 2009.
16. Kajubi P, Green EC, Hudes ES, et al. Multiple sexual partnerships among poor urban dwellers in Kampala, Uganda. *J Acquir Immune Defic Syndr.* 2011;57:153–156.
17. Messersmith LJ, Kane TT, Odebiyi AI, et al. Who's at risk? Men's STD experience and condom use in southwest Nigeria. *Stud Fam Plann.* 2000;31:203–216.
18. Ministry of Health (MoH) [Uganda] and ORC Macro. *Uganda HIV/AIDS Sero-Behavioral Survey 2004–2005*. Calverton, MD: Ministry of Health and ORC Macro; 2006.
19. Morris M, Kretzschmar M. Concurrent partnerships and the spread of HIV. *AIDS*. 1997:11;641–648. 10.1097/00002030-199705000-00012.
20. Morris M, Kretzschmar M. A microsimulation study of the effect of concurrent partnerships on the spread of HIV in Uganda. *Math Popul Stud.* 2000:8;109.
21. Wabwire-Mangen F, Odiit M, Kirungi W, et al. *Modes of Transmission Study: Analysis of HIV Prevention Response and Modes of HIV Transmission, The Uganda Country Synthesis Report*. Kampala, Uganda: GoU/UNAIDS/UAC;2008.
22. Gray R, Ssempijja V, Shelton J, et al. The contribution of HIV-discordant relationships to new HIV infections in Rakai, Uganda. *AIDS*. 2011;25:863–865.
23. UNICEF, UNAIDS, WHO. Young people and HIV/AIDS: opportunity in crisis. 2003. Available at: http://www.unicef.org/publications/files/pub_youngpeople_hivaids_en.pdf. Accessed September 14, 2013.
24. Global coalition on women and AIDS. 2005. Available at: http://data.unaids.org/publications/IRC-pub07/jc1210-gcwa-progressreport-2005_en.pdf. Accessed September 14, 2013.
25. Ntozi JPM. Widowhood, remarriage and migration during the HIV/AIDS epidemic in Uganda. *Health Transit Rev.* 1997;7:125–144.
26. Wawer MJ, Gray RH, Sewankambo NK, et al. A randomized, community trial of intensive sexually transmitted disease for control of AIDS prevention, Rakai, Uganda. *AIDS*. 1998;12:1211–1225.
27. Wawer MJ, Sewankambo NK, Serwadda D, et al. Control of sexually transmitted diseases for AIDS prevention in Uganda: a randomized community trial. Rakai Project Study Group. *Lancet*. 1999;353:525–535.
28. Alcohol and sexual violence perpetration. National Online Resource Center on Violence against Women. In: *Abbey Antonia With Contributions From Lydia Guy Ortiz*. 2008.
29. Koenig MA, Lutalo T, Feng Z, et al. Domestic violence in rural Uganda: evidence from a community-based study. *Bull World Health Organ.* 2003;81:153–160.
30. Zablotska IB, Gray RH, Koenig MA, et al. Alcohol use, intimate partner violence, sexual coercion and HIV among women aged 15–24 in Rakai, Uganda. *AIDS Behav.* 2009;13:225–233.