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HIV self-testing and HIV nondisclosure to male sexual partners among adolescent girls and young women living with HIV in semi-rural northern Uganda: a cross-sectional study

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Abstract

Background The burden of HIV remains disproportionally high among the adolescent girls and young women. This is often coupled with nondisclosure of HIV status partly due to delayed knowledge of HIV status which affects entry into HIV prevention interventions. HIV self-testing which provides instant knowledge of HIV status is being promoted to enable early disclosure. However, previous studies about the association between HIV self-testing (HIVST) and HIV disclosure are scarce. We, therefore, set out to determine the prevalence of HIVST, nondisclosure of HIV status to male partners, and the predictors among adolescent girls and young women living with HIV (AGYWLHIV) in Uganda.

Methods In a cross-sectional study design, a stratified random sample of AGYWLHIV were recruited from ART clinics in semi-rural northern Uganda between November 2022 and April 2023. The participants received an interviewer-administered questionnaire. HIV self-testing was defined as the use of the HIVST method by the AGYWLHIV to discover their HIV status. Similarly, HIV nondisclosure was defined as the AGYWLHIV's failure to disclose her initial HIV status to her current male sexual partner before their first sexual intercourse regardless of the use of condoms.

Results A total of 423 participants with a mean age of 21.6 ± 2.5 years participated in the study. The study found that only 3.8% of the AGYWLHIV discovered their HIV status through HIVST. Furthermore, 26.7% of the AGYWLHIV did not disclose their status to their current male partners, 35.5% experienced non-disclosure from their current male partners, and 16.5% experienced bidirectional non-disclosure. The predictors for non-disclosure of initial HIV status were found to include the AGYWLHIV's knowledge of their initial negative HIV status [APR 0.3 (0.2–0.5), p 0.001], the AGYWLHIV's knowledge of their initial positive HIV status [APR 0.5 (0.3–0.7), p 0.002], the AGYWLHIV's prior knowledge of the positive initial HIV status of the male partner [APR 0.4 (0.2–0.8), p 0.010] and the male partner's nondisclosure of their initial HIV status to the AGYWLHIV [APR 2.0 (1.2–3.5), p 0.008].

Conclusions The prevalence of HIVST and HIV nondisclosure to male sexual partners among the AGYWLHIV in semi-rural Uganda stood at 38 in 1000 and 267 in 1000 respectively. The HIVST wasn't associated with HIV nondisclosure

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but the women's initial negative or positive HIV status, the male partner's initial positive HIV status and the male partners' nondisclosure of their initial HIV status to the AGYWLHIV were found to be independent predictors. These findings point to the need for health workers to target the distribution of HIVST kits at the AGYWLHIV attending ART clinics to give them to men in their sexual and social networks to expand access to HIV testing, improve chances of two-way HIV disclosure and entry into the HIV prevention, treatment, and care services.

Keywords Self-HIV testing, Non-disclosure of HIV status, Women living with HIV, Uganda

Study background

The high HIV burden among young women in sub-Saharan Africa (SSA) is a significant concern. Despite representing just 10% of the population in this region, adolescent girls and young women aged 15–24 (AGYW) accounted for 25% of the HIV infections in 2020 [1]. These HIV acquisition among AGYW are mainly through perinatal and sexual routes.

Despite the availability of the HIV preventive options like condoms, antiretroviral therapy (ART) for prevention, antiretroviral drugs (ARVs) for pre-exposure prophylaxis and post exposure prophylaxis in SSA, many sexually active adolescent girls and young women living with HIV (AGYWLHIV) fail to use these preventive measures (35–55%). The nonuse is primarily due to the lack of prior knowledge of their self-HIV status or that of their male partners, limited access to the HIV preventive measures, and fear of stigma and discrimination [2]. Nonuse of the HIV preventive measures among the AGYWLHIV poses a high risk for sexual transmission of the HIV to the male sexual partners with studies reporting transmission rates ranging from 0.0007 to 0.0082 per coital act [3, 4].

Prior knowledge of HIV status of self or of the sexual partner, and disclosure of HIV status to sexual partners holds significant importance in the adoption of the preventive measures to mitigate the risk of HIV transmission. When couples are aware of their respective HIV statuses, they are more likely to adopt consistent condom use and other safer sexual practices [5], utilize pre-exposure prophylaxis (PrEP) [6], adopt post-exposure prophylaxis (PEP) [7–9], use dual protection methods [10], and consider safer conception methods [11]. Conversely, non-disclosure of HIV status to sexual partners denies the opportunity for partner support and for the unaware partners benefiting from early HIV prevention, treatment, and care services.

HIV self-testing (HIVST) using kits such as Oraquick and CheckNow provide tools for instant testing and knowing of HIV status of self and of sexual partners at home, workplaces, or pericoitally by the bedside in private and confidential manner. The HIVST also minimizes the risk for public disclosure and consequent stigma, and discrimination.

A previous study in Uganda found that both pregnant women and their partners can correctly understand the instructions and perform the HIVST without or with minimal support [12]. This is an indication that the HIVST kits have the potential of reaching many people in sexual networks [12]. Relatedly, the World Health Organization (WHO) recommends health workers to distribute the HIVST kits to key populations (such as people living with HIV, commercial sex workers, adolescent girls and young women) to expand access to HIV testing services in high-burden settings and in populations and regions with the greatest gaps in testing coverage [13]. In response, many HIV high burdened settings including Uganda have adopted the HIVST by including it in national health policies and clinical guidelines [14].

By enabling immediate testing and awareness of one's HIV status, HIV self-testing can also encourage disclosure to sexual partners. However, there is a notable lack of prior research examining HIV self-testing practices among AGYW and its relationship with HIV status disclosure or nondisclosure to sexual partners in SSA, where HIV infections and nondisclosure remain significant challenges.

We therefore set out to determine the prevalence of HIV self-testing practice, and status nondisclosure to male sexual partners, and their relationship among the AGYWLHIV in semi-rural northern Uganda. The research findings will inform HIVST programming for the AGYWLHIV who choose to get married, sexually conceive pregnancy, give birth vaginally, and breast feed their babies [15, 16], all of which carry significant risk of HIV transmission. The HIVST programming is also critical in the current era of highly active antiretroviral therapy (HAART), HIV test and treat and ART treatment for prevention policies [14].

Methods

Study design

The study was a facility-based cross-sectional study [17]. Its primary focus was the quantitative estimation of the prevalence of nondisclosure of HIV status to current male sexual partners and the sexual and reproductive health (SRH) predictors among the AGYWLHIV in Uganda.

Study area and setting

The study was conducted in Lira district and Lira city. Lira is in northern Uganda at about 340 km from Kampala, the capital city of Uganda. By 2020, the HIV

prevalence among individuals aged 15–49 in Lira district and Lira city had reached 7.2%, surpassing the national average of 5.4% [18]. The study participants were recruited from the ART clinics of six public health facilities within Lira district and Lira city, namely Lira Regional Referral Hospital, Lira University Hospital, Ober Health Center, Ogur Health Center, Amuca Health Center, and Barapwo Health Center. These ART clinics collectively cared for 1,771 AGYWLHIV aged 15–24 as of September 2022.

Study population
The study population comprised of AGYWLHIV aged 15–24. The accessible study population included AGYWLHIV aged 15–24 who were attending the ART clinics at public health facilities. Lira district and Lira city in northern Uganda had an estimated 28,000 persons living with HIV (PLHIV) aged 15 and older [19], which accounted for approximately 2% of the total 1,400,000 PLHIV in Uganda [18].

Inclusion criteria
The AGYWLHIV aged 15–24 who were living with HIV for one or more years, reported being sexually active (defined as having ever had sexual intercourse), and resided in Lira district or Lira city were included in the study. The criterion of including AGYWLHIV who have ever had sexual intercourse allowed for participation of wide range of the AGYWLHIV. This was considered as part of the strategy for optimizing the representativeness of the sample and generalizability of the study findings.

Exclusion criteria
Sexually active AGYWLHIV aged 15–24 from Lira district and Lira city were excluded from the study if they were deaf or mute, and therefore could not communicate in the interviews, or if they were visibly too weak/sick to withstand the study procedures.

Sample size determination
The sample size for this study was determined using the Kish Leslie (1965) formula [20]. The formula assumed the Z score at 95% confidence interval of 1.96, the prevalence of HIV status nondisclosure of 0.269 based on a similar previous study in central Uganda [21], and precision of 0.05 to produce a sample size of 303 participants. After 1.5 adjustment for design effect, the adjusted sample size came to 454 AGYWLHIV.

Sampling methods and participant recruitment
The study employed a stratified random sampling (SRS) method. The process of the SRS started with the use of the ART registers to establish a comprehensive list of AGYWLHIV on ART from the six public health facilities in the study area. This list was later stratified according to the three levels used for categorizing Ugandan public health facilities namely regional referral hospital patients, health center level IV patients, and health center level III patients. The proportionate to size sampling technique was eventually applied to determine the 182, 126, and 115 participants for the above strata respectively.

Data collection tool
A questionnaire (Appendix 1) was the data collection tool in this study. The questionnaire was specifically developed for the study using constructs from the Health Belief Model [22] and the existing literature [21, 23–35]. The questionnaire items designed to measure exposure and outcome variables are explained in the following sections describing the measures of the variables. The questionnaire was pre-tested on 30 young women from Lira University Hospital, and adjustments were made to the items whose responses yielded no variability. The items adjusted were the number of male sexual partners and whether the participants fear HIV stigma, discrimination, and intimate partner violence or relationship breakup upon disclosure of their initial HIV status to their male sexual partners.

Data collection procedures
Data collection was conducted from 20th November 2022 to 30th April 2023. The data collection sessions were conducted by Research Assistants (RAs) with nursing and midwifery professional backgrounds. All the RAs were female. One RA was assigned to each of the public health facility-based ART clinics. The data collection sessions were conducted in the local dialect (Langi) from within the premises of the ART clinics. All the questionnaires were administered by face-to-face interview. The questionnaires were anonymous. It took about one hour to complete each questionnaire. The responses (data) were recorded in pen ink directly on the questionnaires.

Outcome variables
The primary outcome was the one-way nondisclosure of the initial HIV status of the AGYWLHIV to the current male sexual partner. Non-disclosure of the initial HIV status was defined as the AGYWLHIV's failure to disclose her initial HIV status to her current male sexual partner before their first sexual intercourse regardless of the use of protective measures such as condoms. An AGYWLHIV who disclosed to her current male sexual partner her initial HIV status before their first sexual intercourse would be regarded to have disclosed while the one who did not, did not disclose. The secondary outcomes were the (a) one-way non-disclosure of the initial HIV status of the current male sexual partner to the AGYWLHIV and (b) the two-way nondisclosure of the initial HIV status of both partners.

Exposure variables and covariates

The exposure variables and covariates for the study were (a) the woman's age at sexual debut, (b) the woman's years of sexual experience, (c) the woman's sexual activity level, (d) the woman's initial HIV status before meeting the current sexual partner, (e), the woman's method of discovery of the HIV status, (f) the woman's period of awareness of her initial HIV status, (g), the woman's desire to bear children, (h) the male partner's desire to bear children, (i) the woman's awareness of the initial HIV status of the male sexual partner, (j) perceptions of the benefits of dual protection methods, (k) knowledge of safer conception methods, (l) perceptions of the benefits of safer conception methods, and (m) the socio-demographic characteristics of the women, particularly their age, religion, marital status, residential address, distance from the nearest health facility, educational level, occupation, and income level. The selection of these exposure variables and covariates were informed by their plausible relationships to the phenomenon of HIV status disclosure, all of which received limited consideration in the previous research studies [11, 21, 23–36] and the Health Belief Model [22]. HIV self-testing was measured by asking the AGYWLHIV how they discovered their HIV status, and what was their status before meeting their current male sexual partner? In response to this question, the participants reported on whether they discovered their HIV status by HIV self-testing or by HIV tests conducted by the health workers.

Measures of the primary and secondary outcome variables

To measure the one-way nondisclosure of HIV status of the women to their current male sexual partners, women were asked whether their initial HIV status was disclosed to their male sexual partner before engaging in the first sexual intercourse with him or not. They were also asked whether the current male sexual partner's initial HIV status was disclosed to them before having their first sexual intercourse or not. The above measures enabled the estimation of the prevalence of one-way nondisclosure, and two-way nondisclosure of the initial HIV status among the participants. If one partner's initial HIV status was nondisclosed but not both, this was regarded as one-way nondisclosure. If neither partner disclosed their initial HIV status to each other, this was regarded as two-way nondisclosure. The study adapted these measures for nondisclosure of the initial HIV status from a previous study conducted in Uganda [21]and considered potential predictors based on the Health Belief Model used in the previous HIV prevention through PrEP and PEP studies [22, 37–39].

Data management and analysis

The data from the completed questionnaires were double entered by two data clerks using EpiData Entry 3.1. software. The validated dataset was exported from EpiData to the IBM Statistical Package for Social Sciences (SPSS) version 29.0 for statistical analysis. The participants' demographic characteristics were summarized into frequency counts, percentages, and point estimates such as mean, standard deviation, and range using descriptive statistics. Prevalence of HIVST and HIV nondisclosure to the male sexual partners were calculated using univariate analysis (frequency counts, percentages and 95% confidence interval). Bivariate analysis (Chi-square statistics) was performed to identify factors associated with the AGYWLHIV's nondisclosure of their initial HIV status to their current male sexual partners. The significantly associated factors from the bivariate analyses with statistical significance level of ≤ 0.05 were then entered into the multivariate modified Poisson regression analysis with robust estimator to identify the independent predictors for the AGYWLHIV's one-way nondisclosure of their initial HIV status to their current male sexual partners. Multicollinearity analysis between the AGYWLHIV's socio-demographic, sexual and reproductive factors found to be associated with the AGYWLHIV's non-disclosure of their initial HIV status to their current male sexual partners at the bivariate analysis level found no multicollinearity among them (Table 4).

Therefore, the factors entered in the multivariate modified Poisson regression model for analysis of the independent predictors for nondisclosure of initial HIV status included the AGYWLHIV's age at sexual debut, marital status, monthly income, initial HIV status before meeting the current male sexual partner, the male sexual partner's initial HIV status before meeting the AGYWLHIV, the male sexual partner's disclosure of his initial HIV status, the male partner's desire to bear children, and the AGYWLHIV getting sexual feelings, among others. The crude prevalence ratio (CPR) and the adjusted prevalence ratio (APR) were calculated and reported with their respective 95% confidence intervals (95% CI) and the statistical significance levels (p-values). Factors found to be associated with the AGYWLHIV's nondisclosure of her initial HIV status at statistical significance level of ≤ 0.05 at multivariate regression level were considered independent predictors for the nondisclosure of the initial HIV status among the AGYWLHIV.

Results

Response rate

As shown in the flow diagram (Fig. 1), a of 423 AGYWL-HIV out of the targeted sample size of 454 (93.2%) were successfully recruited and participated in the study. A total of 31 potential participants (6.8%) declined to participate,
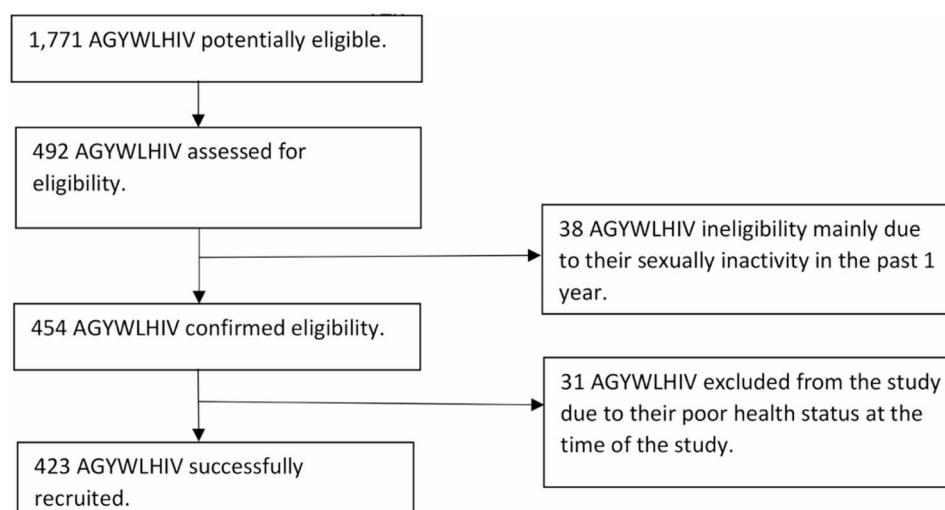
Fig. 1 Flow chart showing the participant's recruitment process

mainly because of their poor health status at the time of the study that could not allow them to withstand the study procedures. There were no statistically significant differences in the socio-demographic characteristics of the AGYWLHIV who participated in the study and those who declined to participate. There were no participants with missing data. This was because the questionnaire was interviewer-administered who ensured that all the applicable questions were answered by every participant.

Socio-demographic characteristics of the AGYWLHIV in the study

The age of the AGYWLHIV in the study ranged from 15 to 24 years with a mean age and standard deviation of 21.6 ± 2.5 years. The socio-demographic characteristics of the AGYWLHIV in the study are shown in Table 1. The majority of the AGYWLHIV were adults aged 19–24 years, married, had attained primary level of education, were low-income earners relying on domestic remittances, and resided within a five-kilometer radius of a health facility.

Prevalence of HIV Self-Testing

Only 16 (3.8%) of the AGYWLHIV discovered their HIV through HIV self-testing. The rest discovered their status by HIV tests performed by the healthcare workers. Association analysis revealed that there wasn't significant association between the method of HIV status discovery by HIVST or provider testing and HIV nondisclosure to the male sexual partners (Fisher's Exact Test, p 0.773) among the AGYWLHIV.

Prevalence of HIV non-disclosure to current male sexual partners

The prevalence of one-way non-disclosure of HIV status of the AGYWLHIV to the current male sexual partners

was found at 26.7% (95% CI 22.4–30.9). Similarly, the prevalence of one-way nondisclosure of the HIV status of the current male sexual partners to the AGYWLHIV were found at 35.5% (95% CI 30.9–40.0). The prevalence of two-way nondisclosure of the HIV status by both partners was found at 16.5% (95% CI 12.9–20.0).

Sexual and reproductive health characteristics and their distribution by the HIV status disclosure among the AGYWLHIV

The distribution of the participant's sexual and reproductive health characteristics of the AGYWLHIV by their HIV status disclosure are shown in Table 2. The findings indicate that all the participants were in active sexual relationships with recent sexual activity within a period of 8.0 ± 15.7 days, of which 48% were married (living with the current male sexual partners). The participants started sexual activity with their current male sexual partners within an average period of 2.4 ± 2.4 years, at an average age of 19.0 ± 2.6 years. More so, 91.7% of the participants were unaware of their initial HIV status at the start of the sexual relationships with their current male sexual partners.

Associations between the women's socio-demographic, sexual and reproductive health characteristics, HIV self-testing and HIV non-disclosure to male sexual partners

Of the 35 socio-demographic, sexual and reproductive health characteristics of the AGYWLHIV analyzed at bivariate level for their unadjusted associations with nondisclosure of the women's HIV status to their current male sexual partners, Table 3 shows the factors found to have statistically significant associations with the HIV nondisclosure to the current male sexual partners. The women's socio-demographic characteristics found to have non-significant associations with

Table 1 Socio-demographic characteristics and disclosure of the HIV status among the AGYWLHIV

Socio-demographic characteristics.	Frequency F (%).	Disclosure	
		Non-disclosed F (%)	Dis-closed F (%)
Mean (SD) of age in years	21.6 (2.5)	21.6 (2.5)	21.5 (2.4)
age group in years.	99 (23.4)	74 (23.9)	25 (22.1)
15–19.	324 (76.6)	236 (76.1)	88 (77.9)
20–24.			
Religion.	184 (43.5)	45 (39.8)	184 (43.5)
Catholic.	159 (37.6)	49 (43.4)	159 (37.6)
Anglican.	50 (11.8)	13 (11.5)	50 (11.8)
Muslim.	30 (7.1)	6 (5.3)	30 (7.1)
Others.			
tribe.	389 (92.0)	281 (90.6)	108 (95.6)
Langi.	34 (8.0)	29 (9.4	5 (4.4)
Other tribes			
marital status.	203 (48.0)	41 (36.3)	93 (30.0)
Married.	134 (31.7)	40 (35.4)	163 (52.6)
Single.	77 (18.2)	30 (26.5)	47 (15.1)
Divorced or separated.	9 (2.1)	2 (1.8)	7 (2.3)
Others.			
level of education.	28 (6.6)	19 (6.1)	9 (8.0)
No formal education.	230 (54.4)	161 (52.0)	69 (61.0)
Primary education.	125 (29.6)	98 (31.6)	27 (23.9)
Secondary education.	40 (9.4)	32 (10.3)	8 (7.1)
Tertiary education.			
source of income.	349 (82.5)	251 (81.0)	98 (86.7)
Non-salary employment.	74 (17.5)	59 (19.0)	15 (13.3)
Salary employment.			
monthly income in USD equivalent.	261 (61.7)	181 (58.4)	80 (70.8)
≤ 24.	162 (38.3)	129 (41.6)	33 (29.2)
> 24.			
nature of residential address.	80 (18.9)	57 (18.4)	23 (20.4)
Rural area.	343 (81.1)	253 (81.6)	90 (79.6)
Semi-urban or urban.			
Mean (SD) of the distance of the AGYWLHIV's residence from the nearest health facility in Km:	2.8 (2.3)	3.1 ± 2.7	2.7 ± 2.2
distance of residence from the health facility in Km.	382 (90.3)	99 (87.6)	283 (91.3)
0–5.	41 (9.7)	14 (12.4)	27 (8.7)
> 5.			
alcohol use.	372 (87.9)	274 (88.4)	98 (86.7)
Never.	51 (12.1)	36 (11.6)	15 (13.3)
Uses.			
tobacco use.	420 (99.3)	308 (99.4)	112 (99.1)
Never.	3 (0.7)	2 (0.6)	1 (0.9)
Occasionally.			
additive drug use.	418 (98.8)	306 (98.7)	112 (99.1)
Never.	5 (1.2)	4 (1.3)	1 (0.9)
Uses addictive energy drinks and herbs.			

Table 1 Legend: AGYWLHIV is young women living with HIV; ∞ means the total percentage exceeds 100% because of rounding off to one place of decimal; Km is kilometers; f is frequency; % is percentage; < is less than, and >is greater than; SD is standard deviation; IQR is interquartile range; MIQR is median and the interquartile range

the women's nondisclosure of their initial HIV status to their current male sexual partners included age (X^2 0.060, df 1, p 0.806), religion (X^2 2.550, df 3, p 0.466), tribe (X^2 2.097, df 1, p 0.148), educational level (X^2 4.281, df 3, p 0.233), source of income (X^2 1.524, df 1, p 0.217), rural or urban nature of the residential address (X^2 0.100, df 1, p 0.751), distance of the residence from the nearest health facility (X^2 0.895, df 1, p 0.344), alcohol use (X^2 0.087, df 1, p 0.768), tobacco use (Fisher's Exact Test, p 1.000), and addictive drug use (Fisher's Exact Test, p 1.000). Similarly, the women's sexual and reproductive health characteristics found to have

Table 2 Sexual and reproductive health characteristics and HIV status disclosure among the AGYWLHIV

Sexual and reproductive factors.	Frequency F (%)	Disclosure	
		Undisclosed F (%)	Disclosed F (%)
mean (SD) for age at sexual debut	16.9 (2.4)	17.0 (2.5)	16.6 (1.9)
age at sexual debut.	105 (24.8)	74 (23.9)	31 (27.4)
≤ 15 years.	259 (61.2)	183 (59.0)	76 (67.3)
16–19 years.	59 (14.0)	53 (17.1)	6 (5.3)
20–24 years.			
Mean (SD) of Gravida	1.1 (1.1)	1.1 (1.1)	1.1 (1.1)
Gravida group	155 (36.6)	112 (36.1)	43 (38.1)
Nulligravida	268 (63.4)	198 (63.9)	70 (61.9)
Gravida 1+			
Mean (SD) of Parity	0.8 (1.0)	0.8 (1.0)	0.8 (1.0)
Parity groups	200 (47.3)	144 (46.5)	56 (49.6)
Nullipara	223 (52.7)	166 (53.5)	57 (50.4)
Para 1+			
Mean (SD) for number of Miscarriages and Abortions:	0.1 (0.4)	0.1 (0.4)	0.2 (0.5)
Number of miscarriages and abortions groups	367 (86.8)	271 (87.4)	96 (85.0)
None	56 (13.2)	39 (12.6)	17 (15.0)
1+			
Mean (SD) of the living children:	0.8 (0.9)	0.8 (0.9)	0.8 (1.0)
No. of living children group	197 (46.6)	142 (45.8)	55 (48.7)
0	226 (53.4)	168 (54.2)	58 (51.3)
1+			
perceived mode of HIV acquisition.	153 (36.1)	115 (37.1)	38 (33.6)
Mother-to-child transmission.	21 (5.0)	16 (5.2)	5 (4.4)
Needle-stick injuries.	249 (58.9)	179 (57.7)	70 (62.0)
Unprotected sexual intercourse.			
method of discovery of HIV-positive status.	310 (96.2)	299 (96.5)	108 (95.6)
HIV testing by Health worker.	16 (3.8)	11 (3.5)	5 (4.4)
HIV Self-testing.			
age at discovery of the HIV-positive status.	168 (39.7)	130 (42.0)	38 (33.6)
≤ 14 years.	120 (28.4)	81 (26.1)	39 (34.5)
15–19 years.	135 (31.9)	99 (31.9)	36 (31.9)
20–24 years.			
Initial HIV status of the AGYWLHIV before meeting the current male sexual partners.	135 (31.9)	30 (26.5)	105 (33.9)
Negative.	267 (63.1)	68 (60.2)	199 (64.2)
Positive.	21 (5.0)	15 (13.3)	6 (1.9)
Unknown.			
awareness of the initial HIV status before meeting the current male sexual partners.	35 (8.3)	29 (9.4)	6 (5.3)
Unaware (not tested nor disclosed to).	388 (91.7)	281 (90.6)	107 (94.7)
Aware (tested or disclosed to).			
ART use before meeting the current male sexual partners.	120 (28.4)	93 (30.0)	27 (23.9)
Not on ART.	303 (71.6)	217 (70.0)	86 (76.1)
On ART.			
Initial HIV status of the current male sexual partner before meeting the AGYWLHIV.	199 (47.1)	41 (36.3)	158 (51.0)
Negative.	100 (23.6)	12 (10.6)	88 (28.4)
Positive.	124 (29.3)	60 (53.1)	64 (20.6)
Unknown.			
whether the current male sexual partner disclosed his initial HIV status to the AGYWLHIV before their first sexual intercourse.	150 (35.5)	70 (61.9)	80 (25.8)
No.	273 (64.5)	43 (38.1)	230 (74.2)
Yes.			
mean (SD) of the duration (years) of the sexual relationships between the AGYWLHIV and their current male sexual partners	2.4 (2.4)	2.5 (2.4)	2.2 (2.3)

Table 2 (continued)

Sexual and reproductive factors.	Frequency F (%)	Disclosure	
		Undisclosed F (%)	Disclosed F (%)
duration (years) of the sexual relationships between the AGYWLHIV and their current male sexual partners	192 (45.4)	138 (44.5)	54 (47.8)
≤ 1 year	231 (54.6)	172 (55.5)	59 (52.2)
≥ 2 years			
whether the male sexual partner's desire to father children.	15 (3.5)	3 (2.7)	12 (3.9)
No.	307 (72.6)	64 (56.6)	243
Yes.	101 (23.9)	46 (40.7)	(78.4)
Don't know or not sure.			55 (17.7)
whether the AGYWLHIV got pregnant in the past 1 year.	323 (76.4)	227 (73.2)	96 (85.0)
No.	100 (23.6)	83 (26.8)	17 (15.0)
Yes.			
whether the AGYWLHIV gets sexual feelings.	36 (8.5)	20 (6.5)	16 (14.2)
No.	387 (91.5)	290 (93.5)	97 (85.8)
Yes.			

Table 2 Legend: AGYWLHIV is young women living with HIV; ∞ means the total percentage exceeds 100% because of rounding off to one place of decimal; Km is kilometers; f is frequency; % is percentage; < is less than, and > is greater than; IQR is the interquartile range; MIQR is the median and the interquartile range

non-significant associations with nondisclosure of their initial HIV status to their current male sexual partners included gravida (X^2 0.062, df 1, p 0.803), parity (X^2 208, df 1, p 0.648), miscarriages and abortions (X^2 0.249, df 1, p 0.618), number of living children (X^2 0.170, df 1, p 0.680), perceived mode of HIV acquisition (X^2 0.615, df 2, p 0.735), age at discovery of the HIV-positive status (X^2 3.491, df 2, p 0.175), awareness of own initial HIV status before meeting the current male sexual partner (X^2 1.785, df 1, p 0.181), age at first sexual intercourse with the current male sexual partner (X^2 0.154, df 2, p 0.926), ART use before the current male sexual partner (X^2 1.234, df 1, p 0.267), failure to get contraceptive method when wanted it to prevent pregnancy (X^2 0.194, df 1, p 0.660), ever receipt of contraceptive method from the HIV/ART clinic (X^2 0.002, df 1, p 0.968), ever use of the male dual protection method particularly condom (X^2 0.021, df 1, p 0.885) and ever use of the female dual protection method particularly ARV plus contraceptive method (X^2 1.118, df 1, p 0.290).

Multicollinearity analysis between the independent variables that were significantly associated with the nondisclosure of the HIV status of the AGYWLHIV

The findings from the multicollinearity analysis between the independent variables that were significantly associated with the non-disclosure of the HIV status of the AGYWLHIV shown in Table 4 indicates low multicollinearity among the independent variables as none of the variance inflation factor (VIF) was ≥ 10.

Based on the multicollinearity analyses (Table 4), the factors entered in the multivariate modified Poisson regression model for analysis of independent predictors for nondisclosure of HIV status included the

AGYWLHIV's age at sexual debut, marital status, monthly income, initial HIV status before meeting the current male sexual partner, the male sexual partner's initial HIV status before meeting the AGYWLHIV, the male sexual partner's disclosure of his initial HIV status, the male partner's desire to bear children, and the AGYWLHIV getting sexual feelings, among others.

Predictors of HIV nondisclosure to the male sexual partners

The findings regarding multivariate modified Poisson regression analysis for the independent predictors of HIV nondisclosure to male sexual partners is shown in Table 5. Three significant independent predictors of HIV non-disclosure to the current male sexual partners were identified namely having a negative initial HIV status, having a positive initial HIV status, and the current male sexual partner's nondisclosure of their HIV status to the AGYWLHIV.

Discussions

We found a very low rate of HIV status discovery through self-testing among the AGYWLHIV in semi-rural Uganda compared to a previous online survey among female University students attending Makerere University situated in Kampala the capital city of Uganda that found that 93% of them were willing to use the HIVST and 19% of them had ever used the HIVST kits [40]. The 3.8% prevalence of HIVST found among the AGYWLHIV in semi-rural Uganda is even much lower than the 59.3% found among other key population (commercial sex workers) in a high HIV burden setting of Ethiopia [41]. The low HIVST prevalence among the AGYWLHIV population in semi-rural Uganda maybe attributed to the

Table 3 Associations between socio-demographic, sexual and reproductive health factors, and HIV non-disclosure to male sexual partners

Factors.	Disclosure status.		Statistics.		
	No F (%)	Yes F (%)	X²	df	*p*-value
the AGYWLHIV's monthly income in USD	181 (58.4)	80 (70.8)	4.884	1	**0.027***
< 24	129 (41.6)	33 (29.2)			
24 or more					
the AGYWLHIV's age at sexual debut	37 (11.9)	16 (14.2)	9.606	2	**0.008***
≤ 14 years.	220 (71.0)	91 (80.5)			
15–19 years.	53 (17.1)	6 (5.3)			
20–24 years.					
the AGYWLHIV's marital status.	93 (30.0)	41 (36.3)	10.965	2	**0.004***
Single.	163 (52.6)	40 (35.4)			
Married.	54 (17.4)	32 (28.3)			
Others.					
the AGYWLHIV's initial HIV status before meeting the current male sexual partner.	105 (33.9)	30 (26.5)	23.050	2	**< 0.001***
Negative.	199 (64.2)	68 (60.2)			
Positive.	6 (1.9)	15 (13.3)			
Unknown.					
the current male sexual partner's initial HIV status before meeting the AGYWLHIV.	158 (51.0)	41 (36.3)	44.606	2	**< 0.001***
Negative.	88 (28.4)	12 (10.6)			
Positive.	64 (20.6)	60 (53.1)			
Unknown.					
whether the current male sexual partner disclosed his initial HIV status to the AGYWLHIV before their first sexual intercourse.	80 (25.8)	70 (61.9)	45.696	1	**< 0.001***
No.	230 (74.2)	43 (38.1)			
Yes.					
whether the current male sexual partner's desire to father children.	12 (3.9)	3 (2.7)	22.468ᴳ	2	**< 0.001***
No.	243 (78.4)	64 (56.6)			
Yes.	55 (17.7)	46 (40.7)			
Don't know or not sure.					
whether the AGYWLHIV got pregnant in the past 1 year.	227 (73.2)	96 (85.0)	5.679	1	**0.012***
No.	83 (26.8)	17 (15.0)			
Yes.					
whether the AGYWLHIV gets sexual feelings.	20 (6.5)	16 (14.2)	5.367	1	**0.012***
No.	290 (93.5)	97 (85.8)			
Yes.					
the AGYWLHIV's perceptions of the benefits of dual protection methods (e.g., condoms).	15 (4.8)	13 (11.5)	6.386	2	**0.041***
No benefits perceived.	253 (81.6)	83 (73.5)			
Correct benefits perceived.	42 (13.6)	17 (15.0)			
Not sure or no idea.					
the AGYWLHIV's knowledge of safer conception methods.	124 (40.0)	74 (65.5)	21.856	3	**< 0.001***
Don't know.	79 (25.5)	15 (13.3)			
Using ARV as ART for the partner living with HIV throughout the unprotected sex for conception.	88 (28.4)	19 (16.8)			
Using ARV as PrEP or PEP for the HIV negative partner before or after unprotected sex for conception respectively.	19 (6.1)	5 (4.4)			
Others e.g., Artificial insemination.					
the AGYWLHIV's perceptions of the benefits of safer conception methods.	65 (21.0)	43 (38.1)	18.308	2	**< 0.001***
No benefits perceived.	210 (67.7)	51 (45.1)			
Correct benefits perceived.	35 (11.3)	19 (16.8)			
Not sure or no idea.					

Table 3 Legend key: AGYWLHIV is young women living with HIV; F is frequency count; % is percentage; Km is kilometers; ART is antiretroviral therapy with antiretroviral drugs; < is less than; > is greater than; *Significant at *p* < 0.05; X² is Chi-square value; G is the likelihood ratio, and df is degree of freedom

fact that most of the women in the study had primary level of education at 54.4% and semi-rural residence (81.1%) compared to the ones in the previous studies who were mostly participants with higher educational attainment (University degree) and were situated in the urban areas [40, 41]. These studies indicate that despite the key benefits of HIVST, its uptake remains low. Health workers can actively design strategies to promote its adoption. Such an approach will facilitate early diagnosis and ensure timely access to care and treatment programs, ultimately improving health outcomes.

Table 4 Multicollinearity analysis among independent variables significantly associated with non-disclosure of the initial HIV status

Independent variables	Collinearity statistics	
	Tolerance	VIF
the AGYWLHIV's monthly income in USD.	0.879	1.137
the AGYWLHIV's age at sexual debut.	0.902	1.108
the AGYWLHIV's marital status.	0.908	1.101
the AGYWLHIV's initial HIV status before meeting the current male sexual partner.	0.824	1.213
the current male sexual partner's initial HIV status before meeting the AGYWLHIV.	0.463	2.162
whether the current male sexual partner disclosed his initial HIV status to the AGYWLHIV before their first sexual intercourse.	0.433	2.309
whether the AGYWLHIV got pregnant in the past 1 year.	0.909	1.100
whether the current male sexual partner's desire to father children.	0.887	1.128
whether the AGYWLHIV gets sexual feelings.	0.920	1.088
the AGYWLHIV's perceptions of the benefits of dual protection methods (e.g., condoms).	0.897	1.115
the AGYWLHIV's knowledge of the safer conception methods.	0.930	1.075
the AGYWLHIV's perceptions of the benefits of the safer conception methods.	0.872	1.146

Table 4 Legend key: VIF is the variance inflation factor

This study found a 26.7% prevalence of one-way nondisclosure of the initial HIV status by the AGYWLHIV (Fig. 2). The 26.7% prevalence of non-disclosure of the initial HIV status by AGYWLHIV found in northern Uganda is lower than the average non-disclosure rate for developing countries of 51% [36]. It is also lower than the nondisclosure rates for other SSA countries such as South Africa, Tanzania, Nigeria, and Ethiopia [25–27, 42, 43]. Nonetheless, the 26.7% nondisclosure rate among AGYWLHIV in northern Uganda is consistent with the previous studies in central Uganda and southwestern Uganda that also found 26.9–27% rates of nondisclosure of HIV status [21, 23]. The high rate of nondisclosure of HIV status among high-risk population in this case the AGYWLHIV as exemplified by the findings of this study from semi-rural northern Uganda and previous studies from across SSA implies that nondisclosure of HIV status has persisted as an issue in young people's sexual partners entry into the HIV prevention, treatment, and care pathway despite the wide availability of the ART program and may require targeted programmatic interventions.

Similarly, the one-way nondisclosure of HIV status to the AGYWLHIV by the current male sexual partners was reported at 35.5%, which is quite high. This is evidence of the need to establish effective counseling and support programs for both the AGYWLHIV and their male sexual partners to foster open discussions, understanding and improve sexual relationships.

It was also found that male sexual partner's nondisclosure of their initial HIV status to the AGYWLHIV was associated with a higher odd of reciprocal nondisclosure of the HIV status of the AGYWLHIV (Table 5). This finding is consistent with previous studies conducted in South Africa and Ethiopia [25, 28, 32, 42]. The male sexual partner's disclosure of his initial HIV status provides the encouragement for the women with prior awareness of their own HIV status to compare if they are concordant or discordant with their male partner, and such comparison is likely to facilitate counter-disclosure of the women's HIV status to their male partners. This finding also points to the importance of continued couple counseling and testing even in the current era of universal access to HAART so that couple's status are disclosed to each other on the spot. It also points to the need for health workers to continue complying with the current policy of post-test counseling on disclosure and follow up of the single individuals taking HIV tests on disclosure of their HIV status to their sexual partners.

Relatedly, this study found that the AGYWLHIV's knowledge of the positive HIV status of their male sexual partners predicts their less likelihood of nondisclosure of their HIV status to their male sexual partners. This finding is consistent with the previous studies conducted in the East and West African countries which also found that people receiving ART who knew the HIV status of their sexual partners were less likely to non-disclose their HIV status to them compared to their counterparts who didn't know [28–31]. As earlier noted, this finding emphasizes the importance of health workers considering counseling of all single individuals taking HIV tests on the importance and benefits of disclosure of their positive HIV status to their sexual partners to enable them to go and check their status and enrolled in HIV prevention interventions if found sero-discordant.

This study further found that AGYWLHIV's earlier knowledge of their initial negative or positive HIV status predicts nondisclosure of their initial HIV status to their male sexual partners before their first sexual encounter (Table 5). This finding is also consistent with a previous study conducted in the West African country of Togo [31]. These research findings emphasize the importance of health workers ensuring young people who take HIV tests are given their test results without delay to know their status especially when the testing method used does not provide instant results unlike HIVST kits. Ensuring all health facilities make use of rapid HIV test kits that work with fingerprint blood samples and provide instant test results is part of the solution. For delays in receiving HIV test results from blood donor testing, dry blood spot collection and PCR testing, efforts should be made to investigate and address the causes of the delays as earlier knowledge of their negative or positive HIV test results

Table 5 Predictors of HIV non-disclosure to the current male sexual partners

Potential Predictor variables	CPR (95% CI)	*p*-value	APR (95% CI)	*p*-value
the AGYWLHIV's age at sexual debut.	2.9 (1.2-7.0)	**0.013***	2.1 (0.8-5.0)	0.093
≤ 14 years.	2.8 (1.3–6.2)	**0.008***	2.1 (0.9–4.6)	0.057
15–19 years.	1		1	
20–24 years.				
the AGYWLHIV's marital status.	0.8 (0.5–1.1)	0.306	0.8 (0.6–1.2)	0.467
Single.	0.5 (0.3–0.7)	**0.001***	0.7 (0.5–1.1)	0.225
Married.	1		1	
Others.				
Monthly income.	1.5 (1.0-2.1)	**0.024***	1.0 (0.6–1.4)	0.911
< 24 USD.	1		1	
≥ 24 USD.				
the AGYWLHIV's initial HIV status before meeting the current male sexual partner.	0.3 (0.2–0.4)	**< 0.001***	0.3 (0.2–0.5)	**< 0.001***
Negative.	0.3 (0.2–0.5)	**< 0.001***	0.5 (0.3–0.7)	**0.002***
Positive.	1		1	
Unknown.				
the current male sexual partner's initial HIV status before meeting the AGYWLHIV.	0.4 (0.3–0.5)	**< 0.001***	0.8 (0.4–1.4)	0.485
Negative.	0.2 (0.1–0.4)	**< 0.001***	0.4 (0.2–0.8)	**0.010***
Positive.	1		1	
Unknown.				
whether the male partner's initial HIV status was disclosed to the AGYWLHIV.	2.9 (2.1-4.0)	**< 0.001***	2.0 (1.2–3.5)	**0.008***
No.	1		1	
Yes.				
whether the male partner's desire to father children.	0.4 (0.1–1.2)	0.119	0.5 (0.1–1.7)	0.336
No.	0.4 (0.3–0.6)	**< 0.001***	0.8 (0.5–1.1)	0.227
Yes.	1		1	
Don't know.				
whether the AGYWLHIV has gotten pregnant in the past 1 year.	1.7 (1.0-2.7)	**0.018***	1.1 (0.7–1.7)	0.511
No.	1		1	
Yes.				
whether the AGYWLHIV gets sexual feelings.	1.7 (1.1–2.6)	**0.005***	1.4 (0.8–2.2)	0.143
No.	1		1	
Yes.				
the AGYWLHIV's perceptions of benefits of dual protection methods.	1.6 (0.9–2.8)	0.098	1.5 (0.8–2.6)	0.158
No benefits perceived.	0.8 (0.5–1.3)	0.495	1.6 (0.9–2.7)	0.063
Some correct benefits perceived.	1		1	
Not sure or no idea.				
the AGYWLHIV's knowledge of the safer conception methods.	1.7 (0.8–3.9)	0.152	1.1 (0.4–2.6)	0.762
-Don't know.	0.7 (0.3–1.8)	0.565	0.9 (0.3–2.1)	0.841
-Using ARV as ART for the partner living with HIV throughout the unprotected sex for conception.	0.8 (0.3–2.0)	0.722	0.9 (0.4–2.3)	0.951
-Using ARV as PrEP or PEP for the HIV negative partner before or after unprotected sex for conception respectively.	1		1	
-Others e.g., Artificial insemination.				
the AGYWLHIV's perceptions of the benefits of safer conception methods.	1.1 (0.7–1.7)	0.573	1.0 (0.6–1.6)	0.797
No benefits perceived.	0.5 (0.3–0.8)	**0.008***	0.6 (0.3–1.1)	0.141
Some correct benefits perceived.	1		1	
Not sure or no idea.				

Table 5 legend key: AGYWLHIV is young women living with HIV; CPR is the crude prevalence ratio; CI is the confidence interval; p-vale is the level of statistical significance; APR is the adjusted prevalence ratio; *Significant at *p* < 0.05; Ref is reference category; < is less than; ART is antiretroviral therapy; PREP is the pre-exposure prophylaxis with antiretroviral drugs; PEP is the post-exposure prophylaxis with antiretroviral drugs

would be an empowerment for the young people to disclose their status to the people who seek for sexual partnership with them.

Notably, we found no significant association between HIVST and HIV nondisclosure to male sexual partners in this study among AGYWLHIV in semi-rural northern Uganda. We attribute the lack of association to the small sample size especially of the subgroup who have ever used HIVST in this study. Future studies involving larger subgroup of the AGYWLHIV who have ever used the HIVST would be more informative.

Internal validity of the study

There were several measures employed in this study that assured the internal validity of the study. The first internal validity assurance measure employed was the use of a standard structured questionnaire that asked the AGYWLHIV about the disclosure of their initial HIV status to their current male sexual partners before their first sexual intercourse regardless of the use of condoms in three dimensions. The three dimensions were whether the AGYWLHIV disclosed their initial HIV status to their current male sexual partners, whether the male sexual partners also disclosed their initial HIV status to the AGYWLHIV and whether both partners disclosed their initial HIV status to each other before their first sexual intercourse. These multiple dimensions of the measurement of nondisclosure allowed for cross-validation of the responses and hence assured internal validity of the measurements. The second internal validity assurance measure employed was the use of youthful female research assistants with health backgrounds (nurses and midwives) to recruit and collect the data from the AGYWLHIV. The youthful female research assistants with the health backgrounds provided peer and health assuring environment for the AGYWLHIV to share disclosure of their HIV status and that of their male sexual partners in truthful and honest manner without fear of confidentiality, stigma and discrimination issues. This contributed to the internal validity of the study. The third internal validity assurance measure employed was the recruitment of the AGYWLHIV through the healthcare system (that was from the ART clinics of the health facilities and using the health workers and the community health workers). This participant recruitment approach provided the AGYWLHIV with the safe and reassuring healthcare environment free from the risk for stigma and discrimination to share data on disclosure of their HIV status and that of their current male sexual partners in truthful and honest manner. The fourth and last internal validity assurance measure we employed was the use of the multivariate regression analysis methods that helped to control for confounding variables and ensured identification of significant independent predictors of nondisclosure of HIV status among the AGYWLHIV.

External validity of the study

The external validity of the study was equally assured through several measures explored in the study. The first external validity assurance measure employed was the use of large scientifically determined sample size and probability sampling method that helped to minimize representation and sampling errors respectively. The recruitment of the AGYWLHIV from several health facilities across the study area also ensured wide representation in the sample and thus an assurance of external

validity of the study in terms of generalizability of the study findings.

Study strengths

This study presents many strengths. The first strength was that the study investigated a unique phenomenon of nondisclosure of HIV status among key population of AGYWLHIV in semi-rural setting of SSA (northern Uganda). The fact that the investigation focused on the sexual and reproductive health related factors of nondisclosure of HIV status to male sexual partners was also an innovation and strength of this study. More so, both the large sample size and the inclusion of participants from diverse healthcare settings allows for the generalization of the study findings. Likewise, the use of a semi-structured questionnaire for data collection from all participants allowed for the standardization of the data collection process and data points. Lastly, the findings of this study provide valuable insights that can significantly enhance public health efforts, particularly in the areas of HIV prevention and care for the AGYWLHIV. These insights are applicable not only in rural Uganda but also in other contexts.

Study limitations

The study wasn't without limitations. The first limitation was the scarcity of previous studies on the association between HIVST and nondisclosure of HIV status to sexual partners to compare this study findings with. Second was the challenge of achieving the adjusted sample size. This challenge was addressed through engaging the community health workers affiliated to the ART clinics to do home visits and refer into the study some of the AGYWLHIV who were not due to return to the ART clinics for refill of their ARV drugs during the period of data collection. This approach potentially allowed for the inclusion into the sample of the AGYWLHIV who obtain their ART services from the private health facilities in the study area. Thirdly, the administration of the questionnaire by face-to-face interview method carried the risks for interviewer's effects on the participants and social desirability bias, particularly in relation to sensitive topics such as sexual and reproductive health [44]. These potential biases were minimized by using female RAs with healthcare backgrounds whose medical professional backgrounds helped in the emphasis of the public health benefits of being honest with sexual and reproductive health data. To further counteract the influence of social desirability bias, the RAs received comprehensive training on how to apply in-depth probing and clarification techniques while conducting the interviews.

Fourthly, the current study did not collect data from the male sexual partners of the AGYWLHIV on their perspectives on HIVST and status disclosure. Data were

also not collected on motivation or demotivation for disclosure. We therefore recommend qualitative studies on the perspectives of male partners on HIVST and status disclosure and also on the motivation or demotivation for disclosure from both sides of the partnership.

Conclusions

The prevalence of HIVST and HIV nondisclosure to male sexual partners among the AGYWLHIV in semi-rural Uganda stood at 38 in 1000 and 267 in 1000 respectively. The HIVST wasn't associated with HIV nondisclosure but the women's initial negative or positive HIV status, the male partner's initial positive HIV status and the male partners' nondisclosure of their initial HIV status to the AGYWLHIV were found to be the independent predictors.

Recommendations

The study findings point to the need for health workers to target the distribution of HIVST kits at the AGYWLHIV attending ART clinics for onward distribution to men in their sexual and social networks to expand access to HIV testing, improve chances of two-way HIV disclosure and entry into the HIV prevention, treatment, and care services.

Health workers working with HIV counseling and testing services should ensure women receive and know their HIV test results and are counselled on disclosure of their HIV status to their male sexual partners for future uptake of sexual and reproductive health interventions. Given the significance of male partner disclosure of their HIV status to elicit reciprocal disclosure from their wives living with HIV, couples counseling should be a key component of HIV testing, treatment, and care services.

The study acknowledges its limitations, including the absence of data on the AGYWLHIV's motivations for HIV status disclosure and the perspectives from the male sexual partners. Therefore, future research, particularly qualitative research is recommended to enable deeper understanding of the motivations for HIV status disclosure among the AGYWHLHIV. Further research is also recommended to gather insights from the male sexual partners of the AGYWLHIV to gain a more complete understanding of the HIV status disclosure dynamics.

Abbreviations
AGYWLHIV   Adolescent girls and young women living with HIV
ART   Antiretroviral therapy
HIV   Human Immunodeficiency virus
PEP   Post-Exposure Prophylaxis
PLHIV   People living with HIV
PrEP   Pre-Exposure Prophylaxis
SPSS   Statistical package for social sciences
SSA   sub-Saharan Africa

Data availability
Data is provided within the manuscript.

Declarations

Ethics approval and consent to participate
The study received ethical approval from the Gulu University Research Ethics Committee (approval number: GUREC-2022-309). Written informed consents were obtained from all participants aged 18 and older. Minors younger than 18 years old provided assent, along with written informed consent from their parents or guardians. Written informed consents were obtained through written signature or thumbprint. The RAs moderated the informed consent process. The consents were obtained before the start of the study. Participants were informed of their right to withdraw from the study at any time and that their participation was voluntary. All data collected was kept confidential and anonymous. Furthermore, all methods were performed in accordance with the Declaration of Helsinki and other relevant guidelines and regulations. Each participant received compensation of 10,000 Ugandan shillings (an equivalent of three U.S. dollars) for their participation in the study.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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