

Trends in HIV Infection among Youth-PAA

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Trends in HIV Prevalence, Incidence and Demographic, Behavioral, and Biological Risk Factors among Youth in Rakai, Uganda, 1999-2011

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Abstract

Significant changes have occurred in HIV treatment and prevention in Uganda over the past decade, as well as change in national policies for universal education. Using the Rakai Community Cohort Study from 1999-2011, we describe trends in HIV prevalence and incidence among youth (15-24 years: n=23,952) and trends in previously identified risk factors. HIV prevalence declined among young women, but not young men. HIV incidence declined among teens, but not among 20-24 year-olds. Substantial declines occurred in marriage and sexual experience, particular among teens. Significant increases occurred in school attendance and male circumcision. Among sexually experienced youth, reporting of multiple partners and sexual concurrency declined. Condom use increased but only among primary partners. Decreases in risk factors and increases in some protective factors were seen in teens, coinciding with a significant decrease in the HIV incidence. This decline in HIV incidence was most directly attributable to increasing access to education.

Introduction

Globally, youth 15-24 years represent about 40% of all new cases of Human Immunodeficiency Virus (HIV) among persons of reproductive age (15-49 years) (UNAIDS, 2009). Over the past two decades, HIV prevalence among young people has declined in many high prevalence countries of east Africa and elsewhere (UNAIDS, 2010). Declines have been concurrent with declines in risk behaviors among youth, however, many factors may influence HIV prevalence among youth, including changes in HIV risk behaviors, and social conditions, prevention and treatment programs - and death from HIV (Wawer 2005, Mmari 2009; Mavedzenge 2011). The changing patterns and determinants of HIV risk in Uganda can best be framed within the context of the developmental and social forces influencing sexual behaviors, relationship formation, and the interconnections between pregnancy and HIV/STI prevention. Likewise, it is critical to explore the roles that HIV prevention policies and the recent availability of ARVs and MC will play in shaping reproductive health behaviors and HIV risk, especially in a setting in which these policies and programs implemented early.

Uganda has made notable progress in containing HIV in the early years of the epidemic through a high-level of political commitment to variety of prevention approaches, including community mobilization, promotion of ABC, and political openness regarding HIV (Gray 2006; Green 2006; Kirby 2008; Kirby 2008; Kilian 1999). Although Uganda's HIV seroprevalence declined steadily in the 1990s, rates of new infections appear to have stabilized in the 2000s, both at the national level and in the Rakai district, in which the proposed study is set.

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Moreover, between 1994-2003, Rakai witnessed remarkable increases in young people's behavioral risk, including an earlier age for sexual debut among boys and increases in non-marital sexual relationships and numbers of sex partners among boys and girls (Wawer 2005). These increases in risk behaviors were offset by a substantial increase in condom use, particularly with casual partners. These increases in sexual risk behaviors suggest possible "prevention fatigue" among young people. Changing availability in Rakai of antiretroviral (ARV) therapies after 2004 and of male circumcision (MC) after 2008 may have begun to reduce HIV transmission. However, this same availability has engendered fears about behavioral disinhibition, i.e., increases in risk behaviors as perceived risk of HIV diminishes (Gray 2006). Such behavioral disinhibition could overwhelm the positive impact of MC and other prevention strategies HIV transmission. And in fact, recent data from Uganda suggests an increase in HIV prevalence among youth in Uganda between 2005 and 2011, particularly among young men under 25 (Ugandan MOH 2006; Ugandan MOH 2012). Understanding of behavioral trends in the face of changing HIV care and treatment should help in understanding the impact of behavioral disinhibition. Likewise, a more complete understanding of Uganda's successes and challenges over time could contribute to improved prevention of HIV among youth in Sub-Saharan Africa.

Multiple factors have been associated with HIV infection among youth including earlier initiation of sexual intercourse, multiple sexual partners and sexual concurrency, male circumcision, failure to use barrier protection, concurrent STI infection, relationship violence, and power dynamics within relationships [Mmari Kirby 2008]. In Sub-Saharan Africa (SSA), youth are at particular risk for HIV given high HIV prevalence, limited health care infrastructure, and practices such as marriage to older partners and sexual concurrency [Clark 2004; Mmari 2008; Mavedzenge 2011; UNAIDS 2010]. In a recent study of risk factors for HIV incident infection among youth in Rakai, we recently found a variety of risk factors including marital dissolution, peri-urban residence, multiple partners, sexual concurrency, having partner(s) from outside one's own community, STI symptoms, alcohol use (among young men) [Santelli 2012]. Being a student was protective against new HIV infections.

This study examined trends in HIV incidence and prevalence and demographic and behavioral risk factors associated with HIV infection among youth, using data from the Rakai Community Cohort Study. Change was examined within the context of changing educational policies, demographic context, and HIV/AIDS treatment and prevention policies.

Methods

We examined trends in HIV risk and associated factors among youth (ages 15-24) participating in the Rakai Community Cohort Study (RCCS) from March 1999 and June 2011. Using a prospective longitudinal study design, we examined (1) trends in HIV prevalence and incidence, (2) trends in demographic

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factors and HIV risk factors, which we had previously found to be associated with HIV incident infection among Rakai youth ([Santelli 2012](#)), and (3) changes in effect of risk factors over time.

The RCCS is an open cohort of residents aged 15-49 years from 50 communities in the Rakai district of southwestern Uganda. It achieves 85% coverage among all residents. Communities are surveyed approximately annually. At each survey round, participants are consented, interviewed and asked to provide biological specimens for HIV and STI testing. For minors, assent and parental/guardian consent for research participation is obtained. Face-to-face interviews are conducted in private locations by same-sex interviewers. Questionnaires include questions on demographic, behavioral, reproductive and health characteristics, as well as perceptions of HIV risk, prevention and related factors. HIV status is measured using two separate ELISA tests and confirmation by HIV-1 western blot.

Between March 1999 and June 2011 there were 9 RCCS survey rounds and 23,952 youth participants aged 15 to 29 years-old. The average number of study rounds in which youth participated was 2 with a range of 1 to 9. Among the RCCS youth, 10,635 were eligible for analysis of incidence rates by entering RCCS as HIV-negative and being followed up at one or more study visits

Description of variables

Information on potential demographic, behavioral, and biological risk and protective factors was gathered exclusively from the RCCS questionnaire at the time of study visit. The majority of questions relevant to our analyses were asked consistently across RCCS surveys rounds.

Whether a participant was currently a student was based on whether he/she chose "Student" from a list of occupations.

Sexual concurrency, multiple partners, and condom use variables were constructed based on detailed questions about sexual partnership(s) in the last year. The RCCS questionnaire assessed up to 2 partners until February 2001 and up to 4 partners after that time. Sexual concurrency was defined as reporting 2 or more partners at the time of interview. Condom use was classified as "always" if the participant responded as such for all partners for whom there was information.

STI symptoms were based on participants' response to "In the past 12 months have you had any of the following health problems?" - followed by a description of each symptom. In this analysis, we focus on report of genital ulcer. For self-assessment of HIV risk, participants were asked to rate the likelihood that they had been exposed to HIV at each follow-up study visit as none at all, low, medium, high or do not know.

Statistical analysis

HIV incidence rates were estimated per 1000 person-years over the interval between RCCS study rounds. Prevalence of HIV and risk behaviors were examined as proportions of all youth regardless of number of rounds of participation. Trends were examined separately for women and men and for 15-

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19 and 20-24 year olds; and, for sexual behaviors, only among sexually-experienced youth.

Statistical significance of trends in prevalence of HIV and risk factors was estimated using the Mantel-Haenszel Extension Trend test. For tests of trend over the full youth age range (15-24 years-old), we report p-values adjusted for single year of age in addition to unadjusted p-values. Trends in incidence rates were tested using both Poisson regression (Zou 2004) and weighted linear regression (Rothman reference). In estimating change over time in prevalence, incidence, and risk and protective factors, we age adjusted by age category (15-19 years-old and 20-24 years old).

Results

Between 1999 and 2011, HIV prevalence declined among young women aged 15-24 (prevalence from 9.6% to 6.2%, p and age-adjusted $p < .001$, Figure 1, Table 1). There appeared to be a decrease in prevalence in young men over time. This decrease was no longer statistically significant when adjusted for age (Table 1), as the male population trended younger over time (Figure 2).

The number of new infection in youth by RCCS survey interval ranged from 5 to 17 in young men and 21 and 29 in young women. HIV incidence declined among teens, but not among 20-24 year-olds (data not shown) and incidence declined for young women but not young men. Young women consistently had incident rates higher than young men (Figure 1, Table 1). The incidence rate in young women decreased from 15.2/1000 to 10.3/1000 person-years between 1999 and 2011 ($p = .09$, age-adjusted $p = .10$ via Poisson regression and $p = .003$, age-adjusted $p = 0.18$). The change among teen women (16.6 to 2.4/1000 person years) was statistically significant ($p = .01$).

Being a student increased dramatically between in Rakai youth between 1999 and 2011 (12.5% to 32.4% among women, age-adjusted $p < .0001$; 23.1% to 43.3% among men, age-adjusted $p < .0001$). The increase in school attendance was most marked in teens (Figure 2). Marriage rates also declined significantly among teen women (46.4% to 23.7%; $p < .0001$) and teen men (4.6% to 0.8%, $p < .0001$) (Figure 2). The percentage of youth that had ever had sexual intercourse declined substantially among teen women (75.5% to 49.7%, $p < .0001$) and young men (62.4% to 40.8%, $p < .0001$).

Among sexually experience youth, reporting of multiple partners declined for men (42.1%, to 28.1%, age adjusted $p < .0001$) and women (8.1%, to 5.4%, age adjusted $p < .0001$) (Figure 3). Sexual concurrency at the time of survey declined among young men (16.9%, to 11.0%, age adjusted $p < .0001$). In young women, sexual concurrency was less common and appeared to be decreasing over time in teen women only (2.2% to 1.3%, $p = 0.05$), but not among young adult women. Condom use with primary partner increased slightly, though there little change in use other partners. Rates of circumcision rose among men (16.2% in 2002 to 37.2% in 2010-11, $p < .0001$) and among primary partners of women.

Lastly, among sexually experience youth, reporting of genital ulcer in the last 12 months increased in young women (10.4% to 17.1%, age-adjusted $p < .0001$), but not young men (Figure 3). Self-reported risk of HIV as medium or

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high increased in both young women (24.6% to 52.4%, age-adjusted p-value age-adjusted $0 < .0001$) and. The latter was also true of young men (Figure 3).

Discussion

Over the past decade, new HIV infections in Rakai declined for young women but not for men, coinciding with remarkable change in risk behaviors, school attendance, and male circumcision. School attendance increased dramatically accompanied by decreases in youth who were ever married and had ever had sex; these trends were particularly striking among young people before age 20 but were also measurable among 20-24 year olds. Among sexually experienced youth, reporting of multiple partners and sexual concurrency declined while condom use generally showed little improvement, except for increases in use with primary partners. Rates of circumcision began to rise after round 10 (2005) as the Rakai circumcision trial began. Given current understanding of HIV risk factors (Santelli 2012, Mavenzinga 2011, Mmari 2009), this pattern of changes by age and gender suggestst that increased access to schooling may be factor in reducing HIV incidence among youth in Rakai.

Globally, educational attainment has improved markedly among youth over the past 50 years and improved access to education has been a primary driver of improvements in national development, social well being, and health status (NRC/ IOM 2005). In understanding the impact of education on health, rising education attainment is associated with delays in entrance into marriage and initiation of sexual experience. Trade offs between early marriage and truncation of schooling are well established. Rising education levels are also related to reductions in teen fertility and unintended fertility among young adult women (NRC/ IOM 2005; Hargreaves 2008; Baird 2012; Ssewamala 2011). For young men, education has similar effects on marriage and sexual activity, although the impact on HIV infection is not well established. Our study clearly suggests access to education is reducing HIV risk behaviors and HIV incidence for young men and women. Education appears to be operating by both reducing initiation of sexual experience and reducing other risk behaviors such as multiple partners and concurrency among sexually experienced youth.

Limitations

Behavioral data were all self reported data. Because of circular migration, loss to follow up at specific rounds was common.

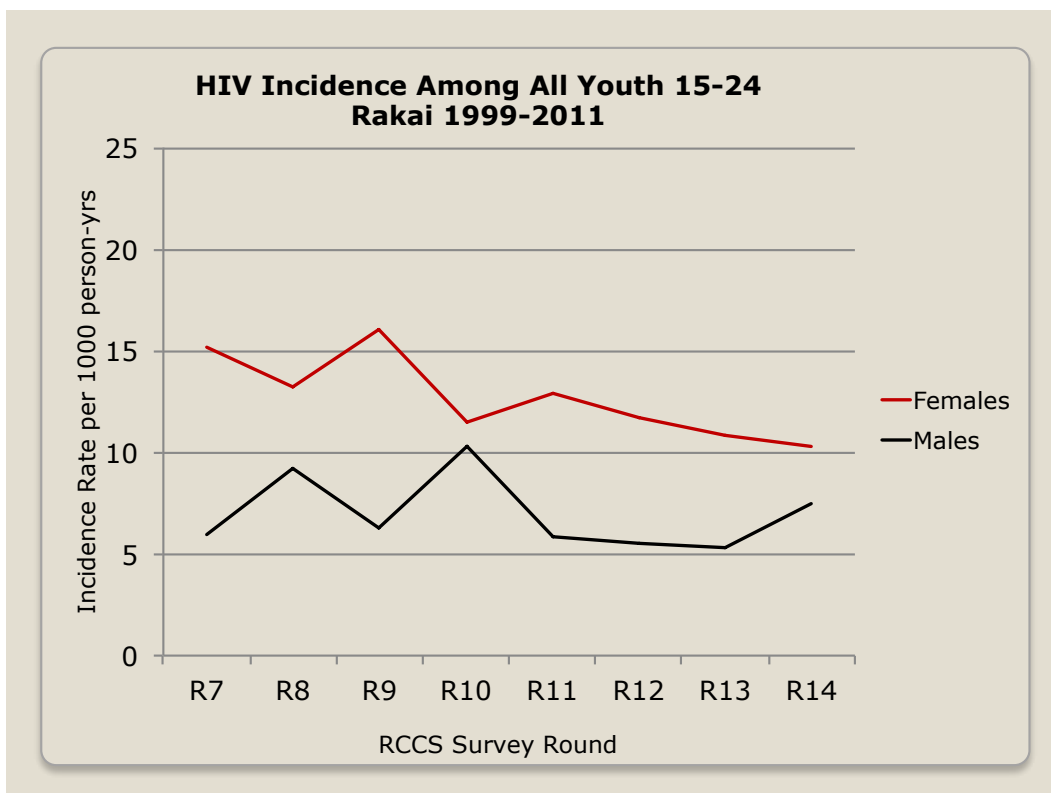
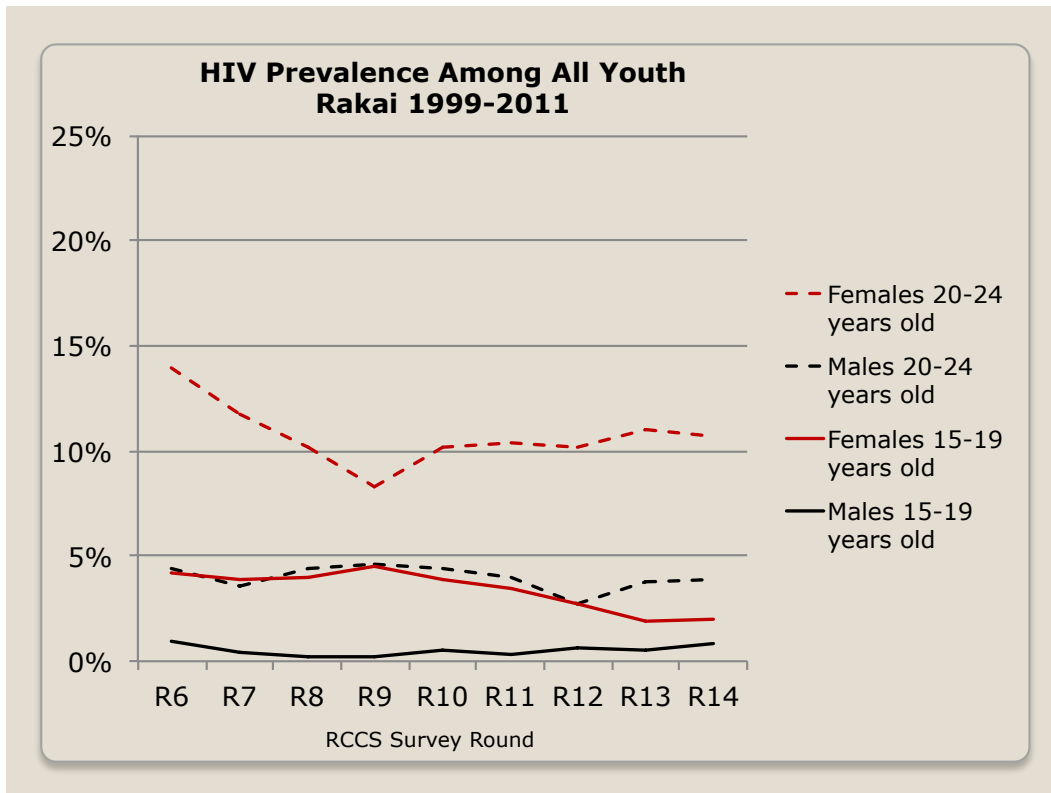
Implications

To understand trends in HIV prevalence and incidence, one must consider trends in demographic factors, behavioral risks for HIV, changes HIV/AIDS treatment and prevention, but also non-HIV policies such as universal primary and secondary education. These data suggest that increased access to primary and secondary school may be important to future HIV prevention efforts among youth in Uganda and in other areas of Sub Saharan Africa.

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Figure 1. Trends in prevalence and Incidence of HIV among Youth in the Rakai District, Uganda, 1999-2011



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Table 1. HIV prevalence and incidence in young men and women aged 15-24 years old, Rakai District, Uganda, 1999-2011

	Rakai Community Cohort Study Survey Round, 1999-2011									p-value for trend (adjusted for age)*
	6	7	8	9	10	11	12	13	14	
MEN										
Number of young men	2365	2188	2505	1877	1653	1974	2354	2404	2583	
Person-years	NA	839	1412	1276	1259	1191	1821	2262	2256	
HIV Prevalence										
All young men	2.7%	2.2%	2.5%	2.6%	2.6%	2.1%	1.6%	1.9%	2.1%	0.02 (0.41)
Men, 15-19 years-old	0.9%	0.4%	0.2%	0.2%	0.5%	0.3%	0.6%	0.5%	0.8%	0.42
Men, 20-24 years-old	4.4%	3.6%	4.4%	4.6%	4.4%	4.0%	2.7%	3.8%	3.9%	0.24
HIV Incidence per 1000 person-years										
All young men	NA	5.96	9.21	6.27	10.32	5.88	5.49	5.31	7.53	0.48 (0.72)
Men, 15-19 years-old	NA	3.14	3.98	0.00	2.20	2.56	2.93	2.09	1.92	0.73
Men, 20-24 years-old	NA	7.69	12.09	9.60	14.91	7.49	7.03	7.67	12.34	0.80
WOMEN										
Number of young women	3612	3460	3744	2699	2685	2880	3233	2881	3005	
Person-years	NA	1381	2124	1806	1924	1859	2311	2582	2138	
HIV Prevalence										
All young women	9.6%	8.4%	7.6%	6.8%	7.8%	7.5%	6.9%	6.5%	6.2%	< 0.001 (< 0.001)
Women, 15-19 years-old	4.2%	3.9%	4.0%	4.5%	3.9%	3.5%	2.7%	1.9%	2.0%	< 0.001
Women, 20-24 years-old	13.9%	11.7%	10.2%	8.3%	10.2%	10.4%	10.2%	11.0%	10.7%	0.02
HIV Incidence per 1000 person-years										
All young women	NA	15.2	13.18	16.06	11.44	12.91	11.69	10.84	10.29	0.09 (0.10)
Women, 15-19 years-old	NA	16.64	10.58	14.57	3.65	19.20	11.04	6.01	2.35	0.01
Women, 20-24 years-old	NA	14.44	14.36	16.71	14.53	10.46	11.93	13.14	15.55	0.69

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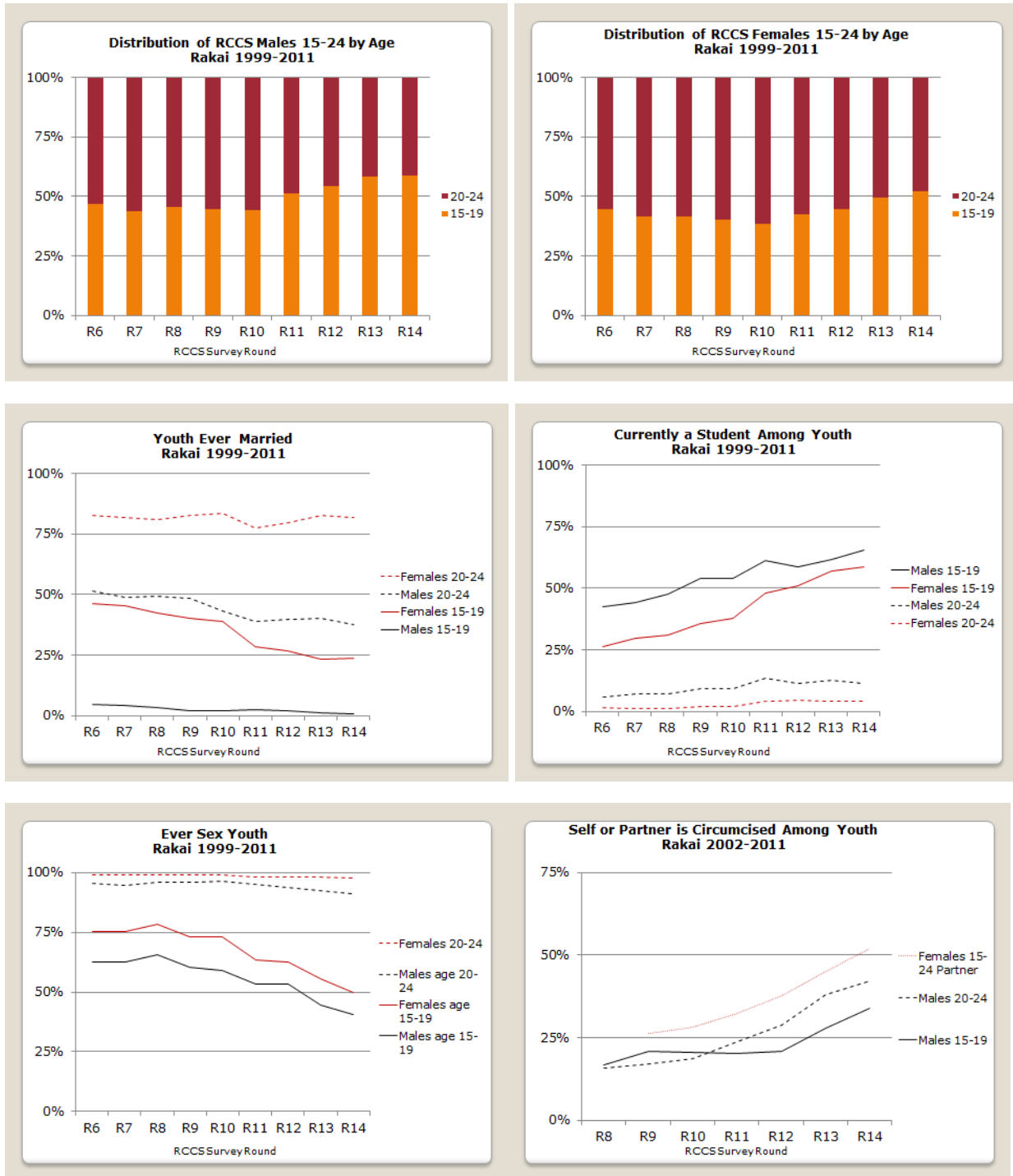
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* P-values estimated using Mantel-Haenszel Extension Trend test with age adjustment by single year of age. P-value from incidence rates estimated using Poisson regression and age adjustment by age categories (15-19 years old/20-24 years old)

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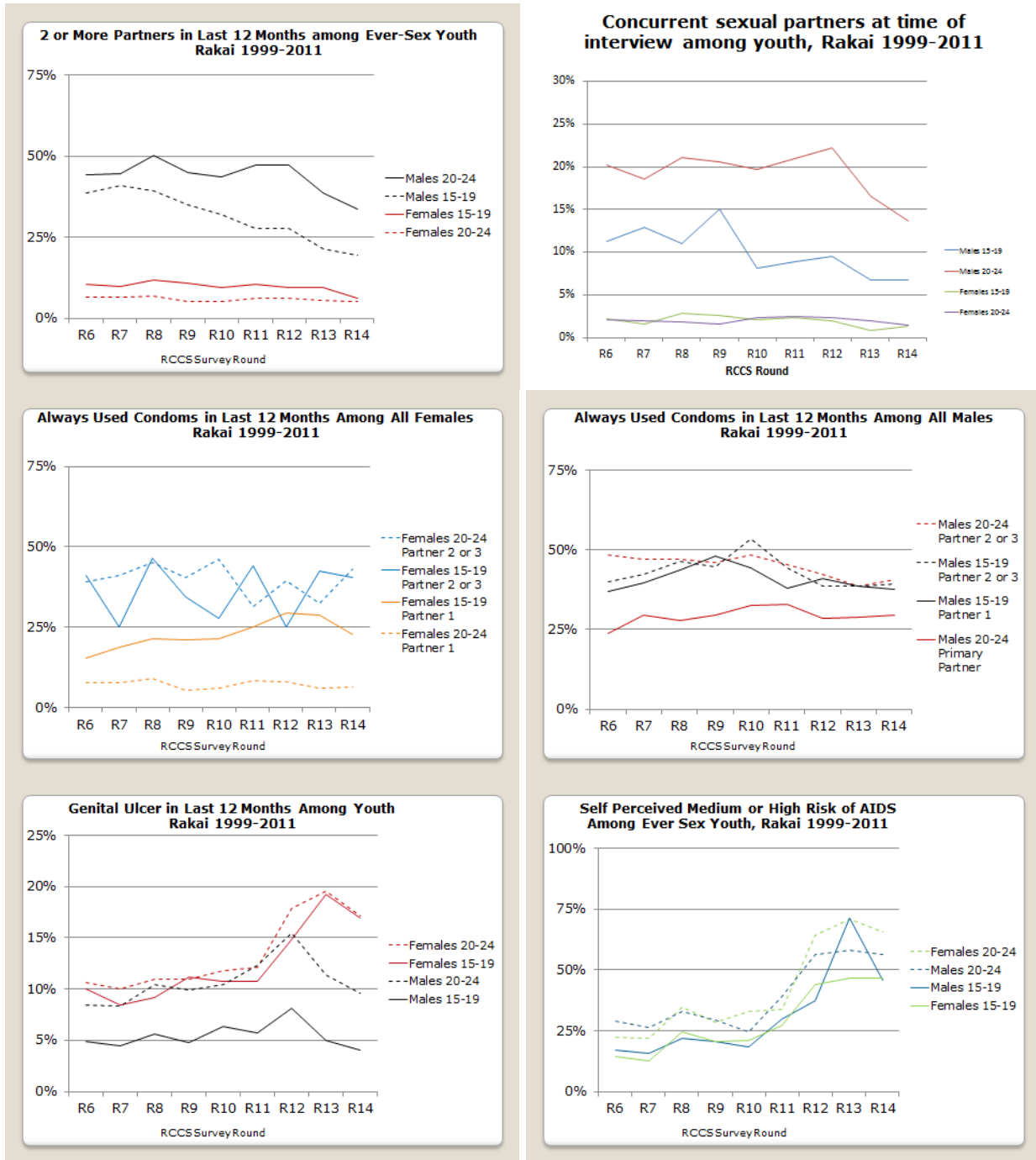
Figure 2. Demographic factors, sexual experience and circumcision among young men and women in the Rakai District, Uganda, 1999-2011



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Figure 3. Sexual behaviors among sexually experienced young men and women in the Rakai District, Uganda, 1999-2011



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