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### Publication Date

2023-07-01

### DOI

10.1016/j.annepidem.2023.04.005

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## Brief communication

# Measuring sexual behavior among in-school youth in Rwanda: a cross-sectional analysis of self-reported timing of first sex and correlates of early sexual debut

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## ARTICLE INFO

## Article history:

Received 9 February 2023

Received in revised form 3 April 2023

Accepted 8 April 2023

Available online 14 April 2023

## Keywords:

Sexual debut

First sex

Youth sexual health

## ABSTRACT

**Purpose:** Understanding the timing of sexual debut is critical for informing sexual and reproductive health interventions. We investigated sexual behavior and early sexual debut among Rwandan youth.

**Methods:** We conducted a cross-sectional analysis of data from a cluster-randomized trial with 6079 students ages 12–19 years in Rwanda. We examined predictors of early sexual debut (< 15 years) using logistic regression to estimate odds ratios and factors associated with the timing of first sex using Cox models to estimate hazard ratios. Interpretations of sex were also explored.

**Results:** Participants were 15 years and 51.5% female on average; 1723 (28.3%) reported sexual activity. Among the 1320 participants who provided an age of sexual debut, 51.4% reported sex at ≤12 years and 75.7% at < 15 years. Males had a higher odds of early sexual debut (adjusted odds ratio: 2.40; 95% CI: 1.99, 2.90) and a higher hazard of sex occurring at an earlier age than females (adjusted hazard ratio: 1.91; 95% CI: 1.67, 2.20). One-third of participants considered “sexual intercourse” to include kissing, touching, or masturbation.

**Conclusions:** Sex at ≤12 years was frequently reported, indicating that interventions facilitating access to youth-friendly sexual and reproductive health services are necessary before age 12. Validation studies are needed to evaluate how interpretations of sexual intercourse influence the assessment of sexual activity.

**Clinical trial:** NCT04198272.

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## Introduction

Sexual debut is a milestone in adolescent development that can expose youth to a range of sexual and reproductive health (SRH) risks, thus serving as a critical moment in SRH education [1,2]. Understanding youth sexual behavior and the timing of sexual debut is critical for informing SRH education and program planning for adolescents, and can provide guidance on the appropriate window

for initiating conversations with youth related to relationships and health.

The timing of sexual debut and the attendant risks and outcomes have been widely studied across sub-Saharan Africa [3–7]. However, the prevalence of early sexual debut and its associated factors vary regionally [8], and few studies have been conducted in Rwanda. Of those, substantial heterogeneity has been found with respect to early sexual debut [9,10]. Some studies have shown that early sexual debut is associated with lower education [11], household wealth [4,6,11], and parental connectedness or supervision [4,6,11,12]; however, no such studies have focused exclusively on Rwanda and few have included populations as young as 12 years of age.

Additionally, few existing studies provide a detailed description of their measurement approach and the steps taken to improve the quality of self-reported data on a highly sensitive topic for

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adolescents. Sexual activity is commonly assessed through a single, direct question about the age of sexual debut, sexual engagement, or condom use [3,4,6,8,12]. While comprehensive training on survey delivery is often provided for study teams [5,7–9], the extent to which studies address misclassification is limited or unknown and calls for rigorous efforts to minimize measurement error and increase the accuracy of sensitive data [13].

To address this gap and further understand the prevalence and correlates of early sexual debut in Rwanda, we analyzed data from a survey conducted among 6079 Rwandan youth ages 12–19 years attending secondary school in 2021. Youth were participants in a cluster randomized trial designed to evaluate the impact of *CyberRwanda*, a digital education intervention that delivers age-appropriate family planning and reproductive health (FP/RH) information and economic empowerment training to adolescents alongside access to youth-friendly FP/RH care and products [14].

## Methods

### Study design, setting, and participants

The *CyberRwanda* impact evaluation is a three-arm effectiveness-implementation study evaluating the impact of *CyberRwanda* in 60 schools across eight districts [14]. This study utilized baseline data with 6079 study participants in the first two levels of secondary school (ages 12–19 years). Details of the trial methodology have been previously described [14].

### Procedures and measurement

Recruitment and baseline data collection were conducted from February to May 2021 (prior to *CyberRwanda* implementation). Surveys were conducted at schools on weekends in Kinyarwanda by trained research assistants. Participants were provided with transport reimbursement for attending data collection events (~\$5 USD).

A multi-pronged approach was used to assess sexual behavior and to increase the accuracy of self-reported data based on findings from a pilot study [15] and consultations with local stakeholders which indicated that asking directly about sexual intercourse may lead to underreporting.

First, the survey was designed to rigorously measure sexual behavior in a non-stigmatizing manner and maximize participant privacy. For all sensitive questions on sexual behavior, tablets were

handed to participants so that they could enter their responses without being probed by research assistants.

Second, in an effort to reduce misclassification and information bias, questions on sexual behavior were asked multiple times in different ways. Participants were indirectly asked about previous sexual behavior via a question on the age of sexual debut rather than directly asking about sexual activity to reduce stigma and normalize sexual behavior. Participants who responded that they had “never had sex” were later asked to confirm if they had previous sexual intercourse in a direct manner.

We also added a question about what is considered “vaginal sex/sexual intercourse” to assess whether there were varying interpretations of sex that may influence self-reports of sexual activity.

### Outcomes

Participants who 1) provided an age of sexual debut (or could not remember the age but reported previous sex); 2) confirmed in a subsequent survey question they had sexual intercourse; or 3) were female and reported a previous pregnancy were categorized as sexually active.

Early sexual debut was defined as a binary indicator of first vaginal sex or sexual intercourse before age 15 [9,16]. Participants  $\geq 15$  years who never had sex or who had their first sex at  $\geq 15$  years were categorized as not having an early sexual debut. The mean age and median age of sexual debut were estimated by setting the age of sexual debut to 12 years for participants who reported first sex at “12 years old or younger.”

For the purposes of this analysis, the correct interpretation of vaginal sex or sexual intercourse was defined as “penetrative sex (penis in vagina) with climax” or “penetrative sex (penis in vagina) without climax”. “Kissing another person on the lips”, “touching your own sexual organs”, and “touching another person’s sexual organs with your hands” were coded as incorrect.

### Analysis

Analyses were conducted using R version 4.0.4 [17] and STATA version 17 [18]. Bivariate analyses were conducted using generalized linear mixed models to determine whether there were differences in sexual behavior by sex and sexual activity status, with associations expressed as prevalence differences.

**Table 1**  
Demographics of youth participants in the *CyberRwanda* effectiveness-implementation study, 2021

	Female (n = 3130)	Male (n = 2949)	Overall (n = 6079)
Age			
Mean $\pm$ SD	15.1 $\pm$ 1.45	15.6 $\pm$ 1.59	15.4 $\pm$ 1.54
Median (Q1–Q3)	15.0 (14.0–16.0)	16.0 (14.0–17.0)	15.0 (14.0–16.0)
School level, n (%)			
Secondary 1	1788 (57.1%)	1668 (56.6%)	3456 (56.9%)
Secondary 2	1342 (42.9%)	1281 (43.4%)	2623 (43.1%)
Partnered,* n (%)	666 (21.3%)	517 (17.5%)	1183 (19.5%)
Household smartphone,* n (%)	1031 (32.9%)	1126 (38.2%)	2157 (35.5%)
Social media account, n (%)	836 (26.7%)	1390 (47.1%)	2226 (36.6%)
Food insecurity,* n (%)			
Little to no hunger	2228 (71.2%)	2265 (76.8%)	4493 (73.9%)
Moderate hunger	821 (26.2%)	643 (21.8%)	1464 (24.1%)
Severe hunger	76 (2.4%)	37 (1.3%)	113 (1.9%)
Parental education,* n (%)			
None	581 (18.6%)	501 (17.0%)	1082 (17.8%)
Primary or higher	1817 (58.1%)	1811 (61.4%)	3628 (59.7%)
Don't know	727 (23.2%)	635 (21.5%)	1362 (22.4%)

Q1 = 1st Quartile; Q3 = 3rd Quartile.

\* Missing data for variables: partnered (n = 5); household smartphone (n = 2), food insecurity (n = 9), parental education (n = 7).

Predictors of early sexual debut (sex before age 15) were estimated using logistic regression, expressing associations as unadjusted and adjusted odds ratios with 95% confidence intervals (CIs). This analysis was restricted to participants  $\geq 15$  years, as the inclusion of sexually active participants  $< 15$  years would potentially overestimate the proportion of respondents categorized as having had early sex. All models accounted for clustering at the school level (STATA *cluster* option).

Factors associated with the timing of sexual debut were estimated using Cox proportional hazard models with the outcome age of sexual debut, expressing associations as unadjusted and adjusted hazard ratios with 95% CIs. Kaplan Meier curves and Cox models were used to determine the probability of initiating sexual activity each year, starting from before age 12 until sexual debut, or until age at time of the survey if the participant indicated that they were not sexually active (at which time the respondent was right censored). A log-rank test was used to assess whether the probability of sexual activity differed by sex. Participants reporting sexual activity without age at first sex ( $n = 403$ , 6.6%) were excluded from this analysis.

### Ethics

Approval for the *CyberRwanda* trial was obtained from the Committee for Protection of Human Subjects at the University of California, Berkeley and the Rwanda National Ethics Committee. Participants provided informed consent and/or parental consent and assent depending on their age.

### Role of the funding source

The study was funded with support from the David & Lucile Packard Foundation and the United States Agency for International Development (USAID). The analysis and interpretation of the data are solely the responsibility of the authors and do not represent the official views of the funders.

### Results

In total, 6079 participants (51.5% female) were enrolled and completed the baseline survey (Table 1). The mean age of participants was 15.4 years; 19.5% reported having a partner (married, girlfriend, or boyfriend); 26.0% reported moderate or severe food insecurity; 36.6% had a social media account.

A total of 1723 (28.3%) participants were sexually active. Reported sexual activity was significantly higher among male participants than females (36.9% vs. 20.2%, prevalence difference [PD]: 0.17; 95% CI: 0.14, 0.19). Most sexually active participants (76.4%) reported that their most recent sex was  $> 1$  year ago; 15.0% reported sex within the past year and less than 5% reported having sex within the past 30 days.

Of the 1723 sexually active participants, 403 (23.4%) participants did not provide an age at first sex. Among the 1320 participants who reported an age of sexual debut, 51.4% reported first sex by 12 years (Table 2) and 75.7% reported first sex before age 15. Male and female participants both had a mean and median age of first sex of 13 years.

When asked what is considered “vaginal sex/sexual intercourse”, 88.8% provided *at least* one correct (penetrative) answer and 59.3% provided correct answers *only*. However, more than one-third of participants included one incorrect (non-penetrative) answer in their response (Supplemental Table 1). Sexually active participants were slightly more likely to select correct responses only compared to sexually inactive participants (63.9% vs. 56.7%); however, this difference was not significant. Notably, among those with an age of sexual debut of  $\leq 12$  years, nearly 66% selected correct answers only.

**Table 2**  
Age of sexual debut, by sex

Age of sexual debut, n (%)	Female (n = 460)	Male (n = 860)	Overall (n = 1320)
12 years old or younger	241 (52.4%)	437 (50.8%)	678 (51.4%)
13 years	67 (14.6%)	139 (16.2%)	206 (15.6%)
14 years	37 (8.0%)	78 (9.1%)	115 (8.7%)
15 years	57 (12.4%)	78 (9.1%)	135 (10.2%)
16 years	28 (6.1%)	61 (7.1%)	89 (6.7%)
17 years	18 (3.9%)	46 (5.3%)	64 (4.8%)
18 years	11 (2.4%)	18 (2.1%)	29 (2.2%)
19 years	1 (0.2%)	3 (0.3%)	4 (0.3%)

403/1723 sexually active participants (23.4%) did not provide an age of sexual debut; 42 had a missing age sexual debut and 361 responded that they did not know the age but had previous sex.

In the analysis of predictors of early sexual debut among those 15 and older, males were significantly more likely to report early sex than females (12.5% female vs. 24.9% male; adjusted odds ratio [aOR]: 2.40; 95% CI: 1.99, 2.90). Participants with a social media account were less likely to report early sex than participants who did not (Table 3). No indicators of socioeconomic status (i.e., food insecurity, parental education, wealth index, and household smartphone ownership) were associated with early sex, nor was knowledge of HIV or fertility home district, or school SRH class attendance. The Kaplan Meier curves and hazard analysis also demonstrated a significant association between earlier age of sexual debut and sex, as well as with age (Supplemental Fig. 1 and Table 2).

**Table 3**  
Predictors of early sexual debut (15 years) among Rwandan youth aged 15 and older, 2021

	OR (95% CI)	Adjusted OR (95% CI)
Age	1.05 (0.99, 1.12)	1.00 (0.94, 1.07)
Male	2.33 (1.96, 2.78)	2.40 (1.99, 2.90)
Social media account	1.00 (0.87, 1.15)	0.86 (0.74, 0.995)
HIV knowledge		
Low	Ref	Ref
Medium	1.05 (0.75, 1.46)	1.01 (0.73, 1.40)
High	1.20 (0.84, 1.71)	1.11 (0.77, 1.60)
Fertility knowledge		
Low	Ref	Ref
Medium	0.87 (0.73, 1.37)	1.00 (0.85, 1.20)
High	0.90 (0.69, 1.18)	0.93 (0.72, 1.19)
Household smartphone	1.01 (0.86, 1.18)	1.02 (0.85, 1.21)
Attended SRH class	0.86 (0.92, 1.45)	1.11 (0.88, 1.40)
Food insecurity		
Little to no hunger	Ref	Ref
Moderate hunger	0.96 (0.79, 1.15)	0.97 (0.80, 1.17)
Severe hunger	0.82 (0.79, 1.15)	1.02 (0.54, 1.93)
Wealth index		
1st quartile	Ref	Ref
2nd quartile	0.99 (0.73, 1.32)	0.93 (0.71, 1.23)
3rd quartile	0.94 (0.72, 1.22)	0.92 (0.71, 1.17)
4th quartile	0.99 (0.76, 1.28)	0.90 (0.69, 1.17)
Parental education		
None	Ref	Ref
Primary or higher	1.13 (0.91, 1.40)	1.14 (0.92, 1.42)
Don't know	0.96 (0.72, 1.27)	0.98 (0.73, 1.31)

OR = odds ratio.

HIV knowledge variable constructed using seven questions on HIV prevention and myths/misconceptions about HIV and HIV transmission; participants who answered all questions correctly were categorized as having high HIV knowledge.

Fertility knowledge variable constructed using two questions about fertile windows and pregnancy; participants who answered both questions correctly were categorized as having high fertility knowledge. Model adjusted for: age, sex, district, social media account, HIV knowledge, fertility knowledge, household smartphone, attended SRH classes, food insecurity, wealth index, and parental education.

## Discussion

This is one of the largest studies on adolescent sexual health in East Africa conducted to date. We found that 28% of our study population was sexually active, and among those who could recall their age at first sex, the median age of sexual debut was 13 years. More than half of sexually active youth initiated sex by 12 years (11% of all youth) and more than 75% of sexually active youth had an early sexual debut before 15 years (16% of all youth). Male participants had a significantly higher hazard of sexual debut at a younger age (overall) and a significantly higher odds of early sexual debut (among those  $\geq 15$  years) compared to females. In contrast to other studies [4,6,11], we did not find any measure of socioeconomic status to be correlated with early sexual debut. However, having a social media account was associated with lower odds of early sex, which may signal that youth are using social media channels to access sexual health information.

Our findings suggest that Rwandan youth are engaging in sex much earlier than previous studies report (population-based surveys in Rwanda estimate a prevalence of early sex between 5% and 12% [9,19]). However, we also found misinterpretations of sexual intercourse among sexually active participants, indicating that there may have been overreporting or misreporting of sexual activity and underscoring the limitations of self-reported data despite the use of carefully designed efforts to improve measurement. Nonetheless, our findings demonstrate that youth are engaging in some form of sexual behavior at a young age (even if not sexual intercourse itself) and highlight the importance of providing age-appropriate SRH education for youth < 12 years in order to facilitate access to stigma-free SRH care.

Our findings also demonstrate the need to develop rigorous measurement strategies to validate data on youth sexual behavior and examine how interpretations of sexual intercourse and the design of quantitative assessments influence the assessment of sexual activity. Consistency of reporting should also be examined, as previous studies have found that some adolescents report different behavior across survey rounds [20–23].

Study limitations include the possibility of poor recall and social desirability bias which may also have contributed to underreporting or misreporting of sexual behavior. In addition, the definition of sexual intercourse question was added after data collection started and asked of a subset of participants, and was limited to vaginal sex (did not include oral or anal sex). Our sample also included only youth who were attending school at baseline; thus, these results may not be generalizable to out-of-school youth.

In conclusion, our findings highlight the critical need for age-appropriate tools to reduce the risk of poor SRH outcomes, particularly for very young adolescents to support their healthy transition into adulthood. *CyberRwanda*, the intervention being evaluated through this study, aims to address this through a digital direct-to-consumer platform providing SRH education and information for youth as young as 12 years of age [14]. Through the two-year impact evaluation, we will re-examine age at first sex to explore the consistency of reporting sexual debut over time and will investigate the potential impact of *CyberRwanda* on adolescent FP/RH outcomes.

## CRedit authorship contribution statement

Conceptualization: RH (1), LAH, LP, and SIM. Methodology: RH (1), LAH, LP, and SIM. Data collection: EG and LK. Formal analysis: RH (1), LAH, and LP. Validation: RH (1), LAH, LP, EG, LK, JK, RH (2), and SIM. Writing – original draft: RH (1), LP, and JK. Writing – reviewing & editing: RH (1) LAH, LP, EG, LK, JK, RH (2), and SIM. Funding acquisition: RH (2) and SIM.

## Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Rebecca Hope reports financial support was provided by David and Lucile Packard Foundation. Rebecca Hope reports financial support was provided by USAID.

## Acknowledgments

The authors would like to thank the study participants for their time participating in this research and the local research team at YLabs Rwanda and USAID for their support in conducting this study. This work was supported by the David & Lucile Packard Foundation and the United States Agency for International Development (USAID).

## Data sharing

The *CyberRwanda* impact evaluation is currently ongoing. De-identified participant data will be available upon the completion of the trial (estimated September 2023) on the Open Science Framework (<https://osf.io/erd9z/>). The pre-registered analysis plan, data analysis files, and data codebook will also be available at this time.

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**Supplemental Table 1**  
Interpretations of “vaginal sex/sexual intercourse”

	Female (n = 451)	Male (n = 429)	Overall (n = 880)
At least one non-penetrative answer	182 (40.4%)	117 (27.3%)	299 (34.0%)
At least one penetrative answer	390 (86.5%)	391 (91.1%)	781 (88.8%)
Only penetrative answers	236 (52.3%)	286 (66.7%)	522 (59.3%)

**Supplemental Table 2**  
Factors associated with age of sexual debut among Rwandan youth, 2021

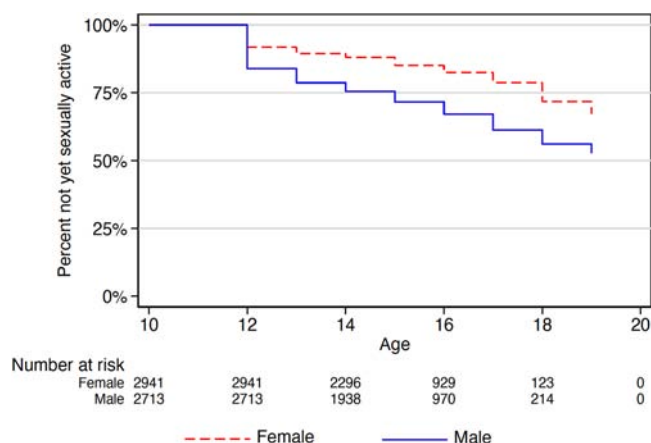
	HR (95% CI)	Adjusted HR* (95% CI)
Age	1.10 (1.05, 1.15)	1.07 (1.02, 1.11)
Male	1.99 (1.75–2.27)	1.91 (1.67, 2.20)
Social media account	1.17 (1.06, 1.29)	0.99 (0.90, 1.10)
HIV knowledge		
Low	Ref	Ref
Medium	1.11 (0.90, 1.37)	1.07 (0.86, 1.33)
High	1.20 (0.96, 1.50)	1.10 (0.87, 1.38)
Fertility knowledge		
Low	Ref	Ref
Medium	0.90 (0.83, 1.13)	1.00 (0.90, 1.12)
High	0.97 (0.80, 1.00)	1.00 (0.85, 1.16)
Household smartphone	1.08 (0.97, 1.20)	1.02 (0.91, 1.13)
Attended SRH class	1.15 (1.00, 1.33)	1.09 (0.95, 1.25)
Food insecurity		
Low to no hunger	Ref	Ref
Moderate hunger	0.94 (0.84, 1.06)	0.97 (0.85, 1.10)
Severe hunger	0.83 (0.57, 1.21)	0.92 (0.61, 1.38)
Wealth index		
1st quartile	Ref	Ref
2nd quartile	1.03 (0.86, 1.22)	1.00 (0.85, 1.18)
3rd quartile	0.99 (0.82, 1.18)	0.96 (0.78, 1.14)
4th quartile	1.12 (0.95, 1.32)	1.03 (0.87, 1.24)
Parental education		
None	Ref	Ref
Primary or higher	1.09 (0.93, 1.28)	1.09 (0.94, 1.27)
Don't know	0.98 (0.90, 1.19)	1.00 (0.82, 1.21)

HR = hazard ratio.

HIV knowledge variable constructed using seven questions on HIV prevention and myths/misconceptions about HIV and HIV transmission; participants who answered all questions correctly were categorized as having high HIV knowledge.

Fertility knowledge variable constructed using two questions about fertile windows and pregnancy; participants who answered both questions correctly were categorized as having high fertility knowledge.

\* Model adjusted for: age, sex, district, social media account, HIV knowledge, fertility knowledge, household smartphone, attended SRH classes, food insecurity, wealth index, and parental education.



**Supplemental Fig. 1.** Kaplan Meier curve of the age of sexual debut by sex.