BMJ Open

Self-reported sexually transmitted infections among adolescent girls and young women in Mali: analysis of prevalence and predictors

Collins Kwame Appiah,[1] Robert Kokou Dowou ,[1] Samuel Kwaku Balame,[2] Leticia Akua Adzigbli,[1] Paa Akonor Yeboah,[3] Richard Gyan Aboagye ,[4] Abdul Cadri[5,6]

To cite: Appiah CK, Dowou RK, Balame SK, *et al*. Self-reported sexually transmitted infections among adolescent girls and young women in Mali: analysis of prevalence and predictors. *BMJ Open* 2023;**13**:e069226. doi:10.1136/bmjopen-2022-069226

► Prepublication history and additional supplemental material for this paper are available online. To view these files, please visit the journal online (http://dx.doi.org/10.1136/bmjopen-2022-069226).

Received 14 October 2022
Accepted 29 March 2023

For numbered affiliations see end of article.

Correspondence to
Richard Gyan Aboagye;
aboagyegyan94@gmail.com

ABSTRACT

Objective To examine the prevalence and predictors of self-reported sexually transmitted infections (SR-STIs) among adolescent girls and young women in Mali.

Design We performed a cross-sectional analysis of data from the Demographic and Health Survey of Mali, which was conducted in 2018. A weighted sample of 2105 adolescent girls and young women aged 15–24 was included. Percentages were used to summarise the results of the prevalence of SR-STIs. We used a multilevel binary logistic regression analysis to examine the predictors of SR-STIs. The results were presented using an adjusted odds ratio (aOR) with 95% confidence interval (CI). Statistical significance was set at p<0.05.

Setting Mali.

Participants Adolescent girls (15–19 years) and young women (20–24 years).

Outcome measure SR-STIs.

Results The prevalence of SR-STIs among the adolescent girls and young women was 14.1% (95% CI=12.3 to 16.2). Adolescent girls and young women who had ever tested for HIV, those with one parity, those with multiparity, those with two or more sexual partners, those residing in urban areas, and those exposed to mass media were more likely to self-report STIs. However, those residing in Sikasso and Kidal regions were less likely to report STIs.

Conclusion Our study has shown that SR-STIs are prevalent among adolescent girls and young women in Mali. Health authorities in Mali and other stakeholders should formulate and implement policies and programmes that increase health education among adolescent girls and young women and encourage free and easy access to STI prevention and treatment services.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ The use of nationally representative data and rigorous statistical analysis ensures that the findings are applicable to adolescent girls and young women in Mali.
⇒ Our findings aid in bridging the literature gap on the prevalence and predictors of sexually transmitted infections among adolescent girls and young women in Mali.
⇒ Our study used secondary data and the analysis was limited to the variables available in the dataset. Hence, interpretation and inferences made from the study should be limited to the variables used.
⇒ Demographic and Health Survey uses a cross-sectional design and this limits the study's ability to draw causal inferences.
⇒ The variables included in this study were assessed based on the adolescent girls and young women's self-reports, which raised the possibility of recall bias and other social desirability biases.

INTRODUCTION

Sexually transmitted infections (STIs) continue to be a public health problem as they are among the most common diseases around the world.[1 2] STIs have serious ramifications for sexual, reproductive, and maternal–child health. Some of the implications include genital complications, pregnancy-related complications, infertility, and increased HIV transmission, as well as severe medical and psychological consequences.[3] STIs are also frequently associated with stigma and gender-based violence.[4]

Every day, more than one million STIs are acquired worldwide.[5] According to the World Health Organization (WHO),[5] 374 million new infections with one of four curable STIs occurred in 2020: chlamydia (129 million), gonorrhoea (82 million), syphilis (7.1 million) and trichomoniasis (156 million). Even though STIs are prevalent across the world, the prevalence and associated burden is relatively higher in low and middle-income countries (LMICs),[6] especially in sub-Saharan Africa (SSA).[7] STIs significantly account for a substantive proportion of morbidity and mortality in SSA each year.[8] Most importantly, it has been found that young women in SSA are disproportionately affected by

the burden of STIs.[7] A study conducted in three primary African regions found that all STIs, with the exception of herpes simplex virus 2, were more prevalent among adolescent girls and young women (AGYW) aged 15–24 years compared to those aged 25–49 years, regardless of population type or region.[6]

A bidirectional association between socioeconomic status and STIs was found in a multilevel analysis of a nationally representative survey sample of sexually active young women in Uganda.[9] Also, it has been reported that having unprotected intercourse with multiple sexual partners is the leading risk factor for STIs, including HIV among young people.[10] Evidence suggests that multiple, complex, and context-specific factors contribute to the long-term spread of STIs among AGYW.[11]

To reduce the burden of STIs and ensure the availability of effective preventive and treatment services, the WHO's Global Health Sector Strategy on STIs has called for the implementation of strategies for global STI prevention and control.[12 13] The first strategic step is to collect data on STI incidence and prevalence in representative populations,[14] with special attention to vulnerable populations in countries with a high prevalence of STIs.

Mali has been reported to be one of the countries with the highest prevalence and burden of STIs among women in SSA.[7] According to a study based on the 2006 demographic and health survey (DHS) in Mali, the prevalence of STIs among women was estimated to be 6%, with a relatively high prevalence (10%) in Bamako. In the same study, the prevalence of STIs was lower in men (3%) compared to women.[15] Similarly, the HIV epidemic in Mali is concentrated in important demographics, particularly female sex workers.[16]

Despite the relatively high prevalence of STIs among women in Mali compared to men, a gap in the literature exists on the prevalence and correlates of STIs among AGYW (15–24). Knowing the prevalence and correlates of STIs among AGYW in Mali is an important step towards preventing and controlling STIs. This may have a cross-cutting impact on reducing the burden of STIs in this vulnerable population. The study would provide information for key context-specific strategies to reduce the risk factors among AGYW. As a result, this study sought to examine the prevalence and correlates of self-reported STIs (SR-STIs) among AGYW in Mali.

METHODS

Data source and study design

We conducted a secondary data analysis of the 2018 Mali DHS (MDHS). We extracted the data from the women's file for the study. Generally, DHS is a representative survey conducted periodically in LMICs.[17] A cross-sectional design was adopted for the survey. The respondents were sampled using a two-stage cluster sampling technique. First, a stratified sample of enumeration areas (EAs) was chosen using probability proportional to size: a sample of a preset number of EAs was selected independently in each stratum using probability proportional to the EA's measure of size. A listing technique was used in the designated EAs to ensure that all dwellings/households were listed. Second, households in the selected EAs were selected using equal probability systematic sampling. A detailed sampling process is highlighted in the literature.[17] Structured questionnaires were used to collect the data from the respondents. Electronic questionnaires were administered using face-to-face interviews. A total of 10 519 women of reproductive age completed the questionnaire. Out of this, 4116 were aged 15–24 years. After dropping the missing observations and restricting the dataset to only sexually active AGYW, a weighted sample of 2105 was included in the study. We drafted the paper with references to the Strengthening Reporting of Observational Studies in Epidemiology guidelines (online supplemental table S1).[18] The dataset used is freely available to download at https://dhsprogram.com/data/dataset/Mali_Standard-DHS_2018.cfm?flag=1.[19]

Variables

Outcome variable

The outcome variable in the study was SR-STIs. During the survey, the AGYW who had ever had sex were asked whether they had an STI or symptoms of an STI (a bad-smelling, abnormal discharge from the vagina, or a genital sore or ulcer) in the 12 months preceding the survey. Three response options were provided: no, yes, and don't know. Based on the literature[7 20 21] that used the DHS dataset, we included only those who responded 'yes' and 'no' in our analysis.

Explanatory variables

We included 15 explanatory variables in the study. The inclusion of the variables was based on the review of literature[7 14 20–23] as well as their availability in the DHS dataset. We grouped the variables into the individual and contextual level variables. Individual-level variables include age of respondents (15–19 and 20–24), level of education (no education, primary, and secondary or higher), marital status (never married, married, cohabiting, and previously married), current working status (no and yes), age at first sex (20 years and above and below 20 years), ever tested for HIV (no and yes), condom use during last sex with a most recent partner (no and yes), number of sexual partners in the last 12 months excluding spouse (zero, one, and two or more), comprehensive HIV knowledge (no and yes), health insurance coverage (no and yes), exposure to mass media (no and yes) and parity (zero, one, two, and three or more births). The contextual-level variables consisted of wealth index (poorest, poorer, middle, richer and richest), place of residence (urban and rural) and region (Koulikoro, Kayes, Sikasso, Segou, Mopti, Toumbouctou, Gao, Kidal, and Bamako). Comprehensive HIV/AIDS knowledge was created as an index variable using six variables. With this, the respondents were said to have comprehensive knowledge if they respond correctly to all the six items:

(a) consistent use of condoms during sexual intercourse can prevent HIV transmission; (b) limiting sex to just one uninfected faithful partner can prevent HIV transmission; (c) a healthy-looking person can have HIV; (d) a person can get HIV through mosquito bites; (e) a person can get HIV by sharing food with an HIV-infected person; and (f) a person can get HIV by witchcraft or supernatural means.

Statistical analyses

Data analyses were carried out using Stata software V.17.0 (Stata Corporation, College Station, Texas, USA). We estimated the prevalence of SR-STIs using percentages with their respective 95% confidence intervals (CIs). Cross-tabulation was adopted to determine the distribution of SR-STIs across the explanatory variables. We used a binary logistic regression analysis to select variables for the multilevel regression model. We presented the results using crude odds ratio (OR), with their 95% CIs. All the variables with $p<0.05$ were considered statistically significant and placed in the multilevel regression model. Later, we employed a multivariable multilevel binary logistic regression analysis to examine the factors associated with SR-STIs among AGYW in Mali, using four models. Model O, which was an empty model with no explanatory factor showed the variance in SR-STIs attributable to the primary sample units. We built Models I and II to contain the individual-level and contextual-level variables, respectively. Model III was fitted to contain all the individual and contextual-level variables. We presented the results using adjusted OR (aOR), with their 95% CIs. Akaike's Information Criterion (AIC) was used to assess the fitness and comparisons of the four models. The model with the least AIC value was chosen as the best-fitted model and its results were interpreted and discussed. All the analyses were weighted to account for sampling probability, nonresponse, and complex survey methodology.

Ethical consideration

Ethical clearance was not sought for this study since the 2018 Mali DHS is publicly available to download. We sought permission to use the 2018 Mali DHS from the MEASURE DHS and it was granted. We followed the ethical guidelines for using secondary data for publication. More information on the data and ethical standards can be assessed at http://goo.gl/ny8T6X.

Patient and public involvement

In this study, patients and the public were not included in the study's design and conduct.

RESULTS

Background characteristics of the respondents

Table 1 presents the background characteristics of the AGYW. Majority of the respondents were aged 20–24 (60.7%), had no education (48.9%), were married (80.1%), and had given birth to one child (35.1%).

Table 1 Background characteristics of the adolescent girls and young women in Mali

Variables	Weighted sample (n)	Weighted percentage (%)
Women's age in years		
15–19	828	39.3
20–24	1277	60.7
Level of education		
No education	1030	48.9
Primary	379	18.0
Secondary or higher	696	33.1
Marital status		
Never married	350	16.6
Married	1686	80.1
Cohabiting	45	2.2
Previously married	24	1.1
Current working status		
No	1120	53.2
Yes	985	46.8
Parity		
Zero birth	601	28.6
One birth	739	35.1
Two births	464	22.0
Three or more births	301	14.3
Covered by health insurance		
No	1988	94.4
Yes	117	5.6
Age at first sex		
20 years and above	110	5.2
Below 20 years	1995	94.8
Condom used during last sex with most recent partner		
No	2039	96.9
Yes	66	3.1
Ever test for HIV		
No	1649	78.3
Yes	456	21.7
Comprehensive HIV knowledge		
No	1604	76.2
Yes	501	23.8
Number of sexual partners excluding spouse, in last 12 months		
Zero	1714	81.4
One	362	17.2
Two or more	29	1.4
Exposure to mass media		
No	302	14.3
Yes	1803	85.7

Continued

Table 1 Continued

Variables	Weighted sample (n)	Weighted percentage (%)
Wealth index		
Poorest	292	13.9
Poorer	370	17.6
Middle	410	19.5
Richer	487	23.1
Richest	546	26.9
Place of residence		
Rural	1516	72.0
Urban	589	28.0
Region		
Kayes	260	12.4
Koulikoro	320	15.2
Sikasso	373	17.7
Segou	283	13.5
Mopti	124	5.9
Toumbouctou	187	8.9
Gao	112	5.3
Kidal	43	2.0
Bamako	403	19.1

Similarly, most of the women were not covered by health insurance (94.4%), had their first sex below 20 years (94.8%), did not use condom during their last sex with recent partner (96.9%), had not tested for HIV (78.3%), and did not know about HIV/AIDS (76.2%).

Prevalence of SR-STIs among the adolescent girls and young women

Table 2 presents the proportion of AGYW who reported SR-STIs within the 12 months prior to the survey. The results showed that 14.1% (95% CI=12.3 to 16.2) of the AGYW reported STIs.

Distribution of SR-STIs across the explanatory variables

Table 2 shows the results on the distribution of SR-STIs across the background characteristics of the respondents. The prevalence of SR-STIs was higher among young women aged 20–24 (15.7%), those who had attained secondary or higher education (17.4%), and those who reported three or more births (18.0%). AGYW who had their first sex below 20 years reported a prevalence of 14.5%, whereas those who had ever tested for HIV reported a prevalence of 22.7%. AGYW who reported having two or more sexual partners excluding their spouse also reported a higher prevalence of STIs (30.8%). Furthermore, the prevalence of SR-STIs was higher among women exposed to mass media (15.4%) compared to those who were not exposed to mass media.

Factors associated with SR-STIs among the adolescent girls and young women in Mali

Fixed effect results

Table 3, Model III presents the results for the factors associated with AGYW SR-STIs in Mali. AGYW who had ever tested for HIV had increased odds of SR-STIs (aOR=1.60, 95% CI=1.06 to 2.40) compared to those with no history of HIV testing. For parity, the odds of SR-STIs were significantly higher among AGYW with one parity (aOR=1.70, 95% CI=1.04 to 2.70) and three or more parity (aOR=2.14, 95% CI=1.13 to 4.02). AGYW with two or more sexual partners were more likely to self-report STIs (aOR=3.48, 95% CI=1.57 to 7.68). Also, the likelihood of AGYW self-reporting STIs was higher among those residing in urban areas (aOR=1.88, 95% CI=1.01 to 3.15) and those exposed to mass media (aOR=1.07, 95% CI=1.07 to 4.65) relative to those in rural areas and those not exposed mass media, respectively. However, lower odds of SR-STIs were found among AGYW residing in Sikasso (aOR=0.27, 95% CI=0.12 to 0.61) and Kidal (aOR=0.05, 95% CI=0.01 to 0.46) regions, respectively.

Random effect results

The results from table 3, Model O showed that SR-STIs vary across the clusters. The result from Model O further shows that the between-cluster variations accounted for 27.7% of the SR-STIs among AGYW (intra-class correlation=0.277). The between-cluster variation reduced from 0.277 (Model O) to 0.223 in Model II. However, it increased slightly to 0.229 in Model III. This indicates that the variations in the probability of AGYW reporting STIs vary across the clusters. Also, AIC decreased from Model O to Model III. Hence, Model III was chosen as the best fitted-model for the study.

DISCUSSION

Our study examined the prevalence and correlates of SR-STIs among AGYW in Mali. We found the overall prevalence of SR-STIs among AGYW in Mali to be 14.1%. The prevalence of SR-STI found in this study is lower than the country-specific prevalence for Mali (32.7%) in a study conducted by Dadzie *et al*.[7] Also, the SR-STIs prevalence in this study is lower than the reported prevalence of STIs for female sex workers in Mali.[16] The prevalence of SR-STIs found in this study calls for the need to implement strategies and programmes that could increase STI testing, treatment, and prevention among AGYW and men in Mali, as well as contribute to achieving the global health strategy for STIs.[5 7]

We found that AGYW who had ever tested for HIV were more likely to report STIs. Our result is consistent with previous studies.[24–27] This finding could be ascribed to the fact that testing for HIV in the health facility could also provide opportunities for AGYW to report other STIs that they could be suffering from.[27 28] This observation points to the need for the health programme planners and authorities in Mali to integrate effective STIs

Table 2 Distribution of self-reported sexually transmitted infections across the explanatory variables

Variables	Self-reported sexually transmitted infections		
	No, % (95% CI)	Yes, % (95% CI)	cOR (95% CI)
Prevalence		14.1 (12.3 to 16.2)	
Women's (years)			
15–19	88.2 (85.3 to 90.6)	11.8 (9.4 to 14.7)	1.00
20–24	84.3 (81.8 to 86.6)	15.7 (13.4 to 18.2)	1.39* (1.05 to 1.83)
Level of education			
No education	88.2 (85.6 to 90.5)	11.8 (9.5 to 14.4)	1.00
Primary	85.4 (80.3 to 89.4)	14.6 (10.6 to 19.7)	1.28 (0.86 to 1.91)
Secondary or higher	82.6 (78.7 to 85.9)	17.4 (14.1 to 21.3)	1.58* (1.12 to 2.24)
Marital status			
Never married	84.5 (79.9 to 88.2)	15.5 (11.8 to 20.1)	1.00
Married	86.2 (83.9 to 88.2)	13.8 (11.8 to 16.1)	0.87 (0.62 to 1.22)
Cohabiting	91.7 (79.6 to 96.9)	8.3 (3.1 to 20.4)	0.49 (0.17 to 1.44)
Previously married	71.9 (47.8 to 87.7)	28.1 (12.3 to 52.2)	2.12 (0.74 to 6.12)
Current working status			
No	85.6 (83.0 to 87.9)	14.4 (12.1 to 17.0)	1.00
Yes	86.1 (83.2 to 88.6)	13.9 (11.4 to 16.8)	0.96 (0.73 to 1.26)
Parity			
Zero birth	89.4 (86.3 to 91.9)	10.6 (8.1 to 13.7)	1.00
One birth	84.7 (81.0 to 87.8)	15.3 (12.2 to 19.0)	1.53* (1.05 to 2.22)
Two births	85.6 (81.5 to 89.0)	14.4 (11.0 to 18.5)	1.42 (0.93 to 2.16)
Three or more births	82.0 (76.7 to 86.3)	18.0 (13.7 to 23.3)	1.86** (1.21 to 2.87)
Covered by health insurance			
No	86.2 (84.1 to 88.1)	13.8 (11.9 to 15.9)	1.00
Yes	79.9 (70.9 to 86.5)	20.1 (13.5 to 29.1)	1.58 (0.97 to 2.57)
Age at first sex			
20 years and above	92.8 (86.0 to 96.4)	7.2 (3.6 to 14.0)	1.00
Below 20 years	85.5 (83.4 to 87.4)	14.5 (12.6 to 16.6)	2.19* (1.05 to 4.54)
Condom use during last sex with most recent partner			
No	85.9 (83.8 to 87.8)	14.1 (12.2 to 16.2)	1.00
Yes	83.7 (72.9 to 90.7)	16.3 (9.3 to 27.1)	1.19 (0.62 to 2.28)
Ever test for HIV			
No	88.2 (86.0 to 90.1)	11.8 (9.9 to 14.0)	1.00
Yes	77.3 (72.6 to 81.5)	22.7 (18.5 to 27.4)	2.20*** (1.61 to 3.00)
Comprehensive HIV knowledge			
No	86.4 (84.0 to 88.4)	13.6 (11.6 to 16.0)	1.00
Yes	84.3 (80.1 to 87.7)	15.7 (12.3 to 19.9)	1.18 (0.84 to 1.64)
Number of sexual partners excluding spouse, in last 12 months			
Zero	86.2 (84.0 to 88.2)	13.8 (11.8 to 16.0)	1.00
One	85.6 (81.1 to 89.2)	14.4 (10.8 to 18.9)	1.05 (0.75 to 1.49)
Two or more	69.2 (50.0 to 83.4)	30.8 (16.6 to 50.0)	2.79* (1.24 to 6.27)
Exposure to mass media			
No	93.4 (88.4 to 96.3)	6.6 (3.7 to 11.6)	1.00
Yes	84.6 (82.3 to 86.7)	15.4 (13.3 to 17.7)	2.58* (1.35 to 4.89)
Wealth index			

Continued

Table 2 Continued

Variables	Self-reported sexually transmitted infections		
	No, % (95% CI)	Yes, % (95% CI)	cOR (95% CI)
Poorest	89.0 (83.9 to 92.6)	11.0 (7.4 to 16.1)	1.00
Poorer	88.9 (84.1 to 92.4)	11.1 (7.6 to 15.9)	1.00 (0.58 to 1.74)
Middle	89.2 (84.9 to 92.4)	10.8 (7.6 to 15.1)	0.98 (0.56 to 1.71)
Richer	86.5 (82.5 to 89.7)	13.5 (10.3 to 17.5)	1.26 (0.73 to 2.16)
Richest	79.1 (73.9 to 83.4)	20.9 (16.6 to 26.1)	2.14* (1.26 to 3.61)
Place of residence			
Rural	88.4 (86.0 to 90.5)	11.6 (9.5 to 14.0)	0.50*** (0.36 to 0.69)
Urban	79.3 (75.0 to 83.0)	20.7 (17.0 to 25.0)	1.00
Region			
Kayes	84.8 (77.4 to 90.1)	15.2 (9.9 to 22.6)	1.00
Koulikoro	85.7 (80.8 to 89.4)	14.3 (10.6 to 19.2)	0.93 (0.51 to 1.70)
Sikasso	95.3 (92.1 to 97.3)	4.7 (2.7 to 7.9)	0.27** (0.13 to 0.57)
Segou	85.5 (79.6 to 89.9)	14.5 (10.1 to 20.4)	0.94 (0.50 to 1.79)
Mopti	81.8 (70.3 to 89.5)	18.2 (10.5 to 29.7)	1.24 (0.55 to 2.77)
Toumbouctou	93.8 (88.4 to 96.8)	6.2 (3.2 to 11.6)	0.37* (0.16 to 0.86)
Gao	84.2 (76.2 to 89.8)	15.8 (10.2 to 23.8)	1.05 (0.52 to 2.11)
Kidal	98.1 (87.9 to 99.7)	1.9 (0.3 to 12.1)	0.11* (0.01 to 0.81)
Bamako	78.7 (73.2 to 83.3)	21.3 (16.7 to 26.8)	1.51 (0.85 to 2.68)

*p<0.05, **p<0.01, ***p<0.001. 1=reference category.
cOR, crude OR.

prevention interventions into the national HIV prevention programmes.

Our study showed that AGYW with multiple sexual partners had higher odds of reporting STIs. This finding is in conformation with previous studies which reported that individuals engaging in multiple sexual partnerships are more likely to report STIs.[7 20 22] This finding is not surprising because engaging in multiple sexual partnerships is a risky sexual behaviour that increases the risk of contracting STIs.[7 23 29 30]

Our current study revealed that AGYW who had their first sex below the age of 20 were more likely to report STIs. This finding is consistent with previous studies which indicated that those whose age at first sex is below 20 years had higher odds of contracting or reporting STIs.[23 31–34] This finding reiterates the fact that early sexual debut is a risky sexual behaviour which may increase the odds of STI among AGYW.[35–37] Our finding implies that delaying sexual debut among young individuals carries a benefit in reducing the prevalence of STIs among AGYW. Hence, measures should be taken by relevant stakeholders in Mali to implement effective educational programmes for AGYW in Mali to reduce the risks of STIs among them.[37–39]

Additionally, AGYW who were exposed to mass media had increased odds of reporting STIs. This finding is similar to findings by other studies which reported that exposure to social media correlates with self-report of STIs among young people.[40–42] Access to mass media may serve as a source of education on STIs and health-seeking which could positively influence individuals' behaviour toward the identification of symptoms as well as testing for STIs.[23 42 43]

Lastly, we found in the current study that place of residence was associated with SR-STIs among AGYW. Specifically, AGYW from urban settings had higher odds of reporting STIs compared to those in rural areas. This finding is consistent with reports from previous studies.[14 44–47] AGYW who reside in urban settings might have had access to healthcare services or testing than those in rural settings; hence, the higher likelihood to report STIs.[44 48–51]

AGYW with a history of parity were more likely to self-report STIs. The high probability could be due to the series of tests conducted for pregnant women during antenatal care visits, which might have led to the diagnosis of STIs. Hence, the likelihood of those who have given birth reporting STIs relative to those with no history of parity. Our findings concur with that of a previous study conducted in South Africa, which reported that STIs are prevalent among pregnant women screened during antenatal care visits.[52]

Strengths and limitations of the study

The major strength of the study is the use of a nationally representative dataset and rigorous statistical analysis to determine SR-STIs among AGYW in Mali. However, the

Table 3 Fixed and random effect analysis of factors associated with SR-STIs among adolescent girls and young women

Variable	Model O	Model I aOR (95% CI)	Model II aOR (95% CI)	Model III aOR (95% CI)
Fixed effect results				
Women's (years)				
15–19		1.00		1.00
20–24		1.32 (0.93 to 1.86)		1.25 (0.89 to 1.77)
Level of education				
No education		1.00		1.00
Primary		1.32 (0.82 to 2.12)		1.30 (0.80 to 2.10)
Secondary or higher		1.25 (0.84 to 1.88)		1.15 (0.75 to 1.78)
Parity				
Zero birth		1.00		1.00
One birth		1.65* (1.01 to 2.68)		1.70* (1.04 to 2.78)
Two births		1.48 (0.85 to 2.57)		1.57 (0.90 to 2.74)
Three or more births		1.98* (1.05 to 3.75)		2.14* (1.13 to 4.02)
Ever test for HIV				
No		1.00		1.00
Yes		1.84** (1.23 to 2.74)		1.60* (1.06 to 2.40)
Number of sexual partners excluding spouse, in last 12 months				
Zero		1.00		1.00
One		1.31 (0.85 to 2.04)		1.22 (0.79 to 1.89)
Two or more		4.26*** (1.90 to 9.53)		3.48** (1.57 to 7.68)
Age at first sex				
20 years and above		1.00		1.00
Below 20 years		2.34* (1.03 to 5.31)		2.46* (1.09 to 5.57)
Exposure to mass media				
No		1.00		1.00
Yes		2.41* (1.19 to 4.90)		2.22* (1.07 to 4.65)
Wealth index				
Poorest			1.00	1.00
Poorer			1.00 (0.55 to 1.80)	0.96 (0.53 to 1.73)
Middle			0.96 (0.49 to 1.90)	0.85 (0.42 to 1.74)
Richer			0.94 (0.49 to 1.80)	0.79 (0.39 to 1.61)
Richest			1.34 (0.58 to 3.09)	1.09 (0.45 to 2.65)
Place of residence				
Rural			1.00	1.00
Urban			2.01* (1.09 to 3.71)	1.88* (1.01 to 3.51)
Region				
Kayes			1.00	1.00
Koulikoro			1.10 (0.57 to 2.14)	1.12 (0.57 to 2.19)
Sikasso			0.26*** (0.12 to 0.58)	0.27** (0.12 to 0.61)
Segou			1.10 (0.54 to 2.25)	1.07 (0.51 to 2.24)
Mopti			1.53 (0.60 to 3.94)	1.52 (0.58 to 4.04)
Toumbouctou			0.40 (0.16 to 1.01)	0.44 (0.17 to 1.14)
Gao			1.00 (0.44 to 2.26)	0.99 (0.44 to 2.22)
Kidal			0.05** (0.01 to 0.44)	0.05** (0.01 to 0.46)

Continued

Table 3 Continued

Variable	Model O	Model I aOR (95% CI)	Model II aOR (95% CI)	Model III aOR (95% CI)
Bamako			0.82 (0.36 to 1.84)	0.79 (0.35 to 1.79)
Random effect model				
PSU variance (95% CI)	1.258 (0.799 to 1.980)	1.125 (0.669 to 1.890)	0.943 (0.568 to 1.567)	0.977 (0.573 to 1.664)
ICC	0.277	0.255	0.223	0.229
Wald chi-square	Reference	56.46 (<0.001)	57.84 (<0.001)	106.02 (<0.001)
Model fitness				
Log-likelihood	−888.60459	−855.13213	−864.38686	−837.19165
AIC	1781.209	1736.264	1758.774	1726.383
n	2105	2105	2105	2105
Number of clusters	336	336	336	336

*p<0.05, **p<0.01, ***p<0.001. 1=reference category.
AIC, Akaike's Information Criterion; aOR, adjusted OR; ICC, intra-class correlation; PSU, primary sampling unit; SR-STIs, self-reported sexually transmitted infections.

cross-sectional nature of the DHS limits the study's ability to make causal inferences. Also, due to the self-reported nature of responses on a sensitive topic such as STIs, there is the possibility of social desirability bias in the responses.

Conclusion

The study showed that SR-STIs is prevalent among AGYW in Mali. Various individual and contextual factors including multiple sexual partnerships, ever tested for HIV, age at sexual debut, parity, mass media exposure, and place of residence were associated with SR-STIs among AGYW in Mali. Based on these findings, it is imperative for the health authorities and partners in Mali to formulate and implement policies and programmes that would increase health education among younger women, and encourage free and easy access to STI prevention and treatment services. These could help reduce the prevalence of STIs among young individuals and hence aid the Mali to achieve the global health strategy targets for STIs.

Author affiliations
[1]Department of Epidemiology and Biostatistics, Fred N. Binka School of Public Health, University of Health and Allied Sciences, Ho, Ghana
[2]Department of Academics, School of Hygiene, Ho, Ghana
[3]Fred N. Binka School of Public Health, University of Health and Allied Sciences, Ho, Ghana
[4]Department of Family and Community Health, Fred N. Binka School of Public Health, University of Health and Allied Sciences, Ho, Ghana
[5]Department of Family Medicine, McGill University Montreal, Montreal, Quebec, Canada
[6]Department of Social and Behavioural Science, University of Ghana, Legon, Ghana

Acknowledgements We are grateful to the MEASURE DHS for making the DHS dataset free and accessible to use for the study.

Contributors CKA, AC and RGA conceived the study. RGA, LAA and AC wrote the methods section and performed the data analysis. CKA, RKD, SKB and PAY were responsible for the initial draft of the manuscript. All the authors reviewed and approved the final version of the manuscript. RGA is the guarantor, accepts full responsibility for the work and/or the conduct of the study, had access to the data, and controlled the decision to publish.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval Not applicable.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available in a public, open access repository. The dataset is freely accessible at https://dhsprogram.com/data/dataset/Mali_Standard-DHS_2018.cfm?flag=1.

ORCID iDs
Robert Kokou Dowou http://orcid.org/0000-0003-4260-9618
Richard Gyan Aboagye http://orcid.org/0000-0002-3498-2909

REFERENCES

1 Unemo M, Bradshaw CS, Hocking JS, *et al*. Sexually transmitted infections: challenges ahead. *The Lancet Infectious Diseases* 2017;17:e235–79.
2 Jary A, Teguete I, Sidibé Y, *et al*. Prevalence of cervical hpv infection, sexually transmitted infections and associated antimicrobial

resistance in women attending cervical cancer screening in mali. *Int J Infect Dis* 2021;108:610–6.
3 Torrone EA, Morrison CS, Chen P-L, *et al*. Prevalence of sexually transmitted infections and bacterial vaginosis among women in sub-Saharan Africa: an individual participant data meta-analysis of 18 HIV prevention studies. *PLoS Med* 2018;15:e1002511.
4 Newman L, Rowley J, Vander Hoorn S, *et al*. Global estimates of the prevalence and incidence of four curable sexually transmitted infections in 2012 based on systematic review and global reporting. *PLoS ONE* 2015;10:e0143304.
5 World Health Organization. Sexually transmitted infections (stis). 2022. Available: https://www.who.int/news-room/fact-sheets/detail/sexually-transmitted-infections-(stis)
6 Masanja V, Wafula ST, Ssekamatte T, *et al*. Trends and correlates of sexually transmitted infections among sexually active ugandan female youths: evidence from three demographic and health surveys, 2006-2016. *BMC Infect Dis* 2021;21:59.
7 Dadzie LK, Agbaglo E, Okyere J, *et al*. Self-Reported sexually transmitted infections among adolescent girls and young women in sub-Saharan Africa. *Int Health* 2022;14:545–53. 10.1093/inthealth/ihab088 Available: https://doi.org/10.1093/inthealth/ihab088
8 Upreti P. P295 Prevalence of stis among nepalese women population. Abstracts for the STI & HIV World Congress (Joint Meeting of the 23rd ISSTDR and 20th IUSTI), July 14–17, 2019, Vancouver, Canada; July 2019
9 Anguzu G, Flynn A, Musaazi J, *et al*. Relationship between socioeconomic status and risk of sexually transmitted infections in Uganda: multilevel analysis of a nationally representative survey. *Int J STD AIDS* 2019;30:284–91.
10 N WC, A S, . Associated risk factors of stis and multiple sexual relationships among Youths in Malawi. *PLoS ONE* 2015;10:e0134286.
11 Williamson DA, Chen MY. Emerging and reemerging sexually transmitted infections. *N Engl J Med* 2020;382:2023–32.
12 World Health Organization. *Global health sector strategy on HIV 2016–2021. towards ending AIDS. WHO/HIV/2016.05*. Geneva: World Health Organization, 2017.
13 Francis SC, Mthiyane TN, Baisley K, *et al*. Prevalence of sexually transmitted infections among young people in South Africa: a nested survey in a health and demographic surveillance site. *PLoS Med* 2018;15:e1002512.
14 Seidu A-A, Ahinkorah BO, Dadzie LK, *et al*. A multi-country cross-sectional study of self-reported sexually transmitted infections among sexually active men in sub-saharan africa. *BMC Public Health* 2020;20.
15 Aminta D, Yacouba C, Issa K, *et al*. Risk factors and syndromic management of sexually transmitted infections among sex workers in the kadiolo circle. *AID* 2021;11:95–103.
16 Tounkara FK, Téguété I, Guédou FA, *et al*. Prevalence and factors associated with HIV and sexually transmitted infections among female sex workers in bamako, mali. *Sex Transm Dis* 2020;47:679–85.
17 Corsi DJ, Neuman M, Finlay JE, *et al*. Demographic and health surveys: a profile. *Int J Epidemiol* 2012;41:1602–13.
18 von Elm E, Altman DG, Egger M, *et al*. The strengthening the reporting of observational studies in epidemiology (strobe) statement: guidelines for reporting observational studies. *Int J Surg* 2014;12:1495–9.
19 DHS data source. n.d. Available: https://dhsprogram.com/data/dataset/Mali_Standard-DHS_2018.cfm?flag=1
20 Aboagye RG, Seidu AA, Ahinkorah BO, *et al*. Sexual violence and self-reported sexually transmitted infections among women in sub-saharan africa. *J Biosoc Sci* 2023;55:292–305.
21 McClintock HF, Dulak SL. Intimate partner violence and sexually transmitted infections among women in sub-Saharan Africa. *J Immigr Minor Health* 2021;23:191–8.
22 Adu C, Mohammed A, Budu E, *et al*. Sexual autonomy and self-reported sexually transmitted infections among women in sexual unions. *Arch Public Health* 2022;80:1–0.
23 Seidu AA, Agbaglo E, Dadzie LK, *et al*. Self-Reported sexually transmitted infections among sexually active men in Ghana. *BMC Public Health* 2021;21:1–8.
24 Boothe MAS, Comé C, Semá Baltazar C, *et al*. High burden of self-reported sexually transmitted infections among key populations in mozambique: the urgent need for an integrated surveillance system. *BMC Infect Dis* 2020;20:636.
25 La Ruche G, Pedrono G, Semaille C, *et al*. Self-report of sexually transmitted infections from 1994 to 2010 by adults living in france. *Rev Epidemiol Sante Publique* 2014;62:S0398-7620(14)00679-8:283–90.:.
26 Mokgatle M, Madiba S, Hlongwane N. n.d. Differences in sexual behavior and partner notification for sexually transmitted infections between the out of school youth and university students in a peri-urban district in South africa—A cross-sectional survey. *Front Public Health*;10.
27 Patel SN, Delaney KP, Pitasi MA, *et al*. Self-Reported prevalence of HIV testing among those reporting having been diagnosed with selected stis or HCV, United States, 2005-2016. *Sex Transm Dis* 2020;47(5S Suppl 1):S53–60.
28 Adekeye OA, Abara WE, Xu J, *et al*. HIV screening rates among medicaid enrollees diagnosed with other sexually transmitted infections. *PLoS One* 2016;11.
29 Stahlman S, Javanbakht M, Cochran S, *et al*. Self-reported stis and sexual risk behaviors in the US military: how gender influences risk. *Sex Transm Dis* 2014;41:359.
30 Mercer CH, Jones KG, Geary RS, *et al*. Association of timing of sexual partnerships and perceptions of partners' concurrency with reporting of sexually transmitted infection diagnosis. *JAMA Netw Open* 2018;1:e185957.
31 Tu W, Batteiger BE, Wiehe S, *et al*. Time from first intercourse to first sexually transmitted infection diagnosis among adolescent women. *Arch Pediatr Adolesc Med* 2009;163:1106–11.
32 Motsima T, Malela-Majika JC. The effects of early first sexual intercourse amongst lesotho women: evidence from the 2009 lesotho demographic and health survey. *Afr J Reprod Health* 2016;20:34–42.
33 Ningpuanyeh WC, Sathiya Susuman A. Correlates of early sexual debut and its associated STI/HIV risk factors among sexually active youths in malawi. *Journal of Asian and African Studies* 2017;52:1213–24.
34 Jung M. Risk factors of sexually transmitted infections among female sex workers in republic of korea. *Infect Dis Poverty* 2019;8:6:6.:.
35 Kangmennaang J, Mkandawire P, Luginaah I. Determinants of risky sexual behaviours among adolescents in central african republic, eswatini and ghana: evidence from multi-indicator cluster surveys. *Afr J AIDS Res* 2019;18:38–50.
36 Tadesse G, Yakob B. Risky sexual behaviors among female youth in tiss abay, a semi-urban area of the amhara region, ethiopia. *PLoS One* 2015;10.
37 Paul C, van Roode T, Herbison P, *et al*. Longitudinal study of self-reported sexually transmitted infection incidence by gender and age up to age thirty-two years. *Sex Transm Dis* 2009;36:63–9.
38 Pflieger JC, Cook EC, Niccolai LM, *et al*. Racial/ethnic differences in patterns of sexual risk behavior and rates of sexually transmitted infections among female young adults. *Am J Public Health* 2013;103:903–9.
39 Land JA, Evers JLH. Chlamydia infection and subfertility. *Best Pract Res Clin Obstet Gynaecol* 2002;16:901–12.
40 Sznitman S, Stanton BF, Vanable PA, *et al*. Long term effects of community-based STI screening and mass media HIV prevention messages on sexual risk behaviors of african american adolescents. *AIDS Behav* 2011;15:1755–63.
41 Coyle K, Basen-Engquist K, Kirby D, *et al*. Safer choices: reducing teen pregnancy, HIV, and STDs . *Public Health Rep* 2001;116(1_suppl):82–93.
42 Dagnew GW, Asresie MB, Fekadu GA, *et al*. Factors associated with sexually transmitted infections among sexually active men in Ethiopia. Further analysis of 2016 Ethiopian demographic and health survey data. *PLoS ONE* 2020;15:e0232793.
43 Alawode OA, Ogunwemimo H, Bolorunduro ME, *et al*. Age at sexual debut and multiple sexual partnerships among adolescents in Nigeria: an assessment of the mediating role of the knowledge of sexually transmitted infections. *Adolescents* 2021;1:421–32.
44 La Ruche G, Pedrono G, Semaille C, *et al*. Self-report of sexually transmitted infections from 1994 to 2010 by adults living in france. *Rev Epidemiol Sante Publique* 2014;62:283–90.
45 Tiruneh K, Wasie B, Gonzalez H. Sexual behavior and vulnerability to HIV infection among seasonal migrant laborers in metema district, northwest ethiopia: a cross-sectional study. *BMC Public Health* 2015;15:122.
46 Choi J, Bahl D, Arora M, *et al*. Changes in self-reported sexually transmitted infections and symptoms among married couples in india from 2006 to 2016: a repeated cross-sectional multivariate analysis from nationally representative data. *BMJ Open* 2021;11.
47 Hailemariam S, Nigusse A, Kebede A, *et al*. Prevalence of self-reported symptoms of sexually transmitted infection among establishment-based female sex workers in Ethiopia. *Canadian Journal of Infectious Diseases and Medical Microbiology* 2020;2020:1–7.
48 Tanfer K, Cubbins LA, Billy JO. Gender, race, class and self-reported sexually transmitted disease incidence. *Fam Plann Perspect* 1995;27:196–202.

49 Caccamo A, Kachur R, Williams SP. Narrative review: sexually transmitted diseases and homeless youth—what do we know about sexually transmitted disease prevalence and risk? *Sexual Trans Dis* 2017;44:466–76.
50 Nagarkar A, Mhaskar P. A systematic review on the prevalence and utilization of health care services for reproductive tract infections/sexually transmitted infections: evidence from india. *Indian J Sex Transm Dis AIDS* 2015;36:18–25.
51 Llangarí-Arizo LM, Sadiq ST, Márquez C, *et al*. Sexually transmitted infections and factors associated with risky sexual practices among female sex workers: a cross sectional study in a large andean city. *PLoS One* 2021;16.
52 Nyemba DC, Peters RPH, Medina-Marino A, *et al*. Impact of aetiological screening of sexually transmitted infections during pregnancy on pregnancy outcomes in south africa. *BMC Pregnancy Childbirth* 2022;22:194.