THE INFLUENCE OF PERCEIVED HIV RISK AND SOCIAL SUPPORT ON WILLINGNESS TO USE PRE EXPOSURE PROPHYLAXIS AMONG PASTORALIST YOUTH IN SOUTHERN ETHIOPIA

Sultan Hussen Hebo[1,2], Mark Spigt[2], Francine Schneider[3]

ABSTRACT

BACKGROUND: Pastoralist youth, whose mobile livelihoods often restrict access to consistent healthcare, face elevated risk of HIV acquisition yet limited engagement with conventional prevention services. Pre-exposure prophylaxis (PrEP) offers a promising biomedical prevention option; however, little is known about the factors influencing PrEP willingness in this marginalized population.

OBJECTIVES: This study aimed to: (i) examine whether HIV risk status, derived through latent class analysis (LCA), predicts willingness to use PrEP; (ii) assess whether perceived HIV risk mediates this association; and (iii) determine whether social support moderates the mediation pathway.

METHODS: A community-based cross-sectional survey was conducted among 638 randomly selected pastoralist youth aged 15–24 years in Southern Ethiopia (April–May 2024). HIV risk status (independent variable) was generated using LCA based on nine HIV risk indicators. Perceived HIV risk (mediator), social support (moderator), and willingness to use PrEP (dependent variable) were measured using interviewer-administered questionnaires. Hypothesized pathways were tested using Hayes' PROCESS macro (Model 4 for mediation; Model 15 for moderated mediation) with 5,000 bootstrap samples.

RESULTS: Overall, 40.4% of participants reported definite willingness to use PrEP. High-risk youth showed significantly greater PrEP willingness than low-risk youth (direct effect, $\beta = 0.92$, $p < 0.001$). Perceived HIV risk partially mediated the association between high HIV risk and PrEP willingness (indirect effect, $\beta = 0.20$, 95% CI 0.10–0.35). Furthermore, social support significantly moderated the perceived-risk PrEP willingness pathway among the high-risk group (index of moderated mediation = 0.21, 95% CI 0.03–0.43), with the mediated effect increasing from 0.12 to 0.35 as social support improved.

CONCLUSION: Our findings indicate that PrEP willingness is higher among pastoralist youth at higher objective HIV risk. This association is partly explained by their perceived HIV risk. Crucially, stronger social support enhances the likelihood that youth who perceive themselves at risk express willingness to use PrEP. These findings underscore the importance of integrating targeted risk communication with community-based support systems to enhance accurate risk perception and promote PrEP uptake among pastoralist youth.

KEYWORDS: HIV prevention; Pre-exposure prophylaxis; Pastoralist youth; HIV risk perception; Social support; Ethiopia

(The Ethiopian Journal of Reproductive Health; 2025; 17; 52-651)

1 Department of Reproductive Health, School of Public Health, Arba Minch University, Arba Minch, Ethiopia

2 Department of Family Medicine, Care and Public Health Research Institute, Maastricht University, Maastricht, Netherlands

3 Department of Health Promotion, Care and Public Health Research Institute, Maastricht University, Maastricht, Netherlands

INTRODUCTION

The global fight against human immunodeficiency virus (HIV) has seen significant advancements, yet the epidemic continues, particularly among adolescents and young people (AYP). Youth aged 15–24 years constitute 22% of the global population yet accounted for over 36% of all new HIV infections in 2022.[1–3] These challenges are particularly acute in sub-Saharan Africa (SSA).[4,5] Ethiopia mirrors this pattern; youth aged 15–24 years comprise 75% of new infections.[6] Progress lags for youth—since 2010, new HIV infections declined just 36% (versus 45% nationally), and AIDS-related deaths fell 50% (versus 82% in adults),[6] underscoring the imperative for youth-specific prevention strategies.

Crucially, HIV risk is not uniformly distributed; marginalized subgroups frequently confront compounded HIV vulnerability due to structural and behavioral factors.[6] Pastoralist youth in Ethiopia—who engage in livestock herding across remote lowland regions—are one such group. Although pastoralist communities inhabit the majority of Ethiopia's landmass, they remain underserved by the national health system.[7] Evidence consistently shows that pastoralist populations experience structural exclusion due to geographic remoteness, livelihood-related mobility, limited formal education, and systemic neglect.[8] These barriers contribute to persistently low access to HIV services and poor intervention coverage. For instance, mobility and weak health infrastructure have contributed to stagnating antiretroviral therapy (ART) coverage in the pastoralist areas.[9,10] Additionally, studies report disproportionately low HIV testing rates and limited comprehensive HIV knowledge among pastoralist youth, indicating reduced engagement in HIV prevention and awareness efforts.[7,8]

Against this backdrop, effective HIV prevention tools like pre-exposure prophylaxis (PrEP) are needed. PrEP—antiretroviral medication taken by HIV-negative individuals—has emerged as a highly effective biomedical intervention for populations at elevated risk.[11] Reflecting its effectiveness, the World Health Organization (WHO) recommends offering PrEP to individuals at substantial risk of HIV acquisition.[12] This strategy is especially relevant for populations with limited autonomy over traditional prevention approaches.[13,14] For pastoralist youth, PrEP offers a uniquely suitable option: an individually controlled prevention method that aligns with their mobility patterns and socio-cultural constraints. However, the success of PrEP relies on consistent adherence, which in turn depends on individuals' willingness to initiate and maintain use.[15] Studies across diverse high-risk populations report widely varying levels of PrEP willingness—from 22% to 90.4%—depending on context-specific barriers and facilitators.[16–25]

Studies show that perceived HIV risk (an individual's belief about their own risk) significantly influences PrEP willingness among youth but often diverges from objective HIV risk (actual HIV risk status measured based on epidemiological risk indicators placing someone at high likelihood of acquiring HIV). For instance, in Malawi, only 26% of adolescent girls and young women (AGYW) with high objective HIV risk perceived themselves at high risk, even though 68% expressed PrEP willingness/interest.[23] This mismatch between objective and perceived risk—well-documented in general youth populations[18,21–24]—likely extends to pastoralist youth, who face elevated actual risks due to factors like mobility, limited healthcare access, and certain socio-cultural practices, yet frequently have low HIV knowledge and misconceptions.[7,10] Among pastoralist communities, commonly held beliefs that HIV is an urban disease, coupled with poor comprehensive knowledge and entrenched misconceptions[25]—such as fears of transmission through casual contact—might create a dangerous cognitive gap: individuals at high objective risk may still perceive low personal risk. This subjective underestimation, more than actual risk, likely diminishes their willingness to use PrEP. Therefore, assessing whether high-risk pastoralist youth perceive their HIV risk is vital; without that awareness, even accessible biomedical interventions may have limited impact.

In influencing youth to perceive their HIV risk and engage in HIV prevention behaviors, social support—encompassing emotional, informational, tangible, and appraisal assistance from family, peers, and the community—plays a vital role.[26] Evidence demonstrates that social support is pivotal in strengthening individuals' understanding of their own HIV risk and motivating protective action.[27] This function is especially crucial where formal healthcare access and information are limited, as supportive networks facilitate the timely exchange of accurate HIV-related information, enabling informed prevention decisions.[28] Given that social support is a malleable factor proven to strengthen networks and improve the uptake of other HIV interventions,[26,29] we hypothesize it will act as a moderator on the pathway from objective HIV risk to PrEP willingness, primarily by enhancing accurate HIV risk perception. Understanding this moderating role holds significant importance for pastoralist youth, who face limited access to conventional prevention services,[7,30] and whose decisions are likely influenced by their collectivist social structures (e.g., clan networks, tribal hierarchies).[31] Consequently, leveraging these existing social dynamics through culturally congruent strategies is essential for designing effective PrEP promotion in pastoral settings.

Taken together, the existing literature reveals three key gaps. First, pastoralist youth remain largely absent from HIV prevention research: little is known about their HIV risk status, perceptions, or intervention access, despite their clear vulnerabilities. Second, even for general youth populations, the misalignment of objective versus perceived HIV risk is a critical problem, which is particularly unaddressed among Ethiopian pastoralists. Finally, the hypothesized influence of social support on the pathway from objective HIV risk to perceived risk and then to PrEP willingness, though critically important, is poorly understood. To fill these gaps, we conducted this study among pastoralist youth in Southern Ethiopia. The overall aim was to understand the interplay of objective HIV risk, risk perception, and social support in shaping PrEP willingness. Specifically, this study aimed to (i) determine if HIV risk status, as derived from latent class analysis, predicts PrEP willingness; (ii) assess whether perceived HIV risk mediates the relationship between HIV risk status and PrEP willingness; and (iii) evaluate if social support moderates the mediation pathway.

Overall, Figure 1 depicts the hypothesized pathways. By clarifying these psychosocial mechanisms in this hard-to-reach population, our purpose is to inform culturally tailored strategies addressing both individual cognition and social context, thereby enhancing PrEP uptake among pastoralist youth.

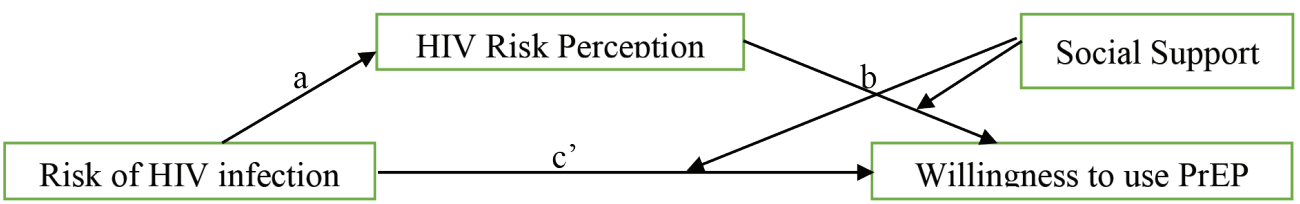

Figure 1: The hypothesized relationships of the study variables and paths (Hayes' PROCESS model 15).

Materials and Methods

Study Design and Period

This study was conducted using a community-based cross-sectional survey between April 1, 2024, and May 28, 2024. This timeframe was chosen because pastoralist communities in the study area tend to be less mobile during this period, making data collection more feasible.

Study Setting and Population

The research took place in the Hammer district, a pastoralist setting in Southern Ethiopia. Pastoralist communities here face unique challenges due to their seasonal movements with livestock. The district includes a mix of livelihoods—pastoral, semi-pastoral, and agrarian—which made it a suitable location for capturing diversity within the broader pastoralist context. From a young age, youth in these areas are involved in herding cattle, sheep, and goats across extensive semi-arid lands, which frequently impacts their ability to access healthcare services.[32]

Our study population comprised pastoralist youth residing in selected kebeles (the smallest administrative units) within the Hammer district. To be included, participants had to: (1) be 15 to 24 years old; (2) identify as part of a Hammer pastoralist community; (3) have lived in a selected kebele for at least the past six months; and (4) provide informed consent (if 18 or older) or assent with parental consent (if under 18). We excluded individuals who were too ill to participate or were not considered members of the pastoralist community.

Sample Size Calculation

The overall target sample size of 641 participants was calculated using the Statulator sample size calculator.[33] This calculation took into account several key parameters to ensure the statistical validity and reliability of our findings. We aimed for a 95% confidence level. We set a margin of error of ±5%, balancing the desire for precision with the practical constraints of data collection. Given the absence of prior studies on similar topics in this specific setting, we assumed a 50% prevalence for our outcome variable, as this maximizes the required sample size for a given level of precision. A design effect of 1.5 was incorporated into the calculation to account for the potential clustering effect inherent in our multi-stage sampling design. Finally, we included a 10% adjustment for potential non-response, anticipating that some selected individuals might refuse to participate or be unavailable for the study.

Sampling Method and Procedure

To ensure a representative sample of pastoralist youth in the Hammer district, we employed a multi-stage stratified sampling design. The Hammer district is comprised of 35 kebeles (administrative units). These kebeles were stratified into three distinct groups based on their primary livelihood type: nomadic, semi-nomadic, and agrarian. This stratification was a critical step, as it allowed us to create homogeneous subgroups within the larger population. We categorized 20 kebeles as nomadic, 10 as semi-nomadic, and 5 as agrarian based on the information we got from the district municipality. Nomadic kebeles are characterized by the constant movement of people and their livestock in search of pasture and water resources. Semi-nomadic kebeles involve seasonal movement, with partial settlement during certain periods of the year, often dictated by agricultural cycles or access to resources. Agrarian kebeles, in contrast, primarily focus on crop cultivation, with limited reliance on livestock herding.[34] Within each of these livelihood strata, we employed a simple random sampling method, using a lottery technique, to select the specific kebeles to be included in our study.

Then, the overall sample size was proportionally allocated to each of the 13 selected kebeles based on their respective youth population sizes. To identify eligible youth within the selected kebeles, we utilized the existing family folders. These folders represent a comprehensive household registry maintained by the local health system and provide detailed demographic information about households in the

area. These family folders served as our sampling frame, providing a list of households within each selected kebele. From the list of eligible households (those containing youth aged 15–24), we employed simple random sampling to select households with eligible youth. In situations where multiple eligible youth resided within a single household, a lottery method was used to randomly select one participant, ensuring that each eligible individual had an equal chance of being included in the study.

Data Collection Methods and Procedures

Data were collected by thirteen trained enumerators and three supervisors, all fluent in the local Hamar language. Prior to fieldwork, they completed a two-day training on the questionnaire, ethical conduct, cultural sensitivity, and handling sensitive topics neutrally. We gathered data using structured questionnaires administered through face-to-face interviews. The questionnaire was initially developed in English, translated into the local language, and then back-translated by an independent expert to check for consistency. The final interviews were conducted using the local language version. Interviews were scheduled at times and places convenient for the participants to foster comfort and open dialogue. To maximize participation, data collectors often visited early in the morning before youth left for herding and in the evening upon their return. Up to three follow-up visits were made for initially unavailable respondents.

Variables and Measurements

Independent Variable: HIV Risk

To identify the participant's objective HIV risk status, we developed a composite measure using latent class analysis (LCA). LCA is a statistical technique that identifies hidden subgroups within a population based on their responses to risk indicators.[35] This approach captured the complex, interrelated nature of HIV risk beyond single HIV risk indicators. Using LCA, we identified three subgroups of HIV risk based on nine HIV risk indicators informed by literature and expert input. The risk indicators included marital status, school enrollment, mobility, HIV knowledge, healthcare access, livelihood type, gender norms (GEM Scale, $\alpha = 0.84$), monthly income, and living arrangement. Based on these, participants were categorized into three HIV risk groups—high, precarious, and low.

Dependent Variable: Willingness to Use PrEP

We measured willingness to use PrEP by presenting a hypothetical scenario where PrEP was available. Participants were then asked: "If PrEP were available to you, how likely would you be willing to use it?" Response options were straightforward: "definitely willing to use" or "definitely not willing to use."[24]

Mediator Variable: Perceived HIV Risk

Perceived HIV risk was measured by asking participants to rate their lifetime chance of getting HIV: "high chance," "small chance," or "no chance."[23]

Moderator Variable: Social Support

We measured social support using the Multidimensional Scale of Perceived Social Support (MSPSS), a widely used and validated instrument in studies involving youth, sexual health, and HIV risk.[36–38] The MSPSS includes 12 items rated on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). It assesses perceived support from three sources: family (e.g., "My family is willing to help me make decisions"), friends (e.g., "I can talk about my problems with my friends"), and community/significant others (e.g., "There is a community group that makes me feel valued"). We calculated an overall mean score, with higher scores indicating higher perceived social support. The reliability (Cronbach's alpha) for the MSPSS in our sample was excellent at 0.88.

Data Analysis

All statistical analyses were conducted using IBM SPSS version 28.0 (IBM, Armonk, New York, USA). We began with descriptive statistics (proportions for categorical data, means and standard deviations [SD] for continuous data) and bivariate correlations. Pearson's correlation was used for relationships

between continuous variables, while Spearman's rho was used when categorical variables were involved.

Subsequently, we performed mediation and moderated mediation analyses using the PROCESS macro (v4.2) for SPSS, a powerful tool developed by Andrew Hayes for testing complex models.[3] Specifically, we utilized PROCESS Model 4 to test the mediating role of perceived HIV risk and Model 15 to test the moderated mediation hypothesis involving social support. The moderated mediation analysis examined whether social support influenced the path from perceived risk to PrEP willingness. To illustrate the moderation effect, we examined the relationship at three levels of social support: low (1 SD below the mean), average (mean), and high (1 SD above the mean). We also visualized the interaction effects to show how the influence of HIV risk and perceived risk on PrEP willingness changed across different levels of social support.

To ensure the robustness of our findings, especially for the indirect effects, we employed bootstrapping with 5,000 resamples. This technique provides more reliable confidence intervals (CIs) for mediation and moderated mediation effects. We considered effects statistically significant if their 95% bootstrap CIs did not include zero.

Results

Descriptive results

Our final analysis included 638 pastoralist youth who provided complete data, achieving a high response rate of 99.5% (638/641). The participants' average age was approximately 19 years (Mean = 18.75, SD = 2.9), with a majority (61%) falling in the 15-19 age bracket. The gender distribution was fairly balanced, with 51.7% male and 48.3% female participants. Regarding perceived social support (from family, friends, and community), the average score was 3.25 (SD = 0.62). While 48.6% reported low social support, 47.2% high support, and the remaining 4.2% moderate support.

Strikingly, although latent class analysis classified nearly 40% of pastoralist youth as high HIV risk, only 3.1% perceived themselves to be at high chance of HIV acquisition—revealing a profound disconnect between objective HIV risk status and personal risk awareness. Interestingly, even with this low perceived HIV risk, a substantial proportion (40.4%) stated they would be definitely willing to use PrEP if it were available. (See Table 1)

Table 1 Frequency distribution of participant characteristics (n=638).

Variable	Frequency (%) or Mean (SD)
Age in years (Mean (SD)	18.75 (2.91)
15-19	389 (61.0)
20-24	249 (39.0)
Gender	
Male	330 (51.7)
Female	308 (48.3)
Social support mean score (SD)	3.25 (0.62)
Low social support	310 (48.6)
Medium social support	27 (4.2)
High social support	301 (47.2)
HIV risk perception	
High chance	20(3.13)
Small chance	132(20.69)
No chance	486(76.18)
Willingness to use PrEP	
Definitely willing	258 (40.4)
Definitely not willing	380 (59.6)
HIV risk status	
High-risk	253 (39.7)
Precarious-risk	268 (42.0)
Low-risk	117 (18.3)

Bivariate correlations of main variables

Our analysis of correlations revealed significant positive associations. Willingness to use PrEP was positively correlated with both HIV risk status ($r = 0.18$, $p < .01$) and perceived HIV risk ($r = 0.21$, $p < .01$). Furthermore, HIV risk status was positively correlated with perceived HIV risk ($r = 0.20$, $p < .01$), suggesting some alignment, albeit imperfect, between actual risk status and personal risk perception. Conversely, social support showed significant negative correlations with both perceived HIV risk ($r = -0.10$, $p < .01$) and HIV risk status ($r = -0.11$, $p < .01$). This indicates that youth with higher social support tended to have both lower risk status and lower perceived risk. Notably, there was no significant direct correlation between social support and willingness to use PrEP ($r = 0.02$, $p = .63$). (See Table 2)

Table 2 Bivariate correlations

	1	2	3	4
1) Willingness to use PrEP	-			
2) HIV risk	0.18**	-		
3) HIV risk perception	0.21**	0.20**	-	
4) Social Support	0.02	-0.11**	-0.10**	-

Note: *p < .05; **p < .01; aCorrelations between PrEP interest and risk subgroup membership with other variables were conducted using Spearman's rho. Correlations between all other variables were conducted using Pearson's r.

Mediation effect analysis

We tested a mediation model (Hayes' PROCESS model 4) where perceived HIV risk potentially explains the relationship between HIV risk status and willingness to use PrEP. The results (Table 3) show that being in a higher HIV risk group significantly predicted higher perceived HIV risk. This was true for both the high-risk group (= 0.26, p < 0.001) and the precarious-risk group (= 0.30, p < 0.001), compared to the low-risk group. In turn, higher perceived HIV risk significantly predicted greater willingness to use PrEP, again for both the high-risk group (β = 0.81, p < 0.001) and the precarious-risk group (β = 0.85, p < 0.001).

Examining the direct effect, we found that being in the high-risk group had a significant direct positive effect on willingness to use PrEP (direct effect = 0.92, p < 0.001), even after accounting for perceived risk. However, the direct effect of being in the precarious-risk group on PrEP willingness was not statistically significant (direct effect = 0.33, p = 0.20).

Crucially, the indirect effect of HIV risk on PrEP willingness through perceived HIV risk was significant for both the high-risk group (indirect effect = 0.20, 95% CI: 0.10, 0.35) and the precarious-risk group (indirect effect = 0.23, 95% CI: 0.13, 0.35). These results confirm that perceived HIV risk acts as a mediator. For high-risk individuals, their elevated risk influences PrEP willingness both directly and indirectly through increased risk perception. For those in the precarious-risk group, the link to PrEP willingness operates primarily indirectly – their HIV risk status increases their perceived risk, which then increases their willingness to use PrEP.

Table 3: Mediation Model Estimates (Hayes' PROCESS Model 4) (n = 638).

HIV risk	a (HIV risk→ HIV risk perception)	b (HIV risk perception → PrEP willingness)	c' (HIV risk→ PrEPwillingness)	Mediated effect
	Estimate	Estimate	Estimate	Estimate (95% CI)
Precarious risk	0. 30 ***	0.85 ***	0.33	0.23 (0.13, 0.35)
High risk	0.26 ***	0.81 ***	0.92 ***	0.20 (0.10, 0.35)

Note: CI, 95% confidence interval; result controlled for age and sex; *p < 0.05, **p < 0.01, ***p<0.001.

Moderated mediation effect analysis

We then tested a moderated mediation model (Hayes' PROCESS model 15) to see if social support influenced the relationships found above, specifically the link between perceived risk and PrEP willingness (path b) and the direct link between objective risk and PrEP willingness (path c'). The analysis revealed a significant interaction effect: social support moderated the impact of perceived HIV risk on PrEP willingness (interaction = 0.70, p = 0.01). Social support also moderated the direct effect of being in the high-risk group on PrEP willingness (interaction = 1.12, p < 0.01).

The moderated mediation results (Table 4) further clarified this. Using the index of moderated mediation, we quantified the extent to which the size of the indirect effect (mediation) depends on the level of a moderator variable. The overall index of moderated mediation was significant for both the high-risk group (index = 0.21, 95% Boot CI: 0.03 to 0.43) and the precarious-risk group (index = 0.18, 95% Boot CI: 0.03 to 0.40). Since zero is not included in these confidence intervals, it confirms that social support significantly alters the strength of the indirect effect (mediation) of perceived HIV risk.

Looking at the conditional indirect effects provides more detail. For the high-risk group, the mediating effect of perceived risk was strongest among those with high social support (1 SD above mean; effect = 0.40, 95% Boot CI = 0.22, 0.65) and weaker, though still significant, among those with low social support (1 SD below mean; effect = 0.14, 95% Boot CI = 0.01, 0.28). A similar pattern emerged for the precarious-risk group: the positive influence of perceived risk on PrEP willingness was amplified at higher levels of social support. Figure 2 visually confirms these patterns, illustrating that as social support increases, the pathway from HIV risk status through perceived risk to PrEP willingness becomes stronger for both high-risk and precarious-risk youth.

Table 4: Moderated Mediation Model Estimates (Hayes' PROCESS Model 15) (n = 638)

	Willingness to use PrEP	
	Precarious risk group	**High-risk group**
Conditional direct effects	**Effect**	**Effect**
Low social support	1.16**	1.63***
Medium social support	0.47	1.12***
High social support	-0.22	0.61
Conditional indirect effects	**Effect (95% CI (Boot))**	**Effect (95% CI (Boot))**
Low social support	0.14 (0.01, 0.28)	0.12 (0.01, 0.27)
Medium social support	0.27 (0.015, 0.42)	0.23 (0.11, 0.40)
High social support	0.40 (0.22, 0.65)	0.35 (0.16, 0.62)
Index of moderated mediation	**Index (95% CI (Boot))**	**Index (95% CI(Boot))**
Social support	0.21 (0.03, 0.43)	0.18 (0.03, 0.40)

Note: Medium social support is indicated by the mean, while low social support is one standard deviation below the mean, and high social support is the maximum value 1; CI, 95% confidence interval; Boot, Bootstrap sample size = 5,000; Results controlled for age and sex; *p < 0.05, **p < 0.01, ***p<0.001.

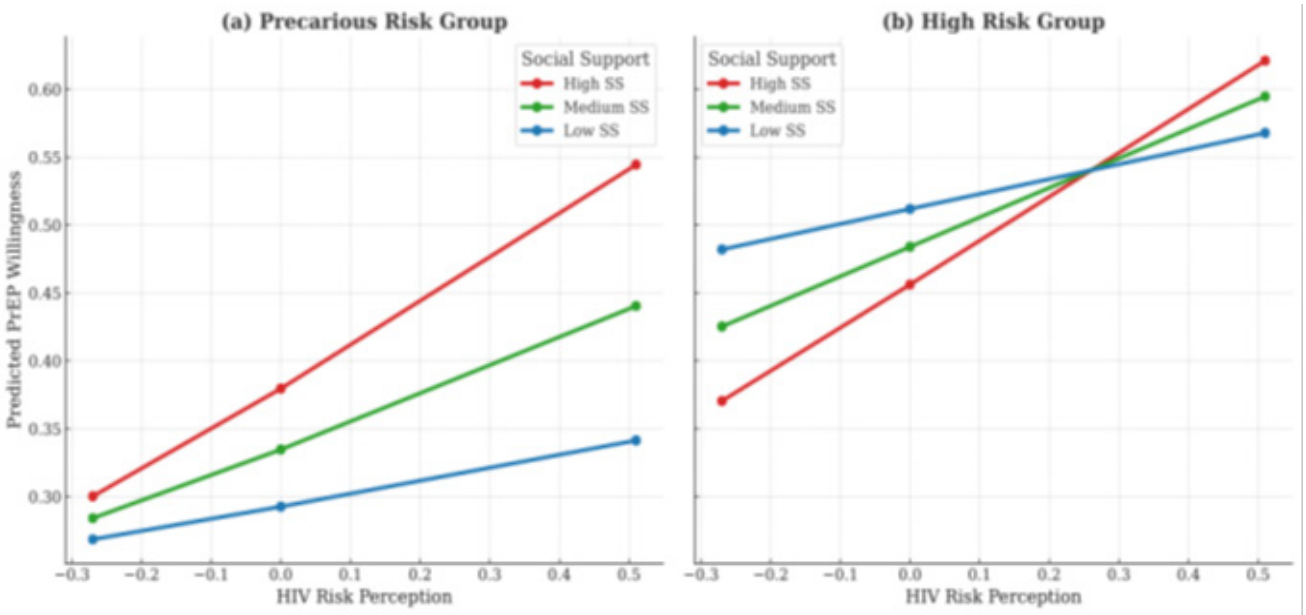

Figure 2: Predicted PrEP willingness as a function of HIV risk perception at different levels of social support in the precarious risk group (a) and high-risk group (b) of pastoralist youth in southern Ethiopia, 2024.

Note: Social support levels are defined as low ss (1 SD below the mean), medium ss (mean), and high ss (1 SD above the mean).

Discussion

This research assessed the factors influencing PrEP willingness among pastoralist youth in Southern Ethiopia, focusing on perceived HIV risk and social support. Our key findings indicate that a considerable portion (40.4%) of these young people expressed willingness to use PrEP. Those objectively classified as having higher HIV risk were indeed more inclined to consider PrEP, and this link was partly channeled through their personal perception of risk. Importantly, social support emerged as a crucial amplifier: higher levels of support strengthened the connection between perceived risk and the willingness to use PrEP. Youth with strong social networks were better able to translate their sense of risk into a readiness for prevention.

The finding that 40.4% of pastoralist youth are willing to use PrEP is significant, especially given the known difficulties in connecting marginalized groups like pastoralists with formal health services.[7] This level of willingness surpasses reports from youth studies in Kisumu, Kenya (30%)[40] and among Black and Latino youth in the US (22%).[22] However, it falls short of willingness levels seen in other African contexts, such as Uganda (86.4%)[24], South Africa (49%)[41], and Nigeria (50.2%).[21] These variations likely stem from differences in study populations and settings; many comparison studies occurred in urban areas. The unique challenges faced by Southern Ethiopian pastoralists, including limited healthcare access and information flow, must be considered. Despite these hurdles and the fact that very few (3.1%) participants perceived themselves as high risk, the expressed willingness suggests a latent demand for PrEP. With tailored information, culturally attuned messaging, and improved service access, PrEP uptake could potentially increase significantly among this population.

Our study revealed that being in the high HIV risk group directly boosted PrEP willingness, but this direct link wasn't seen for the precarious-risk group. This distinction underscores how different levels of objective risk translate into prevention interest. High-risk individuals seem more directly receptive, possibly because existing (though limited) interventions might already target them, raising awareness about risk and prevention options like PrEP, thus directly influencing willingness.[23] Those in the precarious-risk category, however, might not feel the same urgency or awareness. Reaching

them likely requires different strategies, focusing on enhancing their understanding of personal risk and PrEP's benefits. Personalized or community-anchored approaches could prove particularly effective for this group.[42]

We identified perceived HIV risk as a key mediator connecting objective risk status to PrEP willingness. This means that being at higher objective risk influences PrEP willingness partly because it increases an individual's feeling of being at risk. This aligns well with findings from other studies highlighting the critical role of risk perception in driving HIV prevention behaviors.[24,25,43–45] Research by Hill et al. (2019) similarly found perceived risk partially mediated the link between objective risk and PrEP interest. The fact that this mediation occurred for both high-risk and precarious-risk youth suggests it's a fundamental psychological pathway. Interventions aimed at improving accurate risk perception could therefore be valuable in motivating PrEP consideration across different risk levels.[23,45]

A crucial finding was the moderating role of social support. The positive relationship between perceived risk and PrEP willingness was significantly stronger for youth reporting higher social support. Essentially, having supportive family, friends, or community members helped youth convert their awareness of risk into a concrete willingness to adopt PrEP. This resonates with the Stress-Buffering Hypothesis,[46] which suggests social connections can cushion the negative effects of stressors (like perceived health threats) on well-being and behavior. Social support might alleviate the anxiety linked to acknowledging HIV risk, empowering individuals to take proactive preventive steps.[47] Given the strong community bonds in pastoralist societies, leveraging these existing social networks seems a promising strategy. Interventions that engage community leaders, peers, and families to endorse and support PrEP use could effectively enhance willingness by bolstering accurate risk perception and providing encouragement.

While offering valuable insights, this study has limitations that require cautious interpretation. First, PrEP was not available in the study area during data collection, and awareness was low. Responses about willingness were therefore hypothetical and might underestimate actual uptake if PrEP were readily accessible. We believe this lack of real-world experience likely made participants more conservative in their responses. Although we provided standardized PrEP explanations to mitigate misinterpretation, the lack of direct experience limits the generalizability of our findings to settings where PrEP is accessible. Second, self-reported PrEP willingness and risk perception could be subject to social desirability bias, where participants give answers they deem more acceptable. We stressed confidentiality and the absence of "right" or "wrong" answers to minimize this, but it cannot be entirely eliminated. Third, we measured perceived HIV risk with a single-item question, which, while straightforward, may insufficiently capture the multidimensional nature of risk perception. This may have influenced our mediation results, potentially underestimating or oversimplifying the psychological processes linking HIV risk status and PrEP willingness. Future research should employ multi-item, validated scales to more fully characterize perceived risk. Finally, the cross-sectional design allows us to identify associations but not establish causality. We can see relationships between risk, perception, support, and willingness, but we cannot definitively say which causes which.

Conclusions and Recommendations

Our findings demonstrate that HIV risk status significantly predicts PrEP willingness, and that this effect is partially mediated by perceived HIV risk—youth who recognize their HIV risk show greater willingness to use PrEP. Moreover, strong social support further amplifies this pathway, enabling risk-aware youth to act on their willingness to use PrEP.

Based on these findings, we recommend a two-pronged HIV prevention approach for pastoralist youth that addresses both individual risk perception

and social context. First, targeted education should provide clear, culturally relevant information on HIV transmission and PrEP, linking specific behaviors to risk to support accurate self-assessment. Second, programs should strengthen existing social support systems by engaging community figures—such as elders, peer educators, and family members—to foster environments that promote PrEP uptake. Future research should use longitudinal designs to track PrEP initiation and adherence.

Acknowledgements
We sincerely thank the young pastoralist participants (ages 15–24) for their valuable insights, and the Hammer District Health Office for their support and ensuring our team's safety. Special thanks to Mr. Aklilu Defaru.

Author Contributions
All authors contributed equally to the conception and design of the study, data acquisition, analysis, and interpretation.

Funding
This research was supported by Arba Minch University under Grant number GOV/AMU/PhDMast/TH3/CMHS/PH/RCO/04/15.

Ethical approval
Ethical approval for this study was granted by the Institutional Ethical Review Board (IRB) of Arba Minch University (Protocol Number: SH23137, Ref No: IRB/23137/2024). The consent process involved multiple stakeholders. Verbal informed consent was first obtained from district and village administrators. For participants aged 18 and older, written informed consent was collected directly. For participants under 18, both parental or guardian consent and the adolescent's assent were obtained to ethical protocols for minors.

Conflict of Interest
The authors declare no conflicts of interest. The funders of the study had no role in the study's design, data collection, analysis, manuscript preparation, or the decision to publish.

Data Availability Statement
The data that support the findings of this study are available from the corresponding author upon reasonable request by qualified researchers.

Correspondent Author: Sultan Hussen Hebo,
E-mail: Sultanhussn@gmail.com,
m.spigt@maastrichtuniversity.nl (Mark Spigt),
francine.schneider@maastrichtuniversity.nl
(Francine Schneider)
Phone: +251-933-53-95-05

REFERENCES

1. World Health Organization. HIV [Internet]. Geneva: WHO; 2025 [cited 2025 Jun 15]. Available from: https://www.who.int/news-room/fact-sheets/detail/hiv-aids
2. UNICEF. Adolescent HIV prevention [Internet]. New York: UNICEF; 2025 [cited 2023 Jun 11]. Available from: https://data.unicef.org/topic/hivaids/adolescents-young-people/
3. The Partnership for Maternal, Newborn & Child Health. As world marks arrival of 8 Billionth citizen, the largest ever generation of youth call for change [press release] [Internet]. Geneva: PMNCH; 2022 Nov 18 [cited 2025 Jun 10]. Available from: https://pmnch.who.int/news-and-events/news/item/18-11-2022-as-world-marks-arrival-of-8-billionth-citizen-the-largest-ever-generation-of-youth-call-for-change
4. UNAIDS. The path that ends AIDS: UNAIDS global AIDS update 2023 [Internet]. Geneva: UNAIDS; 2023 [cited 2025 Jan 19]. Available from: https://www.unaids.org/en/resources/documents/2023/global-aids-update-2023
5. Cowden RG, Tucker LA, Govender K. Conceptual pathways to HIV risk in Eastern and Southern Africa. In: Govender K, Poku NK, editors. Preventing HIV among young people in southern and eastern Africa. London: Routledge; 2020. p. 31-47.
6. Federal HIV/AIDS Prevention and Control Office. Gender-transformative HIV response for Ethiopia: addressing strategic interests and specific needs [Internet]. Addis Ababa: FHAPCO; 2021 [cited 2025 Jun 20]. Available from: https://africa.unwomen.org/sites/default/files/2022-02/gender%20transformative%20hiv%20response%20for%20ethiopia.pdf
7. Zepro NB, Ali NT, Tarr N, Medhanyie AA, Paris DH, Probst-Hensch N, et al. Sexual and reproductive health services use among adolescents in pastoralist settings, northeastern Ethiopia. BMC Health Serv Res. 2023;23(1):677.
8. Gammino VM, Diaz MR, Pallas SW, Greenleaf AR, Kurnit MR. Health services uptake among nomadic pastoralist populations in Africa: a systematic review of the literature. PLoS Negl Trop Dis. 2020;14(7):e0008474.
9. Zinsstag J, Ould Taleb M, Craig PS. Health of nomadic pastoralists: new approaches towards equity effectiveness. Trop Med Int Health. 2006;11(5):565-8.
10. Jumare J, Habib AG, Gebi U, Zoakah A, Dakum P, Farley J, et al. Migration, pastoralists, HIV infection and access to care: the nomadic Fulani of Northern Nigeria. J Acquir Immune Defic Syndr. 2009;51(2):251.
11. Owens DK, Davidson KW, Krist AH, Barry MJ, Cabana M, Caughey AB, et al. Preexposure prophylaxis for the prevention of HIV infection: US Preventive Services Task Force recommendation statement. JAMA. 2019;321(22):2203-13.
12. World Health Organization. Pre-exposure prophylaxis (PrEP) [Internet]. Geneva: WHO; 2023 [cited 2025 Feb 1]. Available from: https://www.who.int/teams/global-hiv-hepatitis-and-stis-programmes/hiv/prevention/pre-exposure-prophylaxis
13. Baeten JM, Donnell D, Ndase P, Mugo NR, Campbell JD, Wangisi J, et al. Antiretroviral prophylaxis for HIV prevention in heterosexual men and women. N Engl J Med. 2012;367(5):399-410.
14. Thigpen MC, Kebaabetswe PM, Paxton LA, Smith DK, Rose CE, Segolodi TM, et al. Antiretroviral preexposure prophylaxis for heterosexual HIV transmission in Botswana. N Engl J Med. 2012;367(5):423-34.
15. Centers for Disease Control and Prevention. Pre-exposure prophylaxis (PrEP) [Internet]. Atlanta: CDC; 2022 [cited 2025 Jan 9]. Available from: https://www.cdc.gov/hiv/risk/prep/index.html
16. Ferrer L, Folch C, Fernandez-Davila P, Garcia A, Morales A, Belda J, et al. Awareness of pre-exposure prophylaxis for HIV, willingness to use it and potential barriers or facilitators to uptake among men who have sex with men in Spain. AIDS Behav. 2016;20:1423-33.
17. Gordián-Arroyo A, Garofalo R, Kuhns LM, Pearson C, Bruce J, Batey DS, et al. Awareness, willingness, and perceived efficacy of Pre-exposure Prophylaxis among adolescent sexual minority males. J Urban Health. 2020;97:749-57.
18. Holloway IW, Tan D, Gildner JL, Beougher SC, Pulsipher C, Montoya JA, et al. Facilitators and barriers to pre-exposure prophylaxis willingness among young men who have sex with men who use geosocial networking applications in California. AIDS Patient Care STDS. 2017;31(12):517-27.
19. Lee YC, Chang SY, Lin KY, Chang LH, Liu WC, Wu CH, et al. Awareness and willingness towards pre-exposure prophylaxis against HIV infection among individuals seeking voluntary counselling and testing for HIV in Taiwan: a cross-sectional questionnaire survey. BMJ Open. 2017;7(10):e015142.
20. Peng L, Cao W, Gu J, Hao C, Li J, Wei D, et al. Willingness to use and adhere to HIV pre-exposure prophylaxis (PrEP) among men who have sex with men (MSM) in China. Int J Environ Res Public Health. 2019;16(14):2620.
21. Gbaja-Biamila T, Obiezu-Umeh C, Nwaozuru U, Rosenberg NE, Igbokwe M, Oladele D, et al. Awareness of, willingness to use, and experiences with Pre-exposure prophylaxis among youth in Nigeria. BMC Health Serv Res. 2024;24(1):1-10.

22. Taggart T, Liang Y, Pina P, Albritton T. Awareness of and willingness to use PrEP among Black and Latinx adolescents residing in higher prevalence areas in the United States. PLoS One. 2020;15(7):e0234821.
23. Hill LM, Maseko B, Chagomerana M, Hosseinipour MC, Bekker LG, Pettifor A, et al. HIV risk, risk perception, and PrEP interest among adolescent girls and young women in Lilongwe, Malawi: operationalizing the PrEP cascade. J Int AIDS Soc. 2020;23:e25502.
24. Agwang W, Nangendo J, Nabikande S, Okello T, Tusabe J, Semitala FC, et al. Factors associated with willingness to take Pre-Exposure Prophylaxis (PrEP) among high-risk adolescent boys and young men in Masese fishing community, Uganda. PLOS Glob Public Health. 2023;3(6):e0001191.
25. Serbessa MK. Vulnerability to HIV infection among the Borana pastoral community of Southern Ethiopia: a persisting challenge. HIV AIDS (Auckl). 2019; 11:69–76.
26. Qiao S, Li X, Stanton B. Social support and HIV-related risk behaviors: a systematic review of the global literature. AIDS Behav. 2014;18:419-41.
27. Warzywoda S, Fowler JA, Dyda A, Fitzgerald L, Mullens AB, Dean JA. Pre-exposure prophylaxis access, uptake and usage by young people: a systematic review of barriers and facilitators. Ther Adv Infect Dis. 2024;11:20499361241303415.
28. Chen-Charles J, Davey DJ, Toska E, Seeley J, Bekker LG. PrEP Uptake and Utilisation Among Adolescent Girls and Young Women in Sub-Saharan Africa: A Scoping Review. AIDS Behav. 2025 Feb 28:1-21.
29. Parcesepe AM, Filiatreau LM, Gomez A, Ebasone PV, Dzudie A, Pence BW, et al. HIV-related stigma, social support, and symptoms of mental health disorders among people with HIV initiating HIV care in Cameroon. AIDS Patient Care STDS. 2023;37(3):146-54.
30. Ngadaya E, Kimaro G, Kahwa A, Mnyambwa NP, Shemaghembe E, Mwenyeheri T, et al. Knowledge, awareness and use of HIV services among the youth from nomadic and agricultural communities in Tanzania. 2021;11(2):69-74.
31. Yazew BT, Kassa G. Social structure and clan group networks of Afar pastorals along the Lower Awash Valley. Humanit Soc Sci Commun. 2024;11:1-20.
32. Alemneh A, Alemu A. Pastoralism and conflict transformation in Nyangatom, hammer, and dassanech community of Ethiopia. J Soc Transform Reg Dev. 2023;5(2).
33. Dhand NK, Khatkar MS. Statulator: an online statistical calculator [Internet]. 2014 [cited 2024 Jan 2]. Available from: https://statulator.com/SampleSize/ss1P.html
34. Little MA. Pastoralism. In: Muehlenbein MP, editor. Basics in human evolution. London: Academic Press; 2015. p. 337-47.
35. Raykov T, Harrison M, Marcoulides GA. Examining class separation contribution by observed indicators in latent class models: A multiple testing procedure. Struct Equ Modeling. 2019;27(1):88-96.
36. Zimet GD, Dahlem NW, Zimet SG, Farley GK. The multidimensional scale of perceived social support. J Pers Assess. 1988;52(1):30-41.
37. Zakiei A, Norouzi E, Ghasemi SR, Komasi S, Rostampour M, Khazaie H. Controlling risky behavior associated with AIDS: the role of social support, family functioning, self-efficacy and AIDS risk perception. BMC Psychol. 2022;10(1):132.
38. Banstola RS, Ogino T, Inoue S. Self-esteem, perceived social support, social capital, and risk-behavior among urban high school adolescents in Nepal. SSM Popul Health. 2020;11:100570.
39. Hayes AF. Introduction to mediation, moderation, and conditional process analysis: A regression-based approach. New York: Guilford Publications; 2017.
40. Ngere SH, Aduda DO, Nyambuga CO, Oduor PA, Awuoche HA, Nyanjom MA, et al. Exposure and predictors of intention to use HIV pre-exposure prophylaxis (PrEP) among adolescent girls and young women: assessment of Jipende JiPrEP campaign in Kisumu, Kenya. PAMJ One Health. 2021;4(3).
41. Shamu S, Shamu P, Khupakonke S, Farirai T, Chidarikire T, Guloba G, et al. Pre-exposure prophylaxis (PrEP) awareness, attitudes and uptake willingness among young people: gender differences and associated factors in two South African districts. Glob Health Action. 2021;14(1):1886455.
42. Eisingerich AB, Wheelock A, Gomez GB, Garnett GP, Dybul MR, Piot PK. Attitudes and acceptance of oral and parenteral HIV preexposure prophylaxis among potential user groups: a multinational study. PLoS One. 2012;7(1):e28238.
43. Peng P, Su S, Fairley CK, Chu M, Jiang S, Zhuang X, et al. A global estimate of the acceptability of pre-exposure prophylaxis for HIV among men who have sex with men: a systematic review and meta-analysis. AIDS Behav. 2018;22:1063-74.
44. Rankin KA. Is Risk Compensation Real? The Effect of Perceived Level of HIV Acquisition on Risk Behavior in a Pilot Pre-exposure Prophylaxis Demonstration Project in Men Who Have Sex with Men in Malaysia [dissertation]. New Haven (CT): Yale University; 2023.
45. Krajewski T, LeMasters KH, Oser CB, Brinkley-Rubinstein L. Perceived versus actual HIV risk among PrEP indicated persons with criminal legal involvement. AIDS Care. 2024:1-10.

46. Cohen S, Wills TA. Stress, social support, and the buffering hypothesis. Psychol Bull. 1985;98(2):310-57.
47. Uchino BN. Social support and health: A review of physiological processes potentially underlying links to disease outcomes. J Behav Med. 2006;29(4):377-87.