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Prevalence of Sexual Experience and Initiation of Sexual Intercourse among Adolescents, Rakai District, Uganda, 1994–2011

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Contributions Statement

John Santelli conceptualized the study, designed the data analyses, outlined the paper, wrote each draft, and coordinated each revision. Xiaoyu Song and Xiaobo Zhong cleaned the data, conducted all data analyses, participated in data interpretation, and wrote parts of the Methods section. Inge Holden helped in conceptualizing the study and conducted preliminary analyses on risk factors. Ying Wei supervised all data analyses and guided the selection of statistical methods. Kristin Wunder contributed to the preparation of the paper tables and figures and writing of the manuscript. Sanyukta Mathur supervised the research team, contributed to the development of the initial paper idea, participated in data review, and assisted in the preparation of the manuscript. Tom Lutalo, Fred Nalugoda, Ron Gray, and David Serwadda provide scientific and administrative oversight to the Rakai Community Cohort Study, including the maintenance of the cohort and collection of data; they advised on conceptualization of the study; data analysis and interpretation; and policy implications. All authors reviewed drafts of the paper and approved the final version.

Implications and Contributions

Rising school enrollment and declining orphanhood among adolescents in Rakai were associated with declines in sexual experience over time. Increasing access to education - along with risk reduction and treatment-as-prevention - can contribute to adolescent health by helping young people avoid HIV infection, STIs, and unintended pregnancy.

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Abstract

Purpose—To identify risk factors and time trends for sexual experience and sexual debut in rural Uganda.

Methods—Using population-based, longitudinal data from 15–19 year olds in Rakai, Uganda, we examined temporal trends in the prevalence of sexual experience and potential risk factors for sexual experience (n=21,742 person-round observations) using logistic regression. We then identified factors associated with initiation of sex between survey rounds, using Poisson regression to estimate incidence rate ratios (IRR, n=5126 person-year observations).

Results—Sexual experience was more common among adolescent women than men. The prevalence of sexual experience rose for most age-gender groups after 1994 and then declined after 2002. Factors associated with higher prevalence of sexual experience (without adjustment for other factors) included age, not enrolled in school, orphanhood, lower socioeconomic status, and drinking alcohol in the past 30 days; similar factors were associated with initiation of sex. Factors independently associated with initiation of sex included older age, non-enrollment in school (IRR=1.7 for women and 1.8 for men), alcohol use (IRR=1.3 for women and men), and being a double orphan among men (IRR=1.2). Sexual experience began to decline around 2000, while increases in school enrollment began as early as 1994 and declines in orphanhood occurred after 2004 (as ART became available).

Conclusions—Sexual experience among youth in Rakai was associated with social factors particularly school enrollment. Changes in these social factors also appear to influence change over time in sexual experience.

Keywords

Sexual behavior; Initiation of Sexual Intercourse; Risk factors; Adolescent; Social determinants; School enrollment; Orphanhood; Uganda

Introduction

Initiation of sexual intercourse is a key social developmental transition of adolescence, related to physical maturation, cognitive development, increasing awareness and appreciation of one's body, consolidation of personal and sexual identity, and sexual relationship formation.^{1–3} Sexual activity at a population level is commonly measured as the *prevalence* of sexual experience (ever having had sex) within an age group, the *median age* at first intercourse within a population, and, less commonly, as the initiation of sex intercourse (i.e., *incidence*) in longitudinal studies. The median age at sexual initiation declined considerably among industrialized nations during the 20th century beginning with cohorts born in the 1920s through those born in the 1970s; in most countries median age leveled in later cohorts⁴. A global review of sexual behaviors by Wellings and colleagues found that the median age of sexual debut varies considerably by region of the world; they report no universal trend towards earlier sexual intercourse comparing adolescents who reached age 15 between 1975–79 compared to 1995–1999.⁵ Median age at first sex ranges between 15.5 and 18.5 years among women in most Sub Saharan African countries. While traditionally tied to marriage and family formation, sexual initiation among heterosexual youth is increasingly premarital both in developed and developing nations.^{4–7}

A variety of biological, individual, and social factors influence sexual initiation among youth including pubertal timing, poverty, educational factors, involvement in non-sexual risk behaviors such as alcohol use, peer influences, family stability and mobility, sexual coercion, educational and occupational opportunities for young people, connectedness to social institutions such as schools and religious institutions, and sexual beliefs, attitudes, skills, motivations, and intentions.^{1,8–10} Kirby has divided these influences into risk and protective factors, those increasing risk of poor health outcomes and those decreasing risk.⁹ Schooling, for example, is often a protective factor; adolescents who are performing better in school, who do not dropout, and who feel connected to school are more likely to delay initiation of intercourse.^{9,11,12,13} In developing nations, availability of schools and the ability to attend schooling are also protective factors in delaying initiation of sexual intercourse.¹ Likewise, adolescents from stable families – those unaffected by parental death or divorce – are more likely to delay sexual initiation.^{9,13} Lower socioeconomic status (SES) has frequently been associated with reporting earlier initiation of sexual intercourse among young women;⁹ this association may be less common among European nations.¹⁴ Alcohol use has also been associated with sexual risk behaviors including earlier sexual initiation.^{9,15} The research literature on risk and protective factors for adolescent sexual behavior suffers from considerable endogeneity; for example, poverty, family instability, and school dropout are interrelated and influence health behaviors in complex ways.^{1,9} Likewise, adolescents, particularly girls, may underreport sexual activity in certain social contexts.¹⁶ Finally, most studies are cross-sectional.

Initiation of sexual intercourse is an important risk factor for HIV, other STIs, and unintended pregnancy. Acquisition of many STIs, particularly HPV and HSV-2, often occurs soon after sexual initiation.¹⁷ In countries with predominantly heterosexual transmission and generalized HIV epidemics, sexual experienced adolescents, particularly young women, face considerable risk of HIV infection.¹⁸ Likewise, adolescents may become pregnant in the period soon after sexual initiation, particularly where access to contraception is limited.¹⁹ Historically, age at first coitus was strongly associated with adolescent and national fertility rates.²⁰ Delay in sexual initiation contributed to reduction in teen fertility in the U.S. in the 1990s, although most of decline was attributable to improved contraceptive use.²¹ Teen fertility declined sharply among developed nations during the 1960s–1980s after the introduction of modern contraception and despite an early age at sexual initiation.^{22,21} Given its influence on pregnancy and STIs, the age at initiation and the prevalence of sexual experience are commonly measured in demographic surveys such as the Demographic and Health Surveys.⁵ Finally, delaying initiation of sexual intercourse before marriage has been an objective of many national policies to prevent HIV and unintended pregnancy among young people. While helping young people delay initiation may have public health benefits, the public health and medical communities have expressed concern about policies focused on “abstinence only”.^{23,24}

Few analyses in the developing world have examined sexual initiation longitudinally^{10,25} (i.e., measured incidence of sexual debut), compared risk factors for incidence and prevalence of sexual intercourse (i.e., ever had sex), or examined the influence of risk factors on trends over time. This study builds upon a recent study in Rakai examining HIV acquisition over time among youth; that study demonstrated a substantial decline (86%) over time in HIV acquisition among teen women which was associated with rising school enrollment and reduction in sexual risk behaviors including declines in sexual experience.²⁶ Our objective in this study was to identify risk and protective factors, including school enrollment and family instability, associated with sexual experience among 15–19 year old adolescents in a community with a generalized HIV epidemic. We hypothesized that 1- school enrollment would be protective, i.e., associated with lower prevalence of sexual experience and initiation of sexual intercourse, and 2- family instability caused by the death of one or both parents (single or double orphanhood) would be associated with higher incidence of initiation of sexual intercourse.

Methods

We used quantitative data from the Rakai Community Cohort Study (RCCS), consisting of 43 communities including rural villages and trading centers in Southwestern Uganda, followed continuously between 1994–2011 (rounds 1–14). Data came from questionnaires administered to adolescents and from a household census. Initial analyses included youth 15–24 years however sexual experience was relatively common beyond age 19, so those 20+ years were excluded. Analyses were stratified by gender.

The RCCS is a population-based, open cohort of residents 15–49 years; the methodology has been described more fully elsewhere.^{27–29} Briefly, each round of the RCCS begins with a census of households in each community with data on changes to household composition

provided by the head of household. The same households are visited at each round of the survey; household membership changes over time given mortality, migration, and fertility. New households are only added to the cohort when members of an existing cohort household move into a new housing compound within an RCCS community, e.g., a new household formed by a marriage. (Round 5 was an atypical follow up round with no new enrollment, and was excluded from this analysis.) At each survey round, returning cohort participants are reconsented and new household members who are between 15 and 49 years are recruited; those who have turned 15 are also recruited. All eligible household members are then interviewed and asked to provide blood for HIV and STI testing. For minors (< 18 years), minor assent and parental/guardian written consent for research participation is obtained. At each round, community-wide HIV education, HIV counseling and testing, and referral for health care are offered. Ethical approvals were obtained from Uganda National Council for Science and Technology and IRBs at the Uganda Virus Research Institute, Columbia University, and Johns Hopkins University.

Face-to-face interviews were conducted in private locations by same-sex interviewers. Questionnaires included questions on demographic, behavioral, reproductive and health characteristics. The RCCS has achieved over 85% coverage among all residents. Among consenting participants, 99% responded to the full questionnaire and over 90% agreed to specimen collection. Frequent mobility among adolescents, contributed to missing data in specific rounds of the cohort. Mobility includes travel for school and work and migration outside of the RCCS communities. Over Rounds 1–14 of the survey, 50% of adolescents surveyed in any round could be resurveyed in the subsequent round; an additional 8% were resurveyed in a later round and 42% were permanently lost of follow up.

Uganda adopted a national policy of universal primary education in 1997 by offering free primary education in public schools.³⁰ Over time, the Rakai Health Sciences Program has progressively implemented HIV prevention and treatment programs including interventions to prevent HIV infection via STI treatment in 1994, prevention of maternal to child transmission in 2000, anti-retroviral treatment (ART) in 2004, and male medical circumcision (MMC) as part of an RCT in 2004 and as a District-wide service in 2007.

Variables

We examined variables which have been associated with sexual initiation among adolescents in other studies and which were available in most rounds of the RCCS. Data from the household census included orphanhood, socioeconomic status (SES), and age. Orphanhood was derived from questions about the current status of each parent (i.e. had mother and/or father died). A SES index was created based on the use of modern building materials to construct dwellings.³¹ High SES dwelling used iron/tile in roofing and cement in floors and walls. Middle SES dwellings had modern materials two parts of the building (roof, walls, floors). Low SES dwellings used modern materials in one or no part of the building.

School enrollment was based on an adolescent reporting either his or her first or second occupation as “student.” Respondents could select up to two occupations from a broad list. Alcohol use in the last 30 days, religious affiliation, ever married and circumcision status

(among young men) were reported by the adolescents. Ever married includes civil, religious, traditional, and consensual (cohabiting) unions; the later are commonly referred to as marriages in Rakai District.

For prevalence analyses, sexual experience was defined as reporting ever having had sexual intercourse. In incident analyses, initiation of sexual intercourse was defined as reporting sexual experience at any round following a report of no sexual experience at the previous round. Rakai adolescents demonstrate good reliability in reporting sexual experience with 93–94% consistently reporting sexual experience across two survey rounds.

Statistical analysis

We initially examined trends over time in prevalence of sexual experience among adolescents 15–19 years stratifying by single year of age (see Figures 1 and 2). We then examined how characteristics of the sample changed over time; the characteristics included factors potentially associated with sexual experience. The dataset included 21,742 person-rounds of observations: 14,098 for young women and 17,419 for young men (see Tables 1 and 2). We used logistic and multinomial logistic regression with robust variance estimation to adjust for 1- clustering of observations within individuals and of individuals within communities and 2- shifts over time in the population age structure of the 15–19 year old age group, as reported below. Age adjustment was by single year of age. We used age-adjusted linear regression, logistic regression, ordinal logistic regression and multinomial logistic regression with robust variance estimation to test the shifts over time in the population for risk factors that are continuous, binary, ordinal with three categories, and nominal with more than three categories, respectively. All analyses were conducted separately for women and men. We used Stata 12.0 for our analyses.³²

Incidence of sexual intercourse (i.e., initiation) was measured using Poisson regression to calculate incidence rate ratios (IRR).³³ The dataset included 5,126 person-years: 2,283 for young women and 2,843 for young men (Table 3). Poisson regression was also used to identify factors associated with initiation. For the incidence analysis, the sample was limited to adolescents who had at least one prior interview where they reported no sexual experience; adolescents missing the two prior interviews were excluded from analysis. Incident analyses compared the exact date for interview before seroconversion and the interview date after seroconversion. We modeled the incident rate as a linear and linear plus quadratic function of time (using the exact date of the interview), and estimated unadjusted incidence rate ratios (IRR) associated with age, school enrollment, orphanhood status, socioeconomic status, alcohol use in the last 30 days, and religion, while controlling for time and single year of age. Next, multiple Poisson regression models assessed the association on sexual initiation controlling for other factors in the model. Non-significant variables ($p>0.05$) were dropped from the final models.

We initially examined residence in rural vs. trading villages; this variable was dropped from analyses because it was not associated with sexual experience or initiation.

Results

Table 1 describes the characteristics of adolescents (15–19 years of age) by survey round between 1994 and 2011. Averaged over all rounds, the prevalence of sexual experience was more common among young women than young men (69% vs. 55%, $p<.001$). The prevalence of sexual experience for young men and young women rose from Round 1 through Round 8 and then declined through Round 14. Differences between men and women in the prevalence of sexual experience remained similar over time. The mean age of adolescents in the RCCS sample also rose from Rounds 1 (mean age 17.1 year for women or 17.0 for men) to Rounds 9 (men=17.4) or 10 (women=17.5) and then dropped to 17.0 (women) and 16.9 (men). Given these changes in the age structure of the population, our analyses were stratified by single year of age or statistically adjusted for age.

The most notable temporal changes among Rakai adolescents were dramatic increases in school enrollment for both young women (from 23% at Round 1 to 58% at Round 14) and young men (from 36% to 65% over the same period); these increases substantially decreased the gender gap in school enrollment. Single and double orphanhood declined after round 10 (after 2004); this decline coincided with the introduction of ART in Rakai. Also notable was a considerable increase in SES and a sizeable decline in ever married (from 53% in 1997–98 to 24% in 2010–2011). Alcohol use in the past 30 days also decreased among adolescent men and women from Round 1 to Round 12 (data for later years were not collected). Male medical circumcision (MMC), although not monitored at every round, also rose in Rounds 13 and 14, coinciding with new programs to provide MMC beginning at age 12. Minimal change occurred in religious affiliation; a small increase was found in Saved/Pentecostals from <1% to 6% among adolescent women and 3% among men. Catholic affiliation decreased somewhat - from 61% to 56% among women and from 63% to 59% among men.

Figures 1 and 2 show the trends in the age-specific prevalence of self-reported sexual experience among adolescents by survey round between 1994 and 2011. The highest prevalence was consistently found among 19 year olds and lowest prevalence among 15 year olds. Over most years and ages, prevalence was higher among women; differences by gender were most pronounced at age 19 and small or not different at age 15. Over time among adolescent women, age-specific prevalence of sexual experience rose from Round 1 (1994–1995) to Round 8 (2001–2002); the largest increases were at age 15 and 16. Sexual experience then declined from Round 8 through Round 14 (2001–2011). Both linear and quadratic time trends were statistically significant at every age except age 19 where the quadratic trend was not significant ($p=0.32$). Among young men, the prevalence of sexual experience also rose from Round 1 through Round 8 and then declined through Round 14 (significant linear and quadratic terms at all ages except at age 15). Across both sexes from Round 1 to 8, the slope of the increase (log odds ration) was 0.070 with a 95% CI= 0.055, 0.084. From Round 8 to 14, the slope of the overall decrease was -0.130 (95% CI= $(-0.143, -0.118)$).

Table 2 examines age-specific prevalence of sexual experience by potential risk factors. Sexual experience was lower at every age between 15 and 19 among those currently enrolled in school compared to those out of school; differences were greater for young

women compared to young men. Sexual experience was often higher among orphans and double orphans compared to non-orphans, those living in lower SES households, and those reporting alcohol use in the past 30 days. Prevalence of sexual experience was higher among younger Catholics and Muslims and lower among Saved/Pentecostal, although most differences by religious affiliation tended to diminish by age 19.

Table 3 presents the incident rate ratios (IRR) for initiation of sexual activity, first stratified or adjusted for age and then adjusted for other significant factors in the multiple Poisson regression. (The incidence rates for initiation of sexual intercourse among women increased with age and were 0.19, 0.26, 0.26 and 0.30 per thousand per year, at age 16, 17, 18, and 19 respectively. Similarly, the incidence rates among men were 0.19, 0.24, 0.31 and 0.33 per thousand per year, at the same ages.) The risk of initiation increased with age for women and men. Adjusting for age, initiation of sexual experience declined when considering linear change only; when considering linear and quadratic trends simultaneously neither was significant. The incidence of initiation was higher among adolescents who were not currently enrolled in school, among double orphans, and among those using alcohol in the past 30 days. Low SES was associated with an increased probability of initiation among men only. Saved/Pentecostal adolescent women were more likely to delay initiating sexual activity. MMC was not associated with sexual initiation.

In the full Poisson models, initiation of sex for adolescent women was significantly associated with age, school enrollment, and use of alcohol in the past 30 days. For adolescent men, initiation of sex was significantly associated with age, school enrollment, being a double orphan, and alcohol use in the past 30 days.

Discussion

Over the past 20 years, adolescents in Rakai experienced rapid social change including rising socioeconomic status and dramatically increasing school attendance; more recently they have seen improving health status of parents as reflected in declining rates of orphanhood since 2004.³⁴ Likewise the prevalence of sexual experience among adolescent women and men has declined since 2002. Not being enrolled in school was strongly associated with both the prevalence of sexual experience and incidence (initiation) of sexual intercourse suggesting that increasing school enrollment is delaying sexual initiation among adolescents, although this change over time is not a simple linear relationship. Declining use of alcohol (which may be related to increased school enrollment) and decline in double orphanhood may also be contributing to delay in sexual initiation.

Sexual experience was more common among young women than young men; this is common across SSA.^{1,5} This gender difference in sexual experience did not change appreciably over time in Rakai and trends over time were similar, although not identical, for adolescent men and women. Earlier sexual initiation for young women reflects traditional cultural patterns in Uganda where young women frequently get married and initiate childbearing during the teen years and husbands are frequently older than wives. This pattern of early marriage is rapidly changing in Rakai and elsewhere as young women and young men experience increased access to education.^{1,5,6} While delay in marriage may

cause some delay in sexual initiation, in many countries it results in an increasing period of premarital sexual activity.⁵

Trends in sexual experience were related to the trends in social factors in complex ways. While SES was not an independent predictor of sexual initiation, rising SES in Rakai is presumably increasing educational opportunities for young people and particularly for young women. Rising SES has been associated with improved opportunities for schooling in many developing countries.^{1,5}

Although school enrollment is associated with reduced sexual experience, rising school enrollment initially demonstrated little or no impact on population-wide measures of sexual activity before 2002. Given a strong association of school enrollment and sexual experience, several mechanisms may be at work. Perhaps, a threshold is needed for school enrollment to influence sexual activity on a population level. Likewise, sexual experience may reflect the impact of multiple factors influencing schooling such as SES and orphanhood and social policies such as Universal Primary Education. Ethnographic data from Rakai suggest that young women (and young men) perceive staying in school as a way to advance socially and economically and they understand the importance of delaying initiation of sexual experience, childbearing and marriage³⁵

We would note that trends toward increased school enrollment in Rakai clearly preceded implementation of universal primary education (UPE) in Uganda, particularly among younger adolescents (i.e., 15–16 year old women and 15–17 year old men). For older teens schooling began to increase after the implementation of UPE in 1997. Thus, increases in school enrollment presumably reflect UPE, rising SES, and an increased ability to pay for education. Rising school enrollment may also reflect rising educational aspirations among adolescents and parents.³⁰

Considerable declines occurred in orphanhood after 2004, after antiretroviral treatment became available. Rakai has noted this population-wide impact of ART on mortality.³⁴ Although double orphanhood was associated with sexual initiation; this association was reduced in multivariate models, after controlling for school enrollment. Orphanhood may be associated with reduced family resources and the ability to pay for school. The impact of orphanhood may be greater when children are younger; from our data we could not identify the timing for the death of parents. Other studies have shown mixed results of HIV risk from orphanhood; the impact of orphanhood may be compounded by education.¹³ In Uganda, the extended family often adopts children who have lost parents and the extended family may buffer the otherwise adverse impact of orphanhood. Importantly, we would also note that the sampling frame for the RCCS includes only households and does not include orphanages.

We found a consistent relationship between alcohol use in the past 30 days and prevalence and incidence of sexual experience. An association between alcohol use and sexual risk factors for HIV infection has been found in other studies.^{15,36} Alcohol may act as a disinhibitor and thereby encourage sexual initiation; alcohol use could also be a marker for adolescent risk taking and/or earlier transition to adult roles.

One cannot assume that factors associated with recent initiation of a behavior will be the same as factors predicting the proportion who have ever engaged in a behavior. Notably, in this study, risk factors for incidence of sexual initiation and prevalence of sexual experience were similar in unadjusted analyses and analyses controlling for age. Age, school enrollment, orphanhood, SES, and alcohol use were associated with both incidence and prevalence of sexual experience. Moreover, age, school enrollment, and alcohol were relatively strong associations; orphanhood and SES showed smaller associations and those generally became non-significant after controlling for school enrollment. SES and orphanhood likely influence the ability of young people to attend school. We found that the relationship of alcohol and sexual experience was stronger among younger adolescents and weaker among older adolescents.

Limitations

Most of our data are self reported and therefore subject to recall and social desirability bias; adolescent may underreport or over report sexual experience in certain social contexts and may be unreliable in reporting sexual experience in longitudinal studies.¹⁶ Given the sampling plan for the RCCS, all of the orphans in our study were living in households; orphans living in orphanages were not interviewed. The impact of orphanhood and living in an orphanage may be more adverse than orphanhood alone. While we were able to measure school enrollment, other factors such as the quality of education received or connectedness to the school were not available for analysis. Certain variables have missing data, because the adolescent did not report specific information or because a question was not asked in every round. For example, alcohol use was dropped in Rounds 13 and 14. This limited our sample size and our ability to measure associations in multivariate models. The precision of timing of measurements in the RCCS (varying from 1–2 years between surveys) means that we cannot determine the direction of causality; for example, initiation of sexual activity may lead to leaving school within an interval or leaving school may lead to sexual initiation. Our measure of school enrollment is a bit unusual as it was derived from questions on current occupation. Finally, sexual coercion is an important risk factor for early sexual initiation in Rakai^{37,38} however data on sexual coercion was only collected in selected years; thus, we could not examine the impact of coercion in this study.

Implications

Uganda achieved early success in controlling the epidemic of HIV, through a combination of prevention approaches including strong political leadership, community mobilization, and behavior change.^{39,40} Given recent increases in HIV seroprevalence among youth,⁴¹ efforts to reinvigorate prevention efforts are needed.

Effective HIV risk reduction measures for youth include male medical circumcision, sex education, condom use, and HIV treatment as prevention.⁴² Staying in school can also play an important role in protecting youth from sexual initiation and HIV infection. Helping youth delay initiation of sexual intercourse by providing opportunities for education can be a powerful way to prevent HIV infection and other adverse reproductive health outcomes.^{11–13,26,35}

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Abbreviations with List of Acronyms

IRR	incidence rate ratios
ART	antiretroviral therapy
SES	socioeconomic status
HIV	human immunodeficiency virus
STI	sexually transmitted infection
HPV	human papillomavirus
HSV-2	herpes simplex type 2
RCCS	Rakai Community Cohort Study
IRB	institutional review board
MMC	male medical circumcision
SSA	Sub Saharan Africa
UPE	Universal primary education

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Figure 1. Proportion Sexually Experienced by Age, Adolescent Women, Rakai, Uganda, 1994–2011

Footnote: For women, all linear trends over time were significant with the exception of 19 year olds ($p=316$); and all quadratic trends were significant.

Figure 2. Proportion Sexually Experienced by Age, Adolescent Men, Rakai, Uganda, 1994–2011

Footnote: For men, all linear trends over time were significant with the exception of 15 year olds ($p=.23$); and all quadratic trends were significant.

Table 1
 Characteristics of Adolescents (15–19 years) by Survey Round, Rakai, Uganda, 1994–2011

Women	Row Total (person rounds)	R1	R2	R3	R4	R6	R7	R8	R9	R10	R11	R12	R13	R14	All Rounds	p-value for trend (age adjusted)	Statistical Method
Total N	17,419	1,290	1,276	1,322	1,148	1,599	1,491	1,624	1,159	1,102	1,159	1,318	1,357	1,574			
Ever had sex	11,481	69.5	68.6	73.7	72.8	75.5	74.1	77.3	73.9	73.5	65.4	62.9	55.2	49.8	68.5	<0.001	LogRegRE
Age																<0.001	LinRegRE
15	2,569	17.1	13.6	12.9	10.0	15.2	11.9	12.1	11.0	11.1	15.6	19.3	20.0	20.0	14.8		
16	3,151	19.2	19.9	18.7	14.1	17.8	18.0	16.6	17.1	16.5	19.1	18.4	20.2	19.1	18.1		
17	3,301	19.4	17.5	18.3	21.9	17.9	20.4	18.9	18.0	18.4	18.3	19.4	19.2	18.9	19.0		
18	4,187	23.4	23.2	25.0	27.8	23.1	24.7	26.2	26.6	24.2	22.8	21.7	22.5	22.0	24.0		
19	4,211	21.0	25.8	25.0	26.2	26.1	25.0	26.1	27.4	29.8	24.2	21.2	18.1	20.0	24.2		
Enrolled in school																<0.001	LogRegRE
No	9,473	77.1	72.4	69.1	68.6	73.6	69.8	68.4	64.5	63.2	54.1	49.6	43.2	41.7	61.7		
Yes	5,889	22.9	27.6	30.9	31.4	26.5	30.2	31.7	35.5	36.8	45.9	50.4	56.8	58.3	38.3		
Ever married																<0.001	LogRegRE
No	8,338	NA	NA	NA	47.3	54.3	55.9	58.5	59.5	60.8	68.8	72.6	76.5	76.2	63.7		
Yes	4,753	NA	NA	NA	52.7	45.7	44.1	41.5	40.5	39.2	31.2	27.4	23.5	23.8	36.3		
Orphanhood status																	
Not orphan	9,259	52.5	53.3	53.4	52.0	52.2	51.9	52.0	53.8	51.4	54.5	57.9	61.4	66.2	55.0	reference	MLogRegRE
Both parents died	2,598	14.7	14.3	14.0	16.1	17.2	17.0	16.8	17.6	18.0	17.2	14.9	13.0	10.6	15.4	<0.001	MLogRegRE
Mother died	1,571	11.8	10.1	10.7	10.5	10.8	9.7	9.2	9.4	9.8	8.4	8.4	7.5	6.6	9.3	<0.001	MLogRegRE
Father died	3,401	21.0	22.3	21.9	21.4	19.8	21.5	22.0	19.2	20.9	20.0	18.8	18.1	16.7	20.2	<0.001	MLogRegRE
SES																<0.001	OrLogRegRE
High	5,821	23.1	21.4	23.7	22.9	30.7	31.3	34.2	34.8	35.6	37.6	42.7	43.1	50.3	33.5		
Middle	4,923	21.7	25.5	25.6	25.4	26.5	26.7	25.7	28.2	31.2	30.7	33.9	35.5	32.1	28.3		

Women	Row Total (person rounds)	R1	R2	R3	R4	R6	R7	R8	R9	R10	R11	R12	R13	R14	All Rounds	p-value for trend (age adjusted)	Statistical Method
Low	6,643	55.2	53.0	50.8	51.7	42.8	42.0	40.1	37.1	33.2	31.8	23.5	21.4	17.7	38.2	<0.001	LogRegRE
Alcohol use in the last 30 days																	
No	11,123	74.1	75.0	75.3	79.3	76.2	76.9	76.0	87.1	87.8	88.4	91.4	NA	NA	80.5		
Yes	2,700	25.9	25.0	24.8	20.7	23.8	23.1	24.0	12.9	12.2	11.6	8.7	NA	NA	19.5		
Religion																	
None	71	1.2	0.9	0.7	0.8	0.4	0.2	0.1	0.2	0.2	0.1	0.2	0.3	0.2	0.4	<0.001	MLogRegRE
Catholic	10,352	61.3	64.0	62.8	59.6	61.9	61.2	59.2	58.8	58.5	59.1	55.6	56.0	55.9	59.5	reference	MLogRegRE
Protestant	3,534	20.2	19.8	21.3	22.0	21.3	21.1	21.6	19.5	19.2	18.9	20.0	20.6	18.4	20.3	0.549	MLogRegRE
Saved/Pentecostal	513	0.9	1.0	1.0	1.9	1.7	1.4	1.8	1.7	4.0	5.7	5.3	6.1	6.1	3.0	<0.001	MLogRegRE
Muslim	2,827	15.5	13.6	13.8	15.4	14.4	15.6	16.6	19.4	17.5	15.8	18.5	16.4	19.1	16.3	<0.001	MLogRegRE
Other	93	0.8	0.6	0.5	0.4	0.4	0.5	0.7	0.4	0.6	0.4	0.5	0.7	0.3	0.5	0.657	MLogRegRE
Men	Row Total (person rounds)	R1	R2	R3	R4	R6	R7	R8	R9	R10	R11	R12	R13	R14	All Rounds	p-value for trend (age adjusted)	Statistical Method
Total N	14,098	1,042	996	1,070	927	1,102	1,006	1,196	891	776	1,003	1,214	1,340	1,535			
Ever had sex	7,413	52.5	51.6	56.8	54.9	62.2	62.7	65.2	60.5	59.8	54.8	54.3	45.0	41.1	54.9	<0.001	LogRegRE
Age																<0.001	LinRegRE
15	2,132	21.2	13.2	10.0	11.8	14.2	12.8	11.5	11.7	10.8	19.5	19.9	18.1	18.0	15.1		
16	2,839	20.4	20.4	21.0	15.3	18.5	18.6	18.7	18.3	17.9	19.1	20.9	25.2	23.4	20.1		
17	2,766	17.9	16.9	18.8	19.2	19.0	21.5	21.1	18.7	21.8	19.6	19.0	20.4	20.9	19.6		
18	3,448	23.3	28.7	28.4	30.1	23.7	26.1	25.6	25.5	25.1	23.2	21.2	20.2	21.1	24.5		
19	2,913	17.3	20.9	21.8	23.6	24.7	21.0	23.2	25.8	24.4	18.8	19.1	16.3	16.6	20.7		
Enrolled in school																	
No	5,950	64.2	56.1	58.9	49.4	57.4	57.0	53.1	46.8	49.4	40.7	41.4	38.6	34.7	48.3	<0.001	LogRegRE
Yes	6,369	35.8	43.9	41.1	50.6	42.7	43.0	46.9	53.2	50.6	59.3	58.6	61.4	65.3	51.7		

Women	Row Total (person rounds)	R1	R2	R3	R4	R6	R7	R8	R9	R10	R11	R12	R13	R14	All Rounds	p-value for trend (age adjusted)	Statistical Method
Ever married																<0.001	LogRegRE
No	10,293	NA	NA	NA	93.6	95.5	95.7	96.7	97.6	97.7	97.3	97.9	98.2	99.2	97.2		
Yes	296	NA	NA	NA	6.4	4.5	4.3	3.3	2.4	2.3	2.7	2.1	1.8	0.8	2.8		
Orphanhood status																	
Not orphan	7,349	48.8	54.6	52.9	51.0	49.8	47.9	48.0	47.4	48.5	52.7	57.1	62.4	66.5	53.8	reference	MLogRegRE
Both parents died	2,220	17.4	13.1	16.5	16.2	17.6	21.0	21.2	22.4	20.8	17.5	13.9	11.3	9.2	16.3	<0.001	MLogRegRE
Mother died	1,138	10.5	9.1	9.5	10.2	10.3	9.8	8.1	7.1	9.0	6.9	7.4	6.9	6.2	8.3	<0.001	MLogRegRE
Father died	2,944	23.3	23.2	21.2	22.6	22.3	21.4	22.7	23.1	21.7	23.0	21.6	19.5	18.1	21.6	<0.001	MLogRegRE
SES																<0.001	OrLogRegRE
High	4,471	21.2	20.3	21.8	23.0	27.6	25.5	33.0	33.0	35.9	37.4	38.9	39.9	45.7	31.8		
Middle	3,897	22.5	23.5	24.6	21.7	26.5	28.4	25.5	25.7	28.1	28.8	32.7	33.7	32.9	27.7		
Low	5,704	56.3	56.2	53.6	55.4	45.9	46.2	41.5	41.3	36.0	33.9	28.5	26.4	21.4	40.5		
Alcohol use in the last 30 days																	
No	8,055	65.51	67.74	65.7	70.41	70.42	69.68	72.83	83.24	84.54	87.72	88.96	NA	NA	75.4	<0.001	LogRegRE
Yes	2,633	34.49	32.26	34.3	29.59	29.58	30.32	27.17	16.76	15.46	12.28	11.04	NA	NA	24.6		
Circumcision																<0.001	LogRegRE
No	8,012	85.11	86.24	85.31	86.99	NA	NA	83.26	79.24	79.38	77.39	77.18	71.64	65.58	79.0		
Yes	2,133	14.89	13.76	14.69	13.01	NA	NA	16.74	20.76	20.62	22.61	22.82	28.36	34.42	21.0		
Religion																	
None	62	0.7	1.0	0.7	0.8	0.8	0.2	0.0	0.3	0.3	0.2	0.1	0.1	0.1	0.4	<0.001	MLogRegRE
Catholic	8,546	63.4	64.2	63.0	61.9	61.1	60.3	61.0	60.2	61.6	58.3	59.5	57.8	59.1	60.8	reference	MLogRegRE
Protestant	2,751	20.6	20.6	21.8	22.4	21.4	21.1	20.7	19.2	16.9	18.4	17.1	18.9	17.4	19.6	0.09	MLogRegRE
Saved/Pentecostal	323	0.9	1.0	0.7	1.0	2.3	2.7	2.6	1.9	2.8	3.8	4.3	3.5	2.8	2.3	<0.001	MLogRegRE
Muslim	2,290	14.0	12.8	13.7	13.6	14.0	14.8	15.1	17.9	17.9	18.6	18.6	19.3	19.8	16.3	<0.001	MLogRegRE

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Women	Row Total (person rounds)	R1	R2	R3	R4	R6	R7	R8	R9	R10	R11	R12	R13	R14	All Rounds	p-value for trend (age adjusted)	Statistical Method
Other	77	0.4	0.4	0.3	0.4	0.5	0.9	0.8	0.6	0.5	0.7	0.4	0.5	0.8	0.6	0.113	MLogRegRE
LogRegRE=Logistic regression with robust estimation																	
LinRegRE=Linear regression with robust estimation																	
MLogRegRE=Multinomial logistic regression with robust estimation																	
OrLogRegRE=Ordered logistic regression with robust estimation																	

Table 2
Prevalence of Sexual Experience among Adolescents by Risk Factor and Age, Rakai, Uganda, 1994–2011

RISK FAC	Row Total (person rounds)	Women					Men					p-value*	19 yrs	18 yrs	17 yrs	16 yrs	15 yrs	Row Total (person rounds)	p-value*	19 yrs	18 yrs	17 yrs	16 yrs	15 yrs	p-value*
		15 yrs	16 yrs	17 yrs	18 yrs	19 yrs	15 yrs	16 yrs	17 yrs	18 yrs	19 yrs														
Total N	17,419	2,569	3,151	3,301	4,187	4,211												14,098							
Ever sex %	16,757	29.6	49.2	68.6	83.4	92.7												13,509							
Enrolled in school																									
No	9,473	54.4	72.3	86.3	92.7	96.5												5,949							
Yes	5,888	20.0	31.4	41.7	52.6	66.1												6,367							
Ever married																									
No	8,338	26.0	39.6	54.0	64.9	78.1												5,560							
Yes	4,753	100.0	100.0	100.0	100.0	100.0												296							
Orphanhood status																									
Not an orphan	8,915	26.9	46.1	64.4	80.4	92.3												7,026							
Double orphan	2,497	36.7	51.7	74.5	88.7	94.4												2,136							
Mother died	1,505	31.4	50.8	76.0	88.5	94.9												1,087							
Father died	3,260	33.0	55.9	71.9	83.4	91.6												2,817							
SES																									
High	5,699	27.2	45.4	65.2	79.5	89.4												4,356							
Middle	4,752	28.1	46.9	67.3	83.4	93.1												3,757							
Low	6,277	33.1	54.4	72.6	86.8	95.2												5,371							
Alcohol use in the last 30 days																									
No	11,122	31.3	50.2	68.5	84.0	92.4												8,012							
Yes	2,700	45.2	70.9	84.3	92.5	97.5												2,621							
Circumcision																									

RISK FAC	Row Total (person rounds)	Women							Men							p-value*
		15 yrs	16 yrs	17 yrs	18 yrs	19 yrs			15 yrs	16 yrs	17 yrs	18 yrs	19 yrs			
No									25.0	37.5	50.3	68.3	79.8			<0.001
Yes									30.6	39.2	54.9	69.1	83.9			<0.001
Religion																
None	63	40.0	42.9	50.0	75.0	94.4			37.5	25.0	40.0	73.7	83.3			0.039
Catholic	9,945	30.2	52.6	70.6	84.9	93.4			27.6	36.9	51.4	69.7	81.3			<0.001
Protestant	3,391	26.6	44.1	65.3	80.7	92.6			20.5	37.1	49.1	65.0	82.3			<0.001
Saved/Pentec	507	17.9	27.7	52.6	68.2	82.1			23.5	36.7	57.1	57.8	58.2			<0.001
Muslim	2,735	33.3	47.9	69.1	84.9	92.3			29.5	40.1	52.7	70.6	83.2			<0.001
Others	87	26.7	26.3	53.3	50.0	66.7			16.7	17.7	43.8	42.9	62.5			0.029

* Statistical testing examined difference in characteristics adjusting for age.

Table 3

Initiation of Sexual Intercourse among Adolescents, Rakai, Uganda, 15–19 years, 1994–2011

Women										
RISK FACTORS		N	Incidence Rate Ratio (IRR)			Multivariate Poisson Regression, Incidence Rate Ratio (#				
			IRR	95% Lower	95% Upper	P-value	IRR	95% Lower	95% Upper	P-value
Age of respondents										
16		575	ref							
17		696	1.35	1.12	- 1.64	0.002	1.37	1.07	- 1.74	0.012
18		593	1.34	1.11	- 1.63	0.002	1.29	1.01	- 1.65	0.04
19		359	1.60	1.31	- 1.94	<0.001	1.43	1.11	- 1.84	0.006
IRR adjusted for age										
Linear trend for interview year										
Linear trend		2,283	0.96	0.95	- 0.97	<0.001				
Linear and quadratic trends for interview year										
Linear trend		2,283	1.01	0.94	- 1.07	0.865				
Quadratic trend		2,283	1.00	0.99	- 1.00	0.126				
Enrolled in School										
Yes		1,199	ref				ref			
No		663	1.89	1.66	- 2.15	<0.001	1.74	1.48	- 2.03	<0.001
Orphanhood status										
Not an orphan		1,334	ref							
Double orphan		335	1.24	1.06	- 1.45	0.007				
Mother died		178	0.91	0.70	- 1.19	0.501				
Father died		425	1.11	0.95	- 1.30	0.196				
SES										

Women									
RISK FACTORS	N	Incidence Rate Ratio (IRR)			Multivariate Poisson Regression, Incidence Rate Ratio (#				
		IRR	95% Lower	95% Upper	P-value	IRR	95% Lower	95% Upper	P-value
Age of respondents									
High	847	ref							
Median	683	1.03	0.89	- 1.19	0.713				
Low	752	1.12	0.97	- 1.30	0.126				
Alcohol use in the last 30 days									
No	1,534	ref				ref			
Yes	205	1.51	1.28	- 1.78	<0.001	1.29	1.06	- 1.57	0.011
Religion									
Catholic	1,289	ref							
Protestant	513	0.89	0.76	- 1.03	0.117				
Saved/Pent	ecosta817	0.67	0.47	- 0.96	0.029				
Muslim	368	0.84	0.70	- 1.01	0.071				
Men									
RISK FACTORS	N	Incidence Rate Ratio (IRR)			Multivariate Poisson Regression, Incidence Rate Ratio (#				
		IRR	95% Confidence Interval	P-Value	IRR	95% Confidence Interval	P-Value		
Age of respondents									
		Lower	Upper		Lower	Upper			
16	543	ref			ref				
17	825	1.29	1.07	- 1.56	0.008	1.27	1.00	- 1.62	0.055
18	870	1.66	1.38	- 1.98	<0.001	1.40	1.10	- 1.77	0.006
19	576	1.80	1.50	- 2.16	<0.001	1.45	1.14	- 1.84	0.002
IRR adjusted for age									
Linear trend for interview year									
linear trend	2,843	0.97	0.96	- 0.98					<0.001

Men									
RISK FACTORS	N	Incidence Rate Ratio (IRR)			Multivariate Poisson Regression, Incidence Rate Ratio (#				
		IRR	95% Confidence Interval	P-Value	IRR	95% Confidence Interval	P-Value	Lower	Upper
Age of respondents									
Linear and quadratic trends for interview year									
Linear trend	2,843	1.00	0.95	-	1.06	0.89			
Quadratic trend	2,843	1.00	1.00	-	1.00	0.14			
Enrolled in School									
Yes	1,251	ref				ref			
No	955	1.84	1.64	-	2.06	<0.001	1.75	1.51	2.03
Orphanho od status									
Not an orphan	1,554	ref				ref			
Double orphan	429	1.34	1.18	-	1.53	<0.001	1.22	1.03	1.45
Mother died	231	0.85	0.68	-	1.06	0.139	0.91	0.69	1.21
Father died	617	1.06	0.94	-	1.21	0.346	1.11	0.94	1.30
SES									
High	886	ref							
Median	822	1.13	0.99	-	1.28	0.071			
Low	1,132	1.24	1.10	-	1.40	<0.001			
Alcohol use in the last 30 days									
No	1,718	ref				ref			
Yes	398	1.34	1.17	-	1.54	<0.001	1.28	1.08	1.53
Circumcision									
No	1,613	ref							
Yes	508	1.04	0.92	-	1.17	0.58			

Men									
RISK FACTORS	N	Incidence Rate Ratio (IRR)			Multivariate Poisson Regression, Incidence Rate Ratio (#				
		IRR	95% Confidence Interval	P-Value	IRR	95% Confidence Interval	P-Value		
Age of respondents									
Religion									
Catholic	1,702	ref							
Protestant	601	1.01	0.89	-	1.14	0.929			
Saved/Pentecostal	63	0.94	0.65	-	1.34	0.720			
Muslim	444	1.02	0.89	-	1.17	0.792			