HIV Vulnerability Profiles and Risk among Nomadic Youth: A Latent Class Analysis

Sultan Hebo, Dr. Francine Schneider, Dr. Mark Spigt

Extended Abstract

Introduction:

In sub-Saharan Africa, young people face a disproportionate risk of HIV infection, with Ethiopia's large youth population and high adolescent HIV prevalence highlighting the urgency of effective prevention strategies. However, existing interventions often overlook the unique challenges of specific communities, like nomadic pastoralists. This mobile lifestyle creates barriers to healthcare access and HIV services, increasing vulnerability. Seasonal migrations pose further challenges for program development and implementation. Additionally, ingrained social norms discourage open discussions about sexual health, hindering information access and assistance for youth.

Despite ongoing efforts, new infections persist, potentially due to one-size-fits-all prevention approaches designed without considering diverse youth experiences and socio-cultural contexts. Heavy focus on individual behaviors may further exclude youth from programs in communities where discussing sexuality is taboo. Recognizing diversity and moving beyond behavior-centric models is crucial. Expanding interventions to encompass socio-structural factors influencing HIV risk holds promise for more effective prevention. By identifying subgroups of at-risk youth based on these factors within Ethiopia's nomadic setting, this study asses the association between these profiles and HIV risk and prevention behaviors. This knowledge can inform targeted interventions tailored to the specific needs of diverse youth groups within nomadic communities.

Research Approach:

This cross-sectional study recruited 641 adolescents and young adults (AYAs) aged 15-24 in southern Ethiopia's Hammer district. Multi-stage sampling ensured representation across 13 nomadic kebeles. Socio-ecological framework and relevant literature informed selection of HIV vulnerability indicators, including marital status, education, migration, livelihood, income, living arrangements, HIV knowledge, risk perception, and service access. Specific instruments measured comprehensive knowledge, perceived risk, and access to testing/prevention. Behaviors studied included multiple partners, transactional sex, intergenerational sex, alcohol use, condom use, HIV testing, and PrEP intention. Latent Class Analysis (LCA) identified subgroups based on vulnerability factors. Associations between these profiles and risk/prevention behaviors were analyzed using adjusted modal assignments. Model selection used fit indices, entropy statistics, and interpretability. Mplus (v8.4) and Jamovi (v2.3.28) were used for analyses. The differences between subgroups and overall sample HIV risk and preventive behaviors were examined using Wald chi-square tests. Logistic regression models were subsequently developed, first by estimating the associations between subgroup membership and HIV risk and preventive behaviors and then by adding age and sex covariates. Arba Minch University's IRB approved the study.

Result:

A total of 638 adolescents and young adults (AYAs) participated in the study, with 40% identifying as pastoralists. Only one-third of participants demonstrated comprehensive knowledge about HIV transmission and prevention (33.4%), while one-fourth perceived a likelihood of HIV infection (23.8%). Among sexually active participants (49.1%), the majority (92.3%) reported having multiple sexual partners in the last year, with 97.8% inconsistently using condoms.

The study identified a 3-class model as the best fitting for distinct profiles of HIV vulnerability among youth in the nomadic setting. This model, with the lowest BIC value, outperformed others. The 2-class model was considered non-informative, and the 3-class model replicated all classes from the 2-class model while adding an additional class with unique experiences of HIV vulnerability indicators. Table 1

Table 1. Latent class model fit and information criteria for 2 to 6 class solutions among a study sample of adolescents and young adults in a nomadic setting of southern Ethiopia, 2023.

No. of Classes	LL	AIC	BIC	a-BIC	Entropy
1	-	-	-	-	-
2	-3598.72	7239.44	7333.06	7266.39	0.76
3	-3563.08	7190.16	7332.82	7231.23	0.75
4	-3537.69	7161.38	7353.09	7216.56	0.70
5	-3511.25	7130.50	7371.25	7199.81	0.71
6	-3488.43	7106.85	7396.64	7190.27	0.76

Note. LL = log-likelihood; AIC = Akaike information criterion; BIC = Bayesian information criterion; a-BIC = adjusted Bayesian information criterion.

The study identified three distinct HIV vulnerability profiles: high-risk, precarious, and safe groups. "Safe Group" (18.3%): Lower HIV vulnerability, indicated by school enrollment, no migration, living with parents/guardians, and good access to HIV testing and prevention services. "High-Risk Group" (39.7%): Higher vulnerability, indicated by married status, lack of schooling, recent migration, pastoral livelihood, not living with parents/guardians, and good access to HIV prevention services. "Precarious Group" (42.0%): Mixed vulnerability indicators from both safe and high-risk groups, reflecting a precarious state of HIV vulnerability, including lack of school enrollment and poor access to HIV testing and prevention services. Table 2

Table 2. Prevalence of latent class membership and item-response probabilities of study sample of adolescents and young adults from the nomadic setting of southern Ethiopia, 2023.

LCA Indicators	Overall Proportion	Latent Classes Proportion (%)		
		Safe (18.34)	High-risk (39.65)	Precarious (42.01)

		Conditional Item Response Probabilities			
Marital Status	Married	0.433	0.000	**0.953**	**0.157**
	Never Married	0.567	1.000	0.047	**0.843**
School enrollment	Not Enrolled	0.671	**0.473**	**0.964**	**0.501**
	Enrolled	0.329	**0.527**	0.036	**0.499**
Migration (Last year)	Migrated	0.423	0.055	**0.544**	**0.440**
	Not Migrated	0.577	**0.945**	**0.456**	**0.560**
Livelihood	Pastoral	0.398	**0.203**	**0.494**	**0.382**
	Semi-pastoral	0.303	**0.619**	**0.278**	**0.266**
	Agrarian	0.299	**0.178**	**0.228**	**0.392**
Generate Income	No	0.892	1.000	**0.790**	**0.939**
	Yes	0.108	0.000	**0.210**	**0.061**
Living Arrangement	Without parents	0.337	0.000	**0.725**	**0.135**
	With parents	0.663	1.000	**0.275**	**0.865**
HIV Knowledge	No	0.666	**0.725**	**0.617**	**0.687**
	Yes	0.334	**0.275**	**0.383**	**0.313**
HIV risk perception	Likely	0.238	0.011	**0.304**	**0.256**
	Unlikely	0.762	**0.989**	**0.696**	**0.744**
Access to HIV preventive service	Poor	0.489	0.000	**0.471**	**0.651**
	Good	0.511	1.000	**0.529**	**0.349**

Note. The bold font indicates that the probability significantly differs from the overall population at p <.05.

Regression analysis revealed that membership in the high-risk group was associated with greater odds and higher levels of HIV risk and preventive behaviors compared to the safe group. This included a higher likelihood of engaging in multiple sexual partnerships (OR = 4.63) and intergenerational sex (OR = 2.06). Both high-risk and precarious groups had greater odds of engaging in transactional sex, alcohol use, inconsistent condom use, and intention to use PrEP compared to the safe group. While the odds of most risk behaviors were not statistically different between the high-risk and precarious groups, the high-risk group exhibited significantly greater odds of engaging in preventive behaviors such as ever tested for HIV (OR = 1.98) compared to the precarious group. Table 3

Table 3. Association of HIV risk and preventive behaviors with HIV vulnerability profiles among a study sample of 15-24-year-olds in a nomadic setting of southern Ethiopia, 2023.

HIV risk and preventive behaviors	HIV Vulnerability profiles		
	Safe	High-risk	Precarious
Multiple sexual partner (%)	19.7	71.9	31.3
AOR (95% CI)	REF	**4.63 [2.53, 8.50]**	1.62 [0.91, 2.86]
Transactional sex	6.0	24.5	20.5
AOR (95% CI)	REF	**2.94 [1.22, 7.08]**	**3.70 [1.60, 8.53]**

	Safe	High-risk	Precarious
Intergenerational sex	12.8	34.4	19.4
AOR (95% CI)	REF	**2.06 [1.07, 3.99]**	1.49 [0.80, 2.80]
Alcohol use	6.0	41.9	21.6
AOR (95% CI)	REF	**6.09 [2.61, 14,21]**	**3.96 [1.73, 9.08]**
Inconsistent Condom use	20.5	74.3	35.1
AOR (95% CI)	REF	**4.99 [2.73, 9.12]**	**1.87 [1.07, 3.27]**
Ever tested for HIV	6.8	32.0	11.9
AOR (95% CI)	REF	**3.27 [1.44, 7.43]**	1.65 [0.73, 3.75]
Intention to use PrEP	25.6	49.8	38.1
AOR (95% CI)	REF	**2.76 [1.62, 4.72]**	**1.74 [1.07, 2.83]**
	Safe	High-risk	Precarious
Multiple sexual partner (%)	19.7	71.9	31.3
AOR (95% CI)	0.62 [0.35, 1.10]	**2.87 [1.83, 4.51]**	REF
Transactional sex	6.0	24.5	20.5
AOR (95% CI)	**0.27 [0.12, 0.62]**	0.80 [0.48, 1.32]	REF
Intergenerational sex	12.8	34.4	19.4
AOR (95% CI)	0.67 [0.36, 1.26]	1.38 [0.87, 2.20]	REF
Alcohol use	6.0	41.9	21.6
AOR (95% CI)	**0.25 [0.11, 0.58]**	1.54 [0.98, 2.42]	REF
Inconsistent Condom use	20.5	74.3	35.1
AOR (95% CI)	**0.54 [0.31, 0.94]**	**2.67 [1.70, 4.20]**	REF
Ever tested for HIV	6.8	32.0	11.9
AOR (95% CI)	0.60 [0.27, 1.37]	**1.98 [1.18, 3.32]**	REF
Intention to use PrEP	25.6	49.8	38.1
AOR (95% CI)	**0.57 [0.35, 0.93]**	**1.58 [1.06, 2.37]**	REF

Note: AOR = adjusted odds ratio. All regression estimates are adjusted for age and sex. CI = confidence interval. A bold font indicates a significant difference from the reference class at $p < .05$.

The study's use of a segmentation approach, specifically latent class analysis, represents a significant methodological advancement in global public health efforts to address HIV vulnerability among youth. This methodological approach will enable enables tailored interventions that are person-centered and address specific risk profiles and needs, resulting in increased contextual relevance and effectiveness. Furthermore, by identifying unique vulnerability profiles, targeted resource allocation can optimize the efficiency and impact of public health programs, especially in resource-constrained settings such as nomadic communities. Thus, this methodology has a potential contributes to the advancement of public health methodologies and serves as a template for addressing complex public health challenges in diverse cultural and geographic contexts. From a policy and program perspective, this study underscores the importance of effective audience segmentation that considers broader socio-structural factors to inform evidence-based policies and tailored interventions.