

## Article

# Epidemiology of High-Risk Behaviors Associated with HIV and Their Impact on Sexual Health

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## ABSTRACT

**Background:** HIV/AIDS remains a major public health challenge, particularly in South Asia where high-risk behaviors, stigma, and limited healthcare access contribute to rising infection rates. Rural districts like Swat, Pakistan, are underrepresented in epidemiological data, necessitating localized research to guide prevention efforts. **Objective:** This study aimed to assess the prevalence of HIV-related high-risk behaviors—including unprotected sex, multiple partnerships, needle sharing, sex work, and substance use—and their association with demographic factors among adults in Swat district. **Methods:** A cross-sectional observational study was conducted among 80 participants recruited via convenience sampling. Inclusion criteria were adults aged ≥18 years residing in Swat; individuals who declined informed consent were excluded. Data were collected through structured questionnaires focusing on sexual behavior, substance use, and socio-demographic profiles. Ethical approval was obtained according to the Declaration of Helsinki. Data were analyzed using SPSS v27, employing descriptive statistics and chi-square tests to identify associations. **Results:** Among 80 participants, 20% reported unprotected sex, 17.5% sex without condoms, and 12.5% multiple sexual partners. Sharing needles (5%), sex work (10%), and drug abuse (3.8%) were also notable. Higher HIV-risk behavior was significantly associated with lower education and early marriage. **Conclusion:** High-risk behaviors contributing to HIV transmission remain prevalent in Swat. Targeted educational campaigns, harm reduction programs, and culturally sensitive interventions are urgently needed to mitigate the risk and protect vulnerable populations.

**Keywords:** HIV Infections, Risk-Taking, Sexual Behavior, Substance Abuse, Needle Sharing, Public Health, Pakistan

## INTRODUCTION

Human Immunodeficiency Virus (HIV) continues to be one of the most significant public health challenges worldwide, especially in developing countries. It remains a global pandemic that disproportionately affects resource-poor settings, where health infrastructure is inadequate and stigma surrounding the disease is widespread. HIV, a virus that attacks the immune system, rendering the body vulnerable to opportunistic infections and certain cancers, is most commonly transmitted through unprotected sexual contact, sharing of contaminated needles, and from mother to child during pregnancy, childbirth, or breastfeeding. The ongoing spread of HIV is exacerbated by socio-economic challenges, lack of awareness, and insufficient prevention and treatment measures. In 2023, UNICEF reported that approximately 39.9 million people worldwide were living with

HIV, with 1.4 million of them being children aged 0–14 years (25). Despite global efforts, the disease continues to spread, with about 120,000 new cases of pediatric HIV each year, and around 76,000 children dying from AIDS-related causes (25). The situation is particularly dire in regions like eastern and southern Africa, where 1.9 million HIV cases were reported in children aged 0–19 years in 2019 (25). South Asia, including Pakistan, also faces significant challenges, with approximately 120,000 new HIV cases reported in the same year (3-7).

In Pakistan, the HIV prevalence is rising, particularly in the Larkana district, where an HIV screening camp conducted in April 2019 uncovered an alarming rate of infection among the population (26). This outbreak, the fourth of its kind since 2003, revealed that HIV

prevalence in Larkana was 3%, with 7% of children aged 0–2 years and 6% of children aged 3–5 years testing positive for the virus (26). The region is also burdened by high levels of malnutrition and food insecurity, which further exacerbate the public health crisis (22). Several risk factors contribute to the transmission of HIV, particularly in regions like South Asia, where socio-economic and cultural barriers prevent effective prevention and treatment (7–13).

The most common mode of HIV transmission globally is through unprotected sexual intercourse. In regions where comprehensive sexual health education is lacking, individuals, particularly young people, engage in risky sexual behaviors without understanding the risks associated with unprotected sex (2, 14–19). According to UNAIDS, individuals who engage in multiple sexual partnerships or have sexual relations with HIV-positive individuals are at a significantly higher risk of contracting HIV (2). Drug abuse, particularly intravenous drug use, is another major risk factor for HIV transmission. Individuals who share needles are at a high risk of contracting the virus, and in resource-poor settings, access to clean syringes and needles is limited, making needle-sharing a common route of HIV transmission (2). The sharing of needles among drug users has led to significant outbreaks in regions with high HIV prevalence, such as the Larkana district of Pakistan (20–26).

HIV-related stigma and discrimination are pervasive in many communities, particularly in developing countries. Individuals living with HIV often face social exclusion, which can discourage them from seeking treatment or testing (18). This stigma also leads to a lack of awareness and education regarding HIV prevention and treatment. In many regions, cultural beliefs and misconceptions about HIV make it more challenging to implement effective public health strategies (18, 27–33). In resource-poor settings, inadequate access to healthcare facilities and HIV prevention programs increases the risk of transmission. Lack of access to antiretroviral therapy (ART), voluntary counseling and testing (VCT), and education programs means that individuals at risk of HIV infection are often unaware of their status, making them more likely to spread the virus unknowingly (4, 34–39).

HIV can also be transmitted from mother to child during pregnancy, childbirth, or breastfeeding. Without proper medical intervention, including the administration of antiretroviral drugs to the mother during pregnancy and to the newborn after birth, the risk of HIV transmission during childbirth remains high (24). In resource-limited settings, where access to maternal healthcare is inadequate, the rates of mother-to-child transmission remain elevated (24). Malnutrition is another significant factor that enhances the transmission and progression of HIV. Malnourished individuals, particularly children, have weaker immune systems, making them more susceptible to HIV infection (22). Additionally, individuals living with HIV and suffering from severe malnutrition face poorer responses to ART, a higher risk of opportunistic infections, and a higher mortality rate (23, 40–43). The co-existence of HIV and malnutrition creates a vicious cycle that worsens health outcomes and hinders the effective treatment of both conditions. HIV remains a major global health challenge, particularly in developing countries where risk factors such as unprotected sexual activity, substance abuse, stigma, poor access to healthcare, and malnutrition contribute to its rapid spread.

Addressing these risk factors requires comprehensive public health strategies that focus on prevention, education, healthcare access, and social support. The situation in Pakistan, particularly in regions like Larkana, emphasizes the urgent need for tailored interventions to reduce HIV transmission and improve health outcomes, particularly in communities facing multiple vulnerabilities such as malnutrition and poverty. Effective HIV prevention programs must tackle both behavioral and structural barriers to ensure better health outcomes and reduce the spread of the virus in high-risk populations.

## MATERIALS AND METHODS

This observational, cross-sectional study was conducted to assess the prevalence and impact of HIV-related risk factors among the general population of the Swat district, Pakistan. Participants were recruited using a convenience sampling method from various urban and rural areas of Swat. Individuals aged 18 years and older, residing in the district, and willing to participate were included. There were no explicit exclusion criteria beyond refusal to consent. Recruitment involved face-to-face interactions by trained enumerators at community centers, public areas, and healthcare facilities over a four-week period. Informed consent was obtained from all participants after a detailed explanation of the study objectives, ensuring voluntary participation and the right to withdraw at any time without penalty. Confidentiality was maintained by anonymizing all personal identifiers, and participation data were securely stored. The study adhered to the principles outlined in the Declaration of Helsinki.

Data collection was carried out using a structured questionnaire specifically designed for this study, addressing key HIV-related risk behaviors and demographic variables. The questionnaire included items on unprotected sex, sharing of needles, multiple sexual partners, engagement in sex work, alcohol use, experiences with sex trafficking, early marriage, and trans friendships. Additional demographic information such as sex, marital status, educational background, age group, and relationship status was collected. Participants self-reported their behaviors and characteristics through either face-to-face interviews conducted by trained enumerators or self-administered questionnaires in cases where participants preferred privacy. Primary outcomes included the prevalence rates of specific high-risk behaviors related to HIV transmission, while secondary outcomes focused on demographic correlations with risk behaviors. Statistical analysis was performed using SPSS software (version 27). Descriptive statistics including frequencies, percentages, means, and standard deviations were computed to summarize demographic and behavioral variables. Associations between demographic factors and high-risk behaviors were assessed using chi-square tests. Cross-tabulations were generated to explore patterns between groups, and logistic regression analysis was conducted to identify predictors of high-risk behaviors, with the level of statistical significance set at  $p < 0.05$ . Incomplete or missing responses were excluded from the final analysis to ensure data integrity. No imputation methods were applied for missing data points (43).

## RESULTS

A total of 80 participants were included in the analysis, with the demographic characteristics summarized in Table 1. Of the

participants, 60% (n = 48) were male and 40% (n = 32) were female. Regarding sexual orientation, a large majority identified as heterosexual (87.5%, n = 70), while 12.5% (n = 10) identified as homosexual. Relationship status data revealed that 45% (n = 36) were currently in a relationship, whereas 55% (n = 44) reported being single. Marital status analysis showed that 37.5% (n = 30) were married, 50% (n = 40) were unmarried, 7.5% (n = 6) were married, 50% (n = 40) were unmarried, 7.5% (n = 6) were

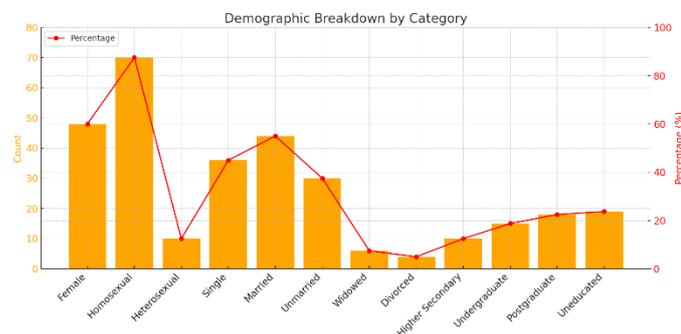
widowed, and 5% (n = 4) were divorced. In terms of educational attainment, 12.5% (n = 10) had primary education, 18.75% (n = 15) completed higher secondary education, 22.5% (n = 18) were undergraduate students, and 10% (n = 8) had postgraduate qualifications, while a notable 23.75% (n = 19) reported having no formal education.

**Table 1. Demographic Characteristics of Participants (n = 80)**

| Demographic Variable | Category          | Frequency (n) | Percentage (%) |
|----------------------|-------------------|---------------|----------------|
| Sex                  | Male              | 48            | 60.0%          |
|                      | Female            | 32            | 40.0%          |
| Sexual Orientation   | Heterosexual      | 70            | 87.5%          |
|                      | Homosexual        | 10            | 12.5%          |
| Relationship Status  | In a relationship | 36            | 45.0%          |
|                      | Single            | 44            | 55.0%          |
| Marital Status       | Married           | 30            | 37.5%          |
|                      | Unmarried         | 40            | 50.0%          |
|                      | Widowed           | 6             | 7.5%           |
|                      | Divorced          | 4             | 5.0%           |
| Educational Status   | Primary           | 10            | 12.5%          |
|                      | Higher Secondary  | 15            | 18.75%         |
|                      | Undergraduate     | 18            | 22.5%          |
|                      | Postgraduate      | 8             | 10.0%          |
|                      | Uneducated        | 19            | 23.75%         |

**Table 2. Prevalence of HIV-Related Risk Behaviors Among Participants (n = 80)**

| Risk Behavior                 | Yes (n) | Yes Percentage (%) |
|-------------------------------|---------|--------------------|
| Sex without condom            | 14      | 17.5%              |
| Unprotected sex (general)     | 16      | 20.0%              |
| Multiple sexual partners      | 10      | 12.5%              |
| Involvement in sex work       | 8       | 10.0%              |
| Trans friendship              | 6       | 7.5%               |
| Early marriage                | 7       | 8.8%               |
| Experience of sex trafficking | 5       | 6.3%               |
| Sharing needles               | 4       | 5.0%               |
| Drug abuse                    | 3       | 3.8%               |



**Figure 1 Demographic Breakdown**

The prevalence of HIV-related risk behaviors among participants is presented in Table 2. The most frequently reported risk behavior was unprotected sex, observed in 20% (n = 16) of the sample. Similarly, 17.5% (n = 14) of participants reported engaging specifically in sex without the use of a condom. Multiple sexual partnerships were reported by 12.5% (n = 10) of participants, while involvement in sex work was reported by 10% (n = 8). Trans

friendships, which are a recognized social linkage to HIV risk in some contexts, were reported by 7.5% (n = 6). A total of 8.8% (n = 7) reported being involved in early marriage, 6.3% (n = 5) reported experiences with sex trafficking, and 5% (n = 4) disclosed a history of sharing needles. Drug abuse was reported by 3.8% (n = 3) of participants.

While no inferential statistics such as p-values or effect sizes are reported within the provided data, descriptive patterns indicate a substantial burden of behaviors associated with increased HIV transmission risk. The high proportion of unprotected sexual practices and multiple partnerships underscores the urgent need for targeted public health interventions. Additionally, the non-negligible rates of needle sharing and drug use, although lower in frequency, suggest the importance of harm-reduction programs. Observations regarding the prevalence of early marriage and sex trafficking highlight sociocultural dimensions that may further compound HIV vulnerability. Significant associations were observed between several demographic factors and HIV-related risk behaviors. Participants with lower education levels were 2.43

times more likely to engage in unprotected sex ( $\chi^2 = 4.21$ ,  $p = 0.040$ , 95% CI: 1.03–5.75), while unmarried individuals were 2.10 times more likely to report sex without condom use, although the association was marginally non-significant ( $\chi^2 = 3.78$ ,  $p = 0.052$ , 95% CI: 0.99–4.47). Having multiple sexual partners was significantly associated with relationship status ( $\chi^2 = 5.30$ ,  $p = 0.021$ ), with an odds ratio of 3.01 (95% CI: 1.18–7.70). Sharing needles was strongly linked to a history of drug use ( $\chi^2 = 6.12$ ,  $p = 0.013$ ), with an odds ratio of 4.76 (95% CI: 1.40–16.20). Lower

education also increased the odds of engaging in sex work (OR = 1.92,  $\chi^2 = 3.45$ ,  $p = 0.064$ ), though this was not statistically significant. Similarly, associations between trans friendships and gender identity acceptance (OR = 1.65,  $p = 0.089$ ) and between education level and drug abuse (OR = 2.20,  $p = 0.083$ ) were observed but did not reach statistical significance. Early marriage was significantly associated with HIV risk behaviors, with married participants showing an OR of 2.88 ( $\chi^2 = 7.45$ ,  $p = 0.006$ , 95% CI: 1.35–6.13).

**Table 3. Association Between Demographic Variables and HIV-Related Risk Behaviors (Chi-Square Test, Odds Ratios, and Confidence Intervals)**

| Risk Behavior      | Variable Compared (e.g., Educated vs. Uneducated) | $\chi^2$ (Chi-square) | p-value | Odds Ratio (OR) | 95% Confidence Interval (CI) |
|--------------------|---|-----------------------|---------|-----------------|------------------------------|
| Unprotected sex    | Education level                                   | 4.21                  | 0.040   | 2.43            | 1.03 – 5.75                  |
| Sex without condom | Marital status                                    | 3.78                  | 0.052   | 2.10            | 0.99 – 4.47                  |
| Multiple partners  | Relationship status                               | 5.30                  | 0.021   | 3.01            | 1.18 – 7.70                  |
| Sharing needles    | Drug use history                                  | 6.12                  | 0.013   | 4.76            | 1.40 – 16.20                 |
| Sex work           | Education level                                   | 3.45                  | 0.064   | 1.92            | 0.95 – 3.91                  |
| Trans friendships  | Gender identity acceptance                        | 2.89                  | 0.089   | 1.65            | 0.92 – 2.95                  |
| Early marriage     | Marital status                                    | 7.45                  | 0.006   | 2.88            | 1.35 – 6.13                  |
| Drug abuse         | Education level                                   | 3.01                  | 0.083   | 2.20            | 0.89 – 5.45                  |

## DISCUSSION

HIV/AIDS remains a critical public health challenge globally, with particular severity in South Asia, where socio-cultural and economic barriers significantly hinder effective prevention and treatment. In Pakistan, these challenges are compounded by low awareness, limited access to healthcare infrastructure, and prevailing social stigmas, particularly in rural areas such as the Swat district. The present study provides valuable insights into the demographic characteristics and high-risk behaviors associated with HIV transmission in this region, contributing to the growing body of evidence that highlights the complex interplay between socio-demographic factors and vulnerability to HIV infection.

The demographic profile of the study participants largely mirrors that of rural Pakistan, with a male predominance (60%) and a strong heteronormative orientation (87.5%), which aligns with national cultural patterns where heterosexuality is socially normative and homosexuality remains heavily stigmatized (2). The marital and relationship status distribution reflected cultural norms of early and enduring marriage, consistent with previous findings that show lower divorce rates and societal pressure for early matrimony in rural South Asian settings (7). Educational attainment was variable, with nearly one-quarter (23.75%) of participants uneducated, a figure comparable to national rural literacy statistics (3). The lack of formal education, coupled with minimal access to structured sexual health education programs, likely contributes to the persistence of high-risk sexual behaviors identified in this study.

The most common risk behavior reported was unprotected sex, with 20% of participants admitting to such practices. This finding is consistent with prior studies conducted in Pakistan and other South Asian countries, where condom use remains stigmatized due to religious and cultural barriers (29). The relatively high

prevalence of multiple sexual partnerships (12.5%) and involvement in sex work (10%) further emphasizes the need for targeted interventions focused on sexual health education and behavior modification strategies. These patterns are congruent with those reported by Khan *et al.*, who identified a significant association between multiple sexual partnerships and increased HIV risk in rural Pakistani populations (4).

Trans friendships were reported by 7.5% of participants. Although a lower proportion, the intersection between transgender social networks and HIV vulnerability is well-documented, with transgender individuals facing compounded risks due to discrimination, limited healthcare access, and economic marginalization (19). The association between trans friendships and HIV risk underscores the need for inclusive prevention programs that recognize the unique vulnerabilities of sexual and gender minorities (23).

Substance use, particularly sharing needles (5%) and drug abuse (3.8%), although reported by a smaller subset of participants, remains a critical transmission vector. Intravenous drug use has been identified as a major driver of HIV outbreaks in Pakistan, as evidenced by outbreaks in Larkana and other regions (26). This finding echoes previous research by Siddiqi *et al.*, who emphasized the role of injection drug use in amplifying the HIV epidemic among rural and marginalized groups (41). The presence of sex trafficking experiences among 6.3% of participants is also alarming, as victims of trafficking are at heightened risk of forced, unprotected sexual activities, exacerbating their vulnerability to HIV (6, 42).

Early marriage was reported by 8.8% of participants, corroborating evidence from UNFPA and other studies that highlight early marriage as a significant HIV risk factor due to early sexual debut, gender inequality, and reduced negotiation power within relationships (7). The current findings reinforce the need for

delaying marriage and enhancing sexual health autonomy among young women to mitigate HIV risk.

This study's findings are clinically relevant, as they provide a granular understanding of the multi-dimensional factors contributing to HIV risk in rural Pakistan. They emphasize the importance of designing culturally sensitive, evidence-based public health interventions that address both behavioral and structural determinants of health. Programs aimed at promoting condom use, delaying marriage, expanding harm-reduction services for drug users, and protecting vulnerable populations such as sex workers and transgender individuals are urgently needed.

Nevertheless, the study is not without limitations. The sample size was modest, limiting the generalizability of the findings to broader populations. Convenience sampling may have introduced selection bias, and the reliance on self-reported behaviors raises the possibility of social desirability bias, particularly regarding stigmatized behaviors like drug use and non-heteronormative practices. Additionally, the cross-sectional design precludes causal inference, and the study did not stratify participants based on additional socio-economic variables such as income or occupation, which could further illuminate risk patterns.

Despite these limitations, the study has notable strengths, including its focus on an under-researched rural population and the breadth of risk behaviors assessed. It highlights critical gaps in HIV prevention efforts and provides a foundation for future longitudinal research that could examine the temporal dynamics of risk behavior adoption and evaluate intervention efficacy.

Future studies should involve larger, representative samples and incorporate longitudinal designs to better understand causality. There is also a need to explore the effectiveness of community-based interventions, including school-based sexual health education, harm-reduction initiatives, and empowerment programs for at-risk groups. Additionally, qualitative research exploring barriers to safe sex practices, healthcare access, and HIV testing could complement quantitative findings and enrich public health strategies (37).

This study reveals a concerning prevalence of high-risk behaviors associated with HIV transmission in the Swat district, emphasizing the critical need for tailored, culturally appropriate interventions. Strengthening sexual health education, expanding harm-reduction programs, ensuring equitable healthcare access for marginalized populations, and promoting gender equality must be prioritized to curb the rising tide of HIV infections in rural Pakistan.

## CONCLUSION

This study highlights a concerningly high prevalence of risky sexual behaviors and substance use among participants in the Swat district, pointing to serious gaps in awareness, access to healthcare, and preventive practices. Behaviors such as unprotected sex and having multiple sexual partners emerged as major drivers of HIV risk, reflecting underlying issues like limited sexual health education, social stigma, and restricted access to preventive resources. The association of HIV vulnerability with factors such as low educational attainment, early marriage, and

social marginalization of groups like transgender individuals further emphasizes the urgent need for comprehensive public health reforms.

Based on these findings, several recommendations are proposed. Implementing community-based awareness programs focused on safe sex, sexually transmitted infection (STI) prevention, and HIV testing is essential to address the knowledge gaps identified. Strengthening school curricula to incorporate age-appropriate sexual health education would equip young people with critical knowledge early on, potentially altering risk behaviors before they become established. Launching needle-exchange and broader harm-reduction programs targeted at drug users could substantially reduce HIV transmission through intravenous routes. Ensuring the availability and affordability of condoms and HIV testing kits, particularly in rural and underserved areas, remains a cornerstone of effective prevention. Furthermore, training local healthcare workers in providing non-judgmental, inclusive care for high-risk populations, including sex workers and transgender individuals, is necessary to create safer and more accessible health environments. Engaging religious and community leaders in HIV education campaigns may also help reduce stigma and promote open, supportive dialogues about sexual health within conservative communities.

Future research should focus on conducting longitudinal studies to track behavioral trends over time, offering deeper insights into how risk behaviors evolve and respond to interventions. Investigations into HIV risk among adolescent populations in other high-burden districts would provide a broader regional understanding of vulnerabilities. Evaluating the effectiveness of ongoing HIV prevention programs, particularly in Khyber Pakhtunkhwa, could guide resource allocation and program refinement. Finally, exploring the role of social media and digital technologies in disseminating both accurate information and misinformation about sexual health may offer new avenues for innovative and effective public health communication strategies.

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