Background

Adolescent girls and young women (AGYW) in Zambia encounter a range of risks and vulnerabilities that significantly impede their healthy development into adulthood. Among the most pressing challenges are early marriage and childbearing, which often cut short their education and limit their future opportunities. Additionally, these young women are frequently subjected to sexual and gender-based violence, which not only endangers their physical safety but also leaves lasting psychological scars. The threat of unwanted pregnancies further complicates their situation, as it can lead to social stigma, economic hardship, and limited life choices. Furthermore, these adolescents are at a heightened risk of contracting HIV and other sexually transmitted infections, which pose serious health risks and perpetuate cycles of poverty and inequality. Understanding the risk factors and pathways contributing to this epidemic in Zambia is important in the war against HIV.

Data and methods

This study used the Zambia 2018 Demographic and Health Survey (ZMDHS) (Zambia Statistics Agency, Ministry of Health (MOH) Zambia & ICF. 2019). The DHS is a cross-sectional household nationally representative survey which is a part of the MEASURE DHS Program and aims at obtaining information on a number of population and health issues including HIV risk, maternal and sexual health outcomes as well as sociodemographic characteristics. Taking households as sampling units, the survey employed a two-stage cluster sampling technique using the 2010 Census of Population and Housing as the sample frame (Zambia Statistics Agency, Ministry of Health (MOH) Zambia & ICF. 2019). A total of 14,189 women aged 15-49 were identified as eligible for individual interviews; 13,683 women were interviewed, yielding a response rate of 96%.

For this analysis, only interviews with AGYW aged 15-24 years were used, as adolescents under 15 years are not included in standard DHS samples. This gave us a total sample of 5,799. Detailed information on sample size estimation and sampling strategies used for data collection is available in the full ZMDHS published reports, accessible to the public at (https://www.dhsprogram.com/).

HIV risk outcomes

This research examined six self-reported HIV risk outcomes identified in the DHS data.). *Age-disparate sexual partnership* was defined as 1 if a respondent indicated getting involved with a partner at least five years older within the past 12 months. *Inconsistent condom use* was defined as 1 if a respondent indicated non-use or inconsistent use of condoms with at least one of the most three recent sexual partners in the past 12 months.

Multiple sexual partnership was defined as 1 if a respondent reported having more than one partner in their lifetime. *Early sexual initiation* was defined as 1 if a respondent indicated engaging in sexual intercourse before reaching the age of 16. The decision to set the threshold for early sexual initiation at

16 years was informed by international standards and guidelines advocated by reputable sources like the World Health Organization (WHO), as well as supported by prior research findings (Mabaso et al., 2018; Lee et al., 2018; WHO, 2004. *Adolescent motherhood,* measured as a conception of first child before the age of 20 according to the World Health Organization's definition. Finally, *child marriage* was defined as being married or cohabiting before the age of 18 years.

Control variables

The selection of independent variables for this study was informed by existing literature. Eight independent variables that are known to impact sexual behavior were identified: age, household poverty status based on the asset index, household location (rural or urban), employment status, religion, gender of the household head, and inequitable gender attitudes.

Data Analysis

The analysis of this study was restricted to AGYW between the ages of 15 and 24 years (n=5799). We computed the analysis in four stages. First, we computed weighted frequencies of the selected characteristics of AGYW and outcomes. The estimates from our analysis were weighted to guarantee the representativeness of the survey. Second, we conducted bivariate analyses of study outcomes and the selected characteristics by motherhood status using unadjusted binary logistic regression analysis with the level of significance set at $p<0.05$. Third, we employed the generalized estimating equations (GEE) technique using a logit link. This approach was preferred for several reasons: (1) multiple outcomes were clustered within individuals, (2) our focus was on the fixed parameters of the model and (3) the GEE method explicitly accounts for measurement error, making it more robust to misspecification of the covariance structure among multiple outcomes.

Results

Multivariable structural equation model of factors associated with HIV sexual risks

In the multivariate analysis, several factors were associated with HIV sexual behaviour risk among AGYW (Table 3). The study shows that after adjusting for other covariates, AGYW ages 20-24 still had increased odds of reporting all six outcomes; age-disparate partnerships (adjusted odds ratio [aOR]=3.90; 95% CI=3.39-4.49), inconsistent condom use (adjusted odds ratio [aOR]=7.35; 95% CI=6.26-8.65), multiple sexual partnerships (adjusted odds ratio [aOR]=4.79; 95% CI=4.17-5.50), child marriage (adjusted odds ratio [aOR]=3.48; 95% CI=2.94-4.12), early sexual debut (adjusted odds ratio [aOR]=1.65; 95% CI=1.44-1.88) and adolescent pregnancy (adjusted odds ratio [aOR]=5.26; 95% CI=4.53-6.12).

Regarding education, AGYW with at least primary education had reduced odds of reporting age disparate partnerships age disparate partnerships (adjusted odds ratio [aOR]=0.64; 95% CI=0.46-0.90). Whereas AGYW with at least secondary education, had decreased odds of reporting age disparate partnerships (adjusted odds ratio [aOR]=0.44; 95% CI=0.31-0.62), inconsistent condom use (adjusted odds ratio [aOR]=0.53; 95% CI=0.36-0.77), child marriage (adjusted odds ratio [aOR]=0.21; 95%

CI=0.15-0.31), early sexual debut (adjusted odds ratio [aOR]=0.35; 95% CI=0.25-0.47) and adolescent pregnancy (adjusted odds ratio [aOR]=0.06; 95% CI=0.03-0.12).

AGYW from poor households had increased odds of inconsistent condom use (adjusted odds ratio [aOR]=1.47; 95% CI=1.22-1.78), child marriage (adjusted odds ratio [aOR]=1.35; 95% CI=1.11-1.63) and adolescent pregnancy (adjusted odds ratio [aOR]=1.48; 95% CI=1.23-1.78). Whereas AGYW who reported rural residence had increased odds of inconsistent condom use
(adjusted odds ratio [aOR]=1.89; 95% CI=1.50-2.38), multiple sexual partnerships (adjusted odds ratio [aOR]=1.36; 95% CI=1.07-1.73), child marriage (adjusted odds ratio [aOR]=2.85; 95% CI=1.10-2.05), early sexual debut (adjusted odds ratio [aOR]=1.65; 95% CI=1.34-2.05), and adolescent pregnancy (adjusted odds ratio [aOR]=1.42; 95% CI=1.09-1.84).

AGYW who identified as protestant had increased risk of reporting three risk outcomes including:, child marriage (adjusted odds ratio [aOR]=1.39; 95% CI=1.09-1.76), early sexual debut (adjusted odds ratio [aOR]=1.24; 95% CI=1.02-152), and adolescent pregnancy (adjusted odds ratio [aOR]=1.25; 95% CI=1.00-1.57) compared to those identified as catholic.

AGYW who reported inequitable gender attitudes had increased odds of reporting four outcomes including: inconsistent condom use (adjusted odds ratio [aOR]=1.46; 95% CI=1.19-1.80), child marriage (adjusted odds ratio [aOR]=1.38; 95% CI=1.15-1.64), early sexual debut (adjusted odds ratio [aOR]=1.39; 95% CI=1.20-1.62) and adolescent pregnancy (adjusted odds ratio [aOR]=1.42; 95% CI=1.18-1.71).

Discussion.

Results to be discussed

Appendices

Table 3: Multivariable structural equation logistic regressions.

Variables	Age disparate (past year)		Inconsistent condom Use		Multiple sexual partnerships (lifetime)		Child marriage (lifetime)		Early sexual debut (before 16)		Adolescent motherhood (lifetime)	
	aOR (95% CI)	**P-value**	**aOR (95% CI)**	**P-value**	**aOR (95% CI)**	**P-value**	**aOR (95% CI)**	**P-value**	**aOR (95% CI)**	**P-value**	**aOR (95% CI)**	**P-value**
Age												
20-24	3.90 (3.39-4.49)	<0.001	7.35 (6.26-8.65)	<0.001	4.79 (4.17-5.50)	<0.001	3.48 (2.94-4.12)	<0.001	1.65 (1.44-1.88)	<0.001	5.26 (4.53-6.12)	<0.001
Education level												
Primary	0.64 (0.46-0.90)	0.010	0.85 (0.59-1.23)	0.389	1.04 (0.64-1.19)	0.813	0.80 (0.56-1.13)	0.206	0.76 (0.56-1.02)	0.064	1.09 (0.80-1.47)	0.600
Secondary	0.44 (0.31-0.62)	<0.001	0.53 (0.36-0.77)	0.001	0.82 (0.75-1.44)	0.246	0.21 (0.15-0.31)	<0.001	0.35 (0.25-0.47)	<0.001	0.50 (0.35-0.70)	<0.001
Tertiary	0.33 (0.17-0.64)	0.001	0.16 (0.09-0.31)	<0.001	0.62 (0.34-1.12)	0.115	0.02 (0.00-0.11)	<0.001	0.05 (0.02-0.13)	<0.001	0.06 (0.03-0.12)	<0.001
Household SES												
Poor	1.01 (0.91-1.35)	0.319	1.47 (1.22-1.78)	<0.001	1.10 (0.90-1.33)	0.359	1.35 (1.11-1.63)	0.002	1.12 (0.94-1.33)	0.210	1.48 (1.23-1.78)	<0.001
Residence												
Rural	1.06 (0.87-1.30)	0.549	1.89 (1.50-2.38)	<0.001	1.36 (1.07-1.73)	0.012	2.85 (1.10-2.05)	0.011	1.65 (1.34-2.05)	<0.001	1.42 (1.09-1.84)	0.009
Religion												
Protestant	1.18 (0.96-1.47)	0.117	1.14 (0.91-1.43)	0.248	1.14 (0.93-1.41)	0.115	1.39 (1.09-1.76)	0.007	1.24 (1.02-1.52)	0.029	1.25 (1.00-1.57)	0.049
Muslim or others	1.08 (0.58-2.03)	0.793	1.55 (0.69-3.47)	0.287	1.14 (0.55-2.33)	0.512	1.05 (0.47-2.32)	0.908	1.77 (0.75-3.04)	0.242	0.65 (0.33-1.27)	0.204
Gender norms												
Inequitable-gender attitudes	1.07 (0.91-1.26)	0.430	1.46 (1.19-1.80)	<0.001	1.09 (0.93-1.28)	0.291	1.38 (1.15-1.64)	<0.001	1.39 (1.20-1.62)	<0.001	1.42 (1.18-1.71)	<0.001

Note: n = 5,521. Clustering of multiple outcomes within individuals is accounted for using the GEE method.

Abbreviations: AOR, adjusted odds ratio; CI, confidence interval; SES- social economic status