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PREVALENCE AND DETERMINATION OF RISK FACTORS OF HIV/AIDS IN QUETTA

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Abstract

HIV/AIDS is still a major public health concern, mostly now in underdeveloped regions where socio-economic and cultural issues affect the transmission of the disease and its control. Initial diagnosis and identification of risk factors are important for the effective prevention of HIV. The current study was designed to determine the HIV seroprevalence, demographic and behavioral risk factors among the participants at the HIV/AIDS Centre at Bolan Medical College, Rahat Medical Hospital, and the Regional Blood Centre Quetta. A cross-sectional study was carried out on 200 participants. Venipuncture samples were collected under aseptic conditions and examined for Immunochromatographic testing (ICT), followed by confirmatory testing by enzyme-linked immunosorbent assay (ELISA). Demographic features and risk factors data were collected over structured questionnaires. A Statistical analysis was carried out via descriptive statistics, Chi-square, and binary logistic regression tests to assess relations and indicators. Generally, the HIV seroprevalence rate was 2%, with 4 positives out of 200 samples by ICT and confirmed by ELISA. Chi-square analysis showed a significant association among gender and variables, with information on HIV spread ($p = 0.037$), HIV testing awareness ($p = 0.034$), sexual activity ($p = 0.017$), constant use of condoms ($p < 0.001$), injecting drug usage ($p = 0.042$), and multiple sexual partners ($p = 0.014$). Nonetheless, because of the relatively small number of positive cases, the outcomes from the multivariable regression analysis should be cautiously considered and cannot be used for causality. Among HIV positive participants, the risk factors were noted, including drug abuse, promiscuity, and unprotected sex, which were more common among married males; these were not found in the negative individuals. However, the presence of positive cases and behavioral risk factors underscores the ongoing risk of HIV transmission, even when the overall prevalence of HIV is low. ICT and ELISA tests showed effectiveness for HIV diagnosis. To stop the spread of HIV in the area, focused awareness campaigns, behavioral treatments, and enhanced screening techniques are crucial. Because of the cross-sectional design of the experiment and the few positive cases, it is not possible to establish any causality.

Keywords: *Antimicrobial resistance, blaCTXM, blaTEM, Balochistan, ESBL, Escherichia coli, tetA, tetB, Livestock, Zoonotic transmission*

INTRODUCTION

Human Immunodeficiency Virus (HIV) is a major public health issue worldwide, mainly in underdeveloped countries, where the occurrence of HIV is high. HIV raises the risk of opportunistic infections and several types of malignancies by targeting the immune system's CD4+ T cells, resulting in progressive immune suppression and acquired immunodeficiency syndrome (AIDS) (1). According to UNICEF 2023 reports, globally 39.9 million persons are infected with HIV and among them, 1.4 million children are between the ages of 0 and 14 (2). Similarly, UNAIDS reported in the same year that 630,000 people died from HIV, and about 1.3 million new infections occurred globally (1).

HIV continues to be most prevalent in Sub-Saharan Africa. The HIV epidemic contributes to morbidity and mortality in South Asia. With an estimated 2.1 million cases, India has the largest population of people with HIV (PLHIV). While Sri Lanka has maintained a very low national prevalence of less than 0.1% and, Nepal has about 11,000 HIV infections. Afghanistan has an estimated 1,000–2,000 (PLHIV) cases, while Bangladesh reports a prevalence of about 0.1% in the total population, or about 1,000–2,000 (PLHIV) cases (3).

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Despite considerable worldwide progress in lowering or stabilizing new cases, HIV cases in Pakistan are still on the increase. UNAIDS reports around 210,000 HIV cases in Pakistan (4). In Pakistan, the HIV epidemic mostly affects certain high-risk groups. It is predicted to be 33% among injecting drug users, 5.5% among transgender sex workers, and 3.7% among male sex workers. Fortunately, prevalence is still low, 0.6%, among female sex workers (5).

In HIV transmission, multiple factors contribute, particularly in South Asia, where socio- economic and cultural barriers limit access to effective prevention and treatment (6). HIV is most frequently spread through unprotected sexual intercourse worldwide. People, especially teenagers and young adults, are engaged sexual risk behaviors in areas with inadequate sexual health education due to limited awareness of the risks involved (7). One of the main risk factors for HIV spread is the use of intravenous drugs. Infection risks rise when sharing needles. This risk is particularly high in areas where access to clean syringes is limited (2). The virus is transmitted from the mother to the child during pregnancy, delivery, or nursing. If treatment is not received, the risk is high. Antiretroviral medications can prevent the transmission of the virus from mother to child (8).

Another risk factor for HIV transmission and disease development is malnutrition. Malnourished people and children are more susceptible due to their weak immune system. In developing countries, HIV spreads due to factors such as unprotected sex, abuse, stigma, limited healthcare access, and poor nutrition. Addressing these challenges requires public health initiatives centered on prevention, education, healthcare, and social support (1). For the purpose of identifying the level of HIV infection in the people, the present study attempts to evaluate the HIV/AIDS prevalence among a subset of subclinical people. The objective of this study was also to identify the risk factors contributing to the spread of HIV.

Quetta, which serves as the capital of Balochistan, is an important urban area populated by diverse individuals. With movements of people for various reasons such as business, employment, migration, and cross-border activities, there is a continued effort to increase awareness about HIV among residents. Although there have been public health programs to educate people on ways to prevent infection, knowledge on this issue still falls far behind expectations in some members of the community. Among the factors contributing to low levels of awareness include social stigma surrounding the disease, cultural taboo on discussion about sexual health issues, poor health education, and delayed consultations. Moreover, individuals who indulge in risky sexual acts may be apprehensive about going to the hospital and getting tested for fear of being discriminated against and reuse of syringes among the drug users also contribute in HIV spread. Quetta, being a prominent urban city in Balochistan, suffers from certain problems like migration of people, lack of health care facilities, stigma associated with HIV, and lack of awareness about its transmission routes.

MATERIALS AND METHODS

DATA COLLECTION

A cross-sectional study design was used in which the sample population was drawn from patients visiting the HIV/AIDS Centre located in Bolan Medical College and Red Blood Centre, Quetta. Sample collection duration was from December 2024 to October 2025 and during this duration the total number of patients visited the mentioned facilities were 200 although all Patients satisfying the criteria for the study and giving their informed consent participated in the study through a convenience sampling technique. The current data represents the HIV cases reported in BMC and RBC, Quetta with minor cases from other districts of Balochistan. The Information on demographics and behavioral risk factors was obtained by means of an interview-based questionnaire. Moreover, information concerning the risk factors was gathered from the HIV centers where the patient's records were acquired through their clinical history at the HIV centers and negative individual were taken as control group.

SAMPLE COLLECTION

For the Data entrance, Microsoft Excel and SPSS software were used. Descriptive statistics analysis was done to conclude the data. Chi-square was implemented to evaluate the correlation between HIV status and risk factors, and Binary logistic regression analysis was done purely for exploratory purposes, and its

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findings were handled with caution owing to the relatively small number of positive cases. Prevalence was determined as the proportion of ELISA- positive individuals among the total tested.

Sample size determination for the study used a simple population proportion calculation formula. As there is no exact previous value for prevalence, an estimate of 50% of prevalence was used (p = 0.5) to give the largest sample size requirement. Using a confidence level of 95% (Z = 1.96) and margin of error of 0.07, the required sample size calculated was 196 subjects. The sample size was adjusted to 200 subjects due to possible loss of data and better representation.

Calculation of sample size:

$$n = Z^2 \times p \times (1-p)/ d^2$$

Where: n = Required sample size

Z = Standard Normal Deviate at 95% Confidence Level =1.96

p = Estimate of Prevalence = 0.5

d = Margin of Error = 0.07

BLOOD SAMPLE COLLECTION

Blood specimens were collected from the HIV/AIDS Centre, BMC, and RBC, and Rahat Medical Hospital, Quetta. Venous blood samples (5*ml*) were drawn under aseptic conditions. Specimens were stored in sterile anticoagulant containers and transported under cold chain conditions to the laboratory for analysis to determine HIV seroprevalence and immune status.

HIV DETECTION BY IMMUNO-CHROMATOGRPHIC TEHNIQUE (ICT)

A total of 200 samples were analyzed using the Abbott HIV-1/2 Ag/Ab Combo Immunochromatographic Test (ICT). Testing was conducted at room temperature, with 1–2 drops of serum or plasma and buffer added to each assay. After 10–20 minutes, based on the appearance of the test and control lines results were interpreted. All samples were subsequently confirmed for HIV antibody detection using Enzyme-Linked Immunosorbent Assay (ELISA).

HIV DETECTION BY ENZYME-LINKED IMMUNO-SORBENT ASSAY (ELISA)

After the Immunochromatographic Technique (ICT), the reactive samples were further analyzed by automated Enzyme-Linked Immunosorbent Assay (ELISA) using the Vitros HIV Combo reagent kit (0770) at Rahat Medical Complex, following the manufacturer's protocol. The procedure involved plate coating, blocking, sample incubation, washing, and the addition of enzyme- conjugated antibodies (Table I). Results were interpreted by an ELISA plate reader.

STATISTICAL ANALYSIS

Statistical analysis test was applied using both descriptive and inferential methods. To summarize the data, descriptive statistics, for example, frequencies, percentages, mean, median, and standard deviation were used. The Chi-square analysis was applied to observed and predicted frequencies under the null hypothesis to identify the correlation between categorical variables. A binary logistic regression was applied to assess the correlation between independent variables and the dichotomous outcome. This combined strategy offers an in-depth comprehension of the data and the connections between the variables (9-11).

RESULTS

Demographic data were collected from 200 participants following the acquisition of written informed consent. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were employed to summarize the dataset. The distributions, patterns, and potential outliers were visualized using bar charts. To examine associations between categorical variables, the Chi-square test of independence was applied. Furthermore, binary logistic regression analysis was conducted to identify significant predictors of the outcome variable and to assess the strength of associations while controlling for potential confounders.

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All statistical analyses were performed using [mention software, e.g., SPSS version 26.0 (IBM Corp., Armonk, NY, USA)], and a p-value of < 0.05 was considered statistically significant.

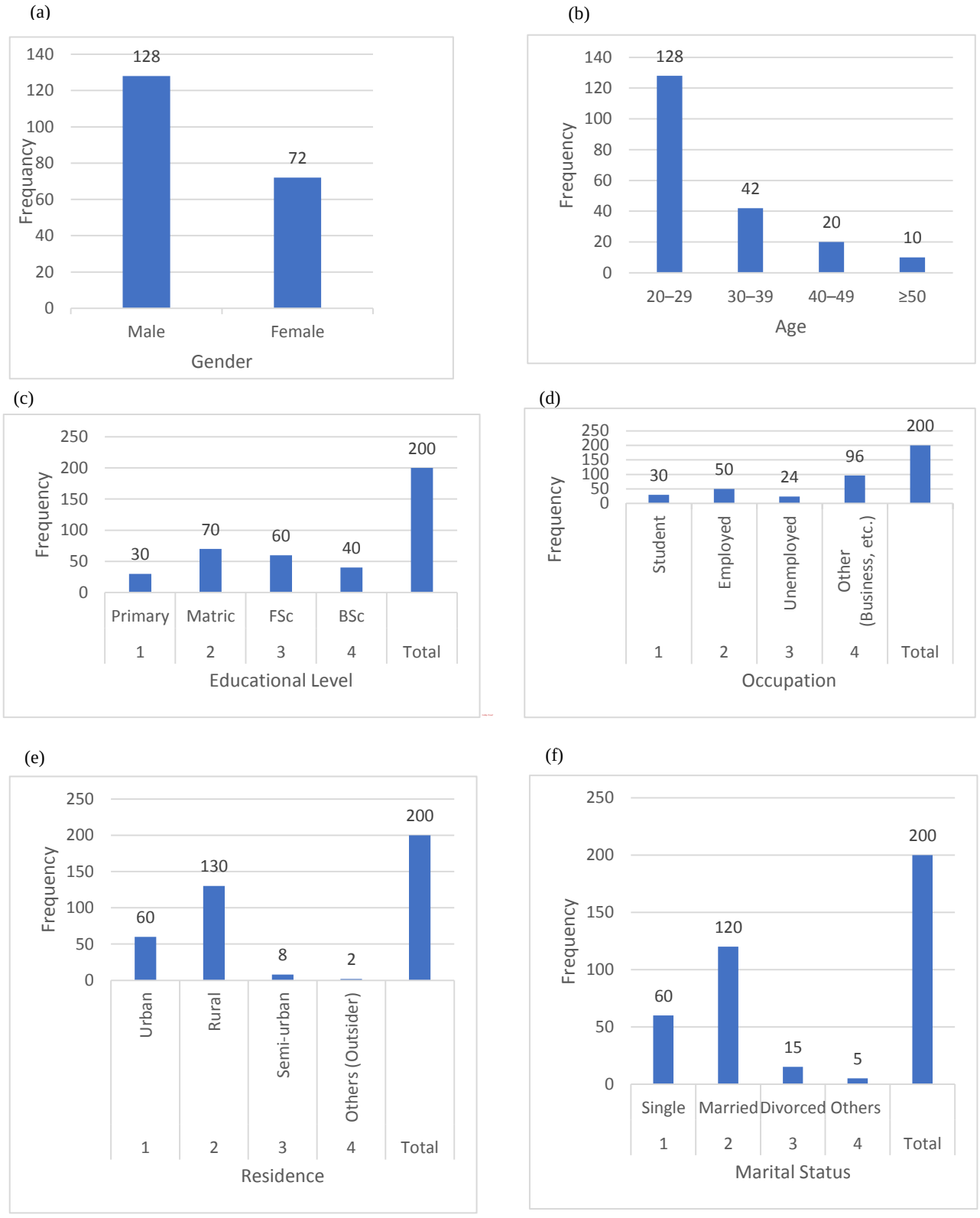


Fig. 1. Demographic characteristics of the study participants (N = 200). Bar charts illustrating the distribution of participants across; **(a)** gender,; **(b)** age groups; **(c)** educational attainment; **(d)** occupational status; **(e)** residential status; **(f)** marital status. Data are presented as frequencies (percentages) where applicable. The predominance of male (64%), young (20–29 years; 64%), married (60%), and rural participants is evident. Abbreviation: FSc, Faculty of Science (Intermediate level).

DEMOGRAPHIC CHARACTERISTICS OF THE STUDY PARTICIPANTS

A comprehensive demographic profile of the study participants is presented in Fig. 1 and summarized in Table 1. The sample comprised 200 participants, with a notable gender disparity: 128 males

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(64.0%) and 72 females (36.0%), coded as 1 and 2 respectively. The predominance of male participants may be attributed to several factors, including gender-based differences in healthcare-seeking behavior, occupational exposure, social stigma, or differential availability at the time of survey administration. This skewed distribution warrants consideration during the interpretation of the study findings. The mean gender coding value was 0.481 (SD = 1.36), reflecting the overall binary coding structure, while the standard deviation indicated moderate response variability (Fig. 1a).

The age distribution revealed a predominantly young cohort. The largest age group comprised individuals aged 20–29 years (n = 128, coded as 1), followed by those in the 30–40 years bracket (n = 42, coded as 2), 40–49 years (n = 20, coded as 3), and participants aged 50 years and above (n = 10, coded as 4). This trend demonstrates a progressive decline in participation with advancing age. The mean age category was 2.09 (SD = 0.978), indicating that the central tendency of the sample clustered around the 30–40 years range, with the standard deviation reflecting moderate age heterogeneity within the study population (Fig. 1b).

Educational attainment was distributed across four levels. The largest proportion of respondents had completed matriculation (secondary education; n = 70, coded as 2), followed by those with F. Sc (intermediate; n = 60, coded as 3), B. Sc degree holders (n = 40, coded as 4), and participants with primary education (n = 30, coded as 1). This distribution indicates that the majority of respondents possessed intermediate-level education, with comparatively fewer individuals at the extreme lower and higher educational strata. The mean educational score was 2.50 (SD = 0.862), suggesting a central tendency between matriculation and F. Sc levels, while the standard deviation pointed to reasonable variability in educational completion across the sample (Fig. 1c).

Occupational status was categorized into four main groups: students (Category 1), employed individuals (Category 2), unemployed individuals (Category 3), and others (Category 4), which included business owners and self-employed participants. The highest frequency was observed in Category 4, suggesting that a substantial proportion of respondents were engaged in business or other non-traditional employment sectors. The overall distribution indicates that most participants fell into the higher occupational categories. The mean occupational score was 2.93 (SD = 0.975), positioning the average response near the midpoint of the scale, while the standard deviation reflected a moderate spread across occupational groups (Fig. 1d).

Residential status was classified into four categories: urban (Category 1), rural (Category 2), semi-urban (Category 3), and others (Category 4), the latter comprising individuals who were not permanent residents of Quetta and had migrated from other districts. The histogram revealed that rural residents constituted the largest group, while urban and semi-urban participants represented smaller proportions. The sample was heavily concentrated in a single residential category, with minimal variation across the remaining groups. The mean value of 1.79 (SD = 0.48) indicated that responses were clustered toward the lower end of the residential scale, with low variability suggesting a relatively homogeneous sample in terms of residency (Figure 1e).

With regard to marital status, participants were categorized as single (n = 60, coded as 1), married (n = 120, coded as 2), divorced (n = 20, coded as 3), and others (n = 0, coded as 4), which included widowed individuals. The distribution showed a clear majority of married individuals, with fewer single participants and only a small proportion falling into the divorced category. The mean marital status score was 1.79 (SD = 0.517), indicating a strong inclination toward the married group, while the limited standard deviation suggested that most respondents shared a similar marital status, reflecting low variability within the sample (Fig. 1f).

Table I. Demographic characteristics of study participants (N = 200)

Characteristic	Category	Frequency (n)	Percentage (%)	Mean ± SD
Gender	Male	128	64.0	0.481 ± 1.36
	Female	72	36.0	
Age Group (years)	20–29	128	64.0	2.09 ± 0.978
	30–40	42	21.0	

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	40–49	20	10.0	
	≥50	10	5.0	
Education Level	Primary	30	15.0	2.50 ± 0.862
	Matric	70	35.0	
	FSc	60	30.0	
	BSc	40	20.0	
Occupation	Student	—	—	2.93 ± 0.975
	Employed	—	—	
	Unemployed	—	—	
	Other (Business, etc.)	—	—	
Residential Status	Urban	—	—	1.79 ± 0.48
	Rural	—	—	
	Semi-Urban	—	—	
	Other	—	—	
Marital Status	Single	60	30.0	1.79 ± 0.517
	Married	120	60.0	
	Divorced	20	10.0	
	Other (Widow, etc.)	0	0.0	

ASSOCIATION BETWEEN GENDER AND HIV-RELATED RISK BEHAVIORS

A chi-square test of independence was performed to examine the association between gender and various HIV-related behavioral risk factors. The results revealed statistically significant associations between gender and several key variables, including history of sexual intercourse ($\chi^2 = 7.996$, df = 2, $p = 0.017$), consistent condom use ($\chi^2 = 21.822$, df = 2, $p < 0.001$), ever used injectable drugs ($\chi^2 = 6.350$, df = 2, $p = 0.042$), and having multiple sexual partners ($\chi^2 = 8.478$, df = 2, $p = 0.014$). However, no significant associations were observed for sharing needles/syringes ($\chi^2 = 4.261$, df = 2, $p = 0.119$), knowledge of HIV preventive methods ($\chi^2 = 0.203$, df = 2, $p = 0.904$), or history of blood transfusion ($\chi^2 = 3.309$, df = 2, $p = 0.191$). A summary of the chi-square analysis is presented in Table II.

Table II. Association between gender and HIV-related risk behaviors

Variable	χ^2 Value	df	p-Value
Ever had sexual intercourse	7.996	2	0.017*
Consistent condom use	21.822	2	<0.001**
Shared needles or syringes	4.261	2	0.119
Knowledge of HIV preventive methods	0.203	2	0.904
Ever used injectable drugs	6.350	2	0.042*
Ever received blood transfusion	3.309	2	0.191
Multiple sexual partners	8.478	2	0.014*

*Note: df = degrees of freedom; *p < 0.05, **p < 0.001 (statistically significant)*

LOGISTIC REGRESSION ANALYSIS OF PREDICTORS OF HIV-RELATED BEHAVIORS

Binary logistic regression analysis was conducted to identify significant predictors of HIV-related behavioral outcomes. The Omnibus Test of Model Coefficients indicated that the logistic regression model was statistically significant ($\chi^2 = 22.832$, df = 13, $p = 0.044$), suggesting that the set of predictor variables collectively contributed to predicting the outcome and provided a significantly better fit than the null model. The identical chi-square, degrees of freedom, and significance values for Step, Block, and Model indicate that all variables were entered simultaneously in a single step. These findings confirm that the model demonstrates a statistically significant improvement in explaining the outcome variable (Table III).

Table III. Omnibus test of model coefficients for logistic regression model

	χ^2	df	p-Value
Step	22.832	13	0.044*
Block	22.832	13	0.044*
Model	22.832	13	0.044*

*Note: df = degrees of freedom; *p < 0.05 (statistically significant)*

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HIV SEROPREVALENCE AND DIAGNOSTIC CONFIRMATION

SCREENING BY IMMUNOCHROMATOGRAPHIC TEST (ICT)

All 200 serum samples were initially screened for HIV antibodies using an immunochromatographic test (ICT). Of these, 196 samples (98.0%) were non-reactive, displaying only the control line, while 4 samples (2.0%) were reactive, showing both control and test lines (Table IV). These findings indicate that the vast majority of the study population was HIV-negative; however, the detection of reactive cases underscores the persistence of HIV transmission risk within the community.

Table IV. Immunochromatographic test (ICT) screening results for HIV antibodies

ICT result	Number of samples (n)	Percentage (%)
Reactive	4	2.0
Non-Reactive	196	98.0
Total	200	100

CONFIRMATORY TESTING BY ENZYME-LINKED IMMUNOSORBENT ASSAY (ELISA)

To confirm the ICT-reactive samples and rule out false-positive results, all 4 reactive samples, along with 2 randomly selected non-reactive samples (as negative controls), were subjected to enzyme-linked immunosorbent assay (ELISA). The absorbance values were measured against a cutoff value of 0.9.

All 4 ICT-reactive samples demonstrated absorbance values substantially above the cutoff, confirming the presence of HIV antibodies. Sample 1 exhibited the highest absorbance (163.0), followed by Sample 2 (120.0), Sample 3 (73.2), and Sample 4 (55.0). In contrast, the 2 negative control samples (Samples 5 and 6) showed absorbance values of 0.03 and 0.12, respectively, both below the cutoff, confirming their negative status (Table V). These results demonstrate complete concordance between ICT screening and ELISA confirmatory testing.

Table V. Confirmatory enzyme-linked immunosorbent assay (ELISA) results

Sample ID	Absorbance value	Cutoff value	Interpretation
Sample 1	163.0	< 0.9	Positive
Sample 2	120.0	< 0.9	Positive
Sample 3	73.2	< 0.9	Positive
Sample 4	55.0	< 0.9	Positive
Sample 5	0.03	< 0.9	Negative
Sample 6	0.12	< 0.9	Negative

RISK FACTORS ASSOCIATED WITH HIV-POSITIVE CASES

Detailed behavioral risk assessment of the 4 HIV-positive patients revealed distinct exposure patterns. As summarized in Table VI, Patient 1 reported a history of drug abuse, Patient 2 had multiple sexual partners, and Patients 3 and 4 engaged in unprotected sexual contact. Notably, all 4 positive cases were married males, suggesting that socio-demographic factors—particularly gender and marital status may play a significant role in shaping HIV transmission dynamics within this population.

Table VI. Behavioral risk factors among HIV-positive patients

Patient ID	Risk factor	HIV status
Patient 1	Drug abuse	Positive
Patient 2	Multiple sexual partners	Positive
Patient 3	Unprotected sexual contact	Positive
Patient 4	Unprotected sexual contact	Positive

DISCUSSION

HIV/AIDS remains a persistent public health challenge globally, with South Asia bearing a disproportionate burden due to pervasive socio-cultural stigma, limited healthcare infrastructure, and economic constraints that impede effective prevention, diagnosis, and treatment initiatives (2). The present

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study was designed to evaluate the seroprevalence of HIV and identify associated risk factors among participants attending the HIV/AIDS Centre at Bolan Medical College, Rahat Medical Hospital, and the Red Blood Centre in Quetta, Balochistan. In addition to serological testing using immunochromatographic (ICT) and enzyme-linked immunosorbent assay (ELISA) methods, the study incorporated a comprehensive statistical analysis of demographic characteristics, risk behaviors, and diagnostic concordance.

The overall HIV seroprevalence rate observed in this study was 2% (4 out of 200 samples), which is consistent with national estimates indicating that Pakistan continues to be classified as a low-prevalence country, with an adult HIV prevalence of approximately 0.1%–0.2% (12). Although this rate falls within the expected range for the general population, the identification of four confirmed positive cases underscores the persistence of ongoing HIV transmission risk within the community. Notably, the risk factors identified among HIV-positive individuals in our cohort included intravenous drug abuse, multiple sexual partnerships, and unprotected sexual contact behaviors that were predominantly reported among married males. This pattern aligns with global epidemiological evidence suggesting that stable, married male populations may serve as a bridge group for HIV transmission to the general population (13).

Descriptive analysis of the study population revealed a predominantly young and demographically heterogeneous cohort, with participants distributed across varying marital statuses, educational levels, residential settings, and occupational categories. This demographic composition contrasts with studies focusing specifically on people who inject drugs (PWIDs), which have reported a higher mean age (30.0 ± 9.0 years) and a more uniformly high-risk profile, characterized by low educational attainment and engagement in high-risk bebehaviors(2)In the present study, the seroprevalence rate of 2% is considerably lower than the 30.3% reported in PWID-dominant cohorts (14), suggesting that our sample represents a relatively lower-risk population. Similarly, previous research has documented unsafe sexual practices in 20% of participants, inconsistent condom use in 17.5%, multiple sexual partners in 12.5%, commercial sex work in 10%, needle sharing in 5%, and drug abuse in 3.8% (2). In comparison, the lower prevalence of high-risk behaviors observed in our cohort further supports the relatively favorable epidemiological profile of this population.

Chi-square analysis revealed statistically significant associations between gender and several behavioral risk factors, including knowledge of HIV transmission ($p = 0.037$), awareness of HIV testing services ($p = 0.034$), sexual practices ($p = 0.017$), consistent condom use ($p < 0.001$), injection drug use ($p = 0.042$), and having multiple sexual partners ($p = 0.014$). These findings suggest that gender plays a substantial role in shaping HIV-related risk behaviors, with males exhibiting a higher propensity for engagement in high-risk activities. Conversely, no significant associations were observed between gender and variables such as general HIV/AIDS awareness, prior HIV testing history, needle sharing practices, preventive awareness, or blood transfusion history ($p > 0.05$), indicating that these factors were comparable across genders. This pattern is consistent with earlier studies that have reported gender-based disparities in HIV risk behaviors, particularly in patriarchal societies where males may have greater social and economic autonomy to engage in risky practices (16, 17).

Binary logistic regression analysis further confirmed gender as a significant predictor of HIV-related behaviors ($\chi^2 = 22.832$, $df = 13$, $p = 0.044$), reinforcing the notion that demographic variables, particularly gender, influence risk behavior patterns. This finding is congruent with previous research documenting similar behavioral predictors, with injectable drug use emerging as a particularly strong determinant (adjusted OR = 2.64) in logistic regression models (5). The convergence of these results across different geographical and epidemiological settings underscores the universal relevance of gender-sensitive approaches in HIV prevention and intervention strategies.

A notable finding of the present study was the complete concordance observed between ICT and ELISA results. Specifically, 2% of samples were reactive on ICT screening, and all of these were subsequently confirmed as positive by ELISA. The ELISA demonstrated enhanced diagnostic performance, with absorbance values ranging from 55 to 163—substantially above the cutoff value of 0.9—indicating significantly greater sensitivity and reliability compared to the ICT. These findings are corroborated by previous evaluations reporting ELISA sensitivity of 95–100% and specificity of 99–100%, whereas ICT has

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shown variable performance with occasional false-negative results (14) The high concordance and superior quantitative performance of ELISA in our study reinforce its utility as a confirmatory test in resource-limited settings where rapid screening is commonly employed.

In summary, although the overall HIV seroprevalence in our study population remains low, the identification of behavioral risk factors and the demographic correlates thereof highlight the continued vulnerability of specific subgroups to HIV acquisition. The findings emphasize the need for targeted screening programs, gender-specific awareness campaigns, and behavioral preventive interventions to curtail HIV transmission in the region. The high diagnostic accuracy of ELISA further supports its integration into routine confirmatory testing algorithms, particularly in settings with limited laboratory infrastructure. Given the complex interplay of socio-cultural, demographic, and behavioral factors influencing HIV epidemiology in Balochistan, sustained public health efforts and community engagement remain essential to achieving the UNAIDS 95-95-95 targets and ultimately reducing the burden of HIV/AIDS in Pakistan.

CONCLUSION

This study confirms the utility of combining ICT screening with ELISA confirmatory testing for accurate HIV diagnosis. Although seroprevalence remains low (2%), identified risk behaviors including drug abuse and unprotected sex highlight ongoing transmission risk. Recommendations include community awareness campaigns, voluntary screening, harm reduction strategies, and stigma-free services for women and transgender individuals. Study limitations include restricted geographic scope, modest sample size, and convenience sampling, which limit generalizability. Nevertheless, the findings underscore the need for strengthened diagnostic infrastructure and targeted behavioral interventions to curb HIV transmission in Balochistan.

Conflict of interest:

All authors declare no conflict of interest.

Authors' contribution:

VD Data collection and experimental work; FUR Data analysis and manuscript editing; MS Contributed and assisted in laboratory work; HW Supervised the overall research study.

Declaration of generative AI-assisted tools:

Authors declared that no AI-assisted tools were used.

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