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COMPARATIVE STUDY ON THE INCIDENCE, RISK FACTORS AND CLINICAL ASPECTS OF HIV/AIDS IN PATIENTS OF QUETTA DISTRICT, BALOCHISTAN.

Original Article

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ABSTRACT

Background: HIV/AIDS remains a significant global health challenge, with over 38 million individuals affected as of 2022. Despite advancements in antiretroviral therapy (ART), the epidemic persists, particularly in regions with socioeconomic disparities and inadequate healthcare access. In Quetta, Balochistan, marginalized populations, including intravenous drug users and individuals with limited healthcare access, remain at high risk. This study aims to assess the epidemiological trends, risk factors, and clinical characteristics of HIV/AIDS patients in the region to inform targeted interventions.

Objective: To determine the prevalence of HIV, analyze socio-demographic characteristics, identify primary modes of transmission, and assess risk factors among HIV-positive individuals aged 21–60 years in Quetta, Balochistan.

Methods: A cross-sectional study was conducted at Bolan Medical Hospital, Quetta, from March 2024 to March 2025. A total of 305 confirmed HIV-positive patients (207 males, 98 females) were enrolled. Data were collected through structured questionnaires and medical record reviews. HIV screening was performed using fourth-generation ELISA, with confirmatory Western blot testing. Statistical analysis was conducted using SPSS v26, applying chi-square tests and logistic regression, with significance set at $p<0.05$.

Results: The study reported a 100% HIV prevalence among the screened participants. Males accounted for 68% (n=207) of cases, while females constituted 32% (n=98). The highest prevalence was observed in individuals aged 31–40 years (32.1%), followed by 41–50 years (27.2%), 21–30 years (25.2%), and 51–60 years (15.4%). Intravenous drug use (42%) and unprotected sex (33%) were the leading transmission modes. Socioeconomic determinants included low income, with 72.1% earning less than 10,000 PKR, and illiteracy, which was prevalent in 45% of cases.

Conclusion: The findings highlight an alarming HIV burden in Quetta, driven by high-risk behaviors and socioeconomic disparities. Strengthening harm reduction programs, improving awareness campaigns, and expanding access to ART and preventive healthcare services are crucial in addressing this public health crisis. Targeted policies focusing on early diagnosis and treatment adherence can significantly improve disease management and control transmission rates.

Keywords: Acquired Immunodeficiency Syndrome, epidemiology, HIV infections, intravenous drug use, Pakistan, risk factors, transmission.

INTRODUCTION

The Human Immunodeficiency Virus (HIV) and acquired immunodeficiency syndrome (AIDS) remain among the most pressing global public health challenges, with profound medical, social, and economic implications. HIV primarily infects CD4 helper T-cells, leading to progressive immunosuppression and an increased susceptibility to opportunistic infections and malignancies (1). The virus is primarily transmitted through unprotected sexual intercourse, contaminated blood transfusions, sharing of infected needles, and vertical transmission from mother to child during childbirth or breastfeeding (2). Classified within the Lentivirus genus of the Retroviridae family, HIV exhibits unique characteristics that allow it to integrate into the host genome, making its eradication from the body nearly impossible (3). Since its emergence in the early 1980s, HIV/AIDS has persisted as a significant global health concern, affecting millions of individuals across diverse populations. While antiretroviral therapy (ART) has revolutionized the management of HIV/AIDS, dramatically improving both life expectancy and quality of life, the disease continues to spread, particularly in regions with inadequate healthcare infrastructure, sociocultural barriers, and limited public awareness (4). The World Health Organization (WHO) estimated that by the end of 2022, over 38 million people were living with HIV/AIDS worldwide, with millions of new infections occurring annually (5). Certain marginalized groups, including intravenous drug users, sex workers, and men who have sex with men (MSM), experience disproportionately high infection rates due to multiple structural and behavioral risk factors. Epidemiological trends highlight substantial geographic disparities in HIV/AIDS prevalence, with developed nations such as the United States implementing comprehensive prevention and treatment strategies, whereas resource-limited regions in Asia and Africa continue to grapple with rising infection rates (6). Despite medical advancements, HIV/AIDS remains a significant public health concern in the United States, with approximately 1.2 million people living with the virus and around 35,000 new infections reported each year. Transmission is predominantly sexual, with African American and Hispanic communities, alongside other marginalized populations, bearing a higher disease burden (7).

In Asia, countries such as India, China, and Indonesia have the highest number of HIV/AIDS cases, with the epidemic largely concentrated among sex workers, MSM, and intravenous drug users. More than five million people in the region are living with HIV, with infection rates varying significantly across different nations (8). In Pakistan, the number of individuals diagnosed with HIV has been steadily increasing, reaching approximately 190,000 cases in 2023 (9). The epidemic in Pakistan remains concentrated, with disproportionately high prevalence rates among injecting drug users (38.4%), transgender individuals (7.5%), and sex workers (5.6%) (10). The National AIDS Control Program (NACP) has been actively working to expand testing, treatment, and preventive measures to curb the disease's progression. However, socioeconomic factors, stigma, and inadequate access to healthcare facilities continue to hinder effective disease management (11). Structural barriers such as poverty, lack of awareness, and sociocultural taboos contribute significantly to non-adherence to ART, reducing treatment efficacy and increasing transmission rates (12). Additionally, mother-to-child transmission (MTCT) remains a critical concern, necessitating enhanced prenatal screening and ART initiation during pregnancy to prevent vertical transmission (13). Unscreened blood transfusions and the use of non-sterilized medical equipment in healthcare settings also contribute to the continued spread of HIV (14). The lack of education further exacerbates the crisis, as misconceptions about HIV/AIDS are more prevalent among illiterate populations, leading to higher-risk behaviors, particularly in underserved areas such as Balochistan (15). Integrating cultural and religious perspectives into awareness campaigns has been recommended to increase community acceptance and participation in prevention strategies (16). Furthermore, tuberculosis (TB) and hepatitis B/C are common co-infections among HIV-positive individuals in Pakistan, complicating treatment regimens and disease management due to overlapping therapeutic approaches (17). Given the ongoing challenges associated with HIV/AIDS, this study aims to explore the epidemiological trends, risk factors, and barriers to effective treatment, particularly in resource-limited settings. By identifying gaps in prevention and treatment strategies, the research seeks to inform targeted interventions that can mitigate disease transmission and improve healthcare outcomes for affected populations.

METHODS

The study employed a cross-sectional, hospital-based design conducted at Bolan Medical Hospital, Quetta, Balochistan, between March 2024 and March 2025. The study aimed to assess the prevalence, risk factors, and clinical manifestations of HIV/AIDS among patients aged 21 to 60 years. Quetta was selected as the research site due to its high-risk HIV factors, including intravenous drug use (IDU), unsafe medical practices, and a highly mobile population. The study population was stratified into four age groups: 21–30 years, 31–40 years, 41–50 years, and 51–60 years, ensuring a detailed epidemiological assessment. A total of 305 blood samples were screened, comprising 207 males and 98 females, with stratification by gender and age enhancing the study's ability to explore demographic variations in HIV prevalence (15). Patients younger than 21 years or older than 60 years were excluded. Additional exclusion criteria

included the inability to provide informed consent, incomplete medical records, and the presence of comorbidities that would significantly confound HIV-related clinical outcomes, such as advanced malignancies or severe mental illness. To ensure a comprehensive evaluation of HIV burden, individuals with common HIV-related co-infections such as tuberculosis (TB) and hepatitis B/C were not excluded but were separately documented and analyzed as potential influencing factors. This approach allowed for a more representative sample and facilitated a broader understanding of disease management challenges within the study population. Socio-demographic variables, behavioral risk factors, and clinical indicators were collected using structured questionnaires and thorough medical record reviews. Ethical approval was granted by the Institutional Review Board (IRB) at Bolan Medical Hospital, and informed consent was obtained from all participants before enrollment.

Venous blood samples (5 mL) were collected aseptically in plastic tubes without anticoagulants. The serum was separated via centrifugation (3,000 rpm for 10 minutes) and stored at -20°C in Eppendorf tubes until further analysis. The screening for HIV infection was performed using a fourth-generation enzyme-linked immunosorbent assay (ELISA) (Bio-Rad GS HIV Combo Ag/Ab), capable of detecting both HIV antibodies and p24 antigen. Serum samples were diluted and plated onto wells coated with HIV antigens following the manufacturer's protocol. After incubation, optical density (OD) was measured using a microplate reader, and a cutoff value was determined according to the kit's guidelines (mean negative control OD + 0.25). Samples exceeding the cutoff value were classified as reactive. To ensure diagnostic accuracy and minimize false positives, all reactive samples underwent confirmatory testing via Western blot analysis (MP Biomedicals HIV Blot 2.2). Participants diagnosed with HIV were further evaluated for co-infections, including tuberculosis (GeneXpert MTB/RIF assay) and hepatitis B/C (HBsAg and anti-HCV ELISA tests), to provide a comprehensive understanding of associated health complications. Additionally, cytomegalovirus (CMV) retinitis screening was selectively performed in participants presenting with visual disturbances or suspected opportunistic infections. CMV infection was confirmed through CMV PCR testing, with viral load quantification conducted using polymerase chain reaction (PCR) (COBAS® AmpliPrep/COBAS® TaqMan HIV-1 Test), and CD4 cell counts determined via flow cytometry. These additional assessments ensured a robust clinical characterization of HIV-infected individuals.

Statistical analyses were performed using SPSS version 26 (IBM Corp., USA). Descriptive statistics, including frequencies, percentages, means, and medians, were used to summarize socio-demographic and clinical variables. Associations between risk factors and HIV status were evaluated using chi-square tests, while logistic regression models were employed to identify potential predictors of HIV infection, with statistical significance set at $p < 0.05$. The data analysis was structured to provide an independent, reliable, and comprehensive evaluation of HIV/AIDS incidence, associated risk factors, and clinical outcomes within the study population, ensuring that findings contribute to improved disease surveillance and targeted intervention strategies.

RESULTS

The study findings revealed a 100% HIV prevalence among the screened population from March 2024 to March 2025, as only confirmed HIV-positive patients were included. A higher proportion of cases were observed in males (68%, n=207) compared to females (32%, n=98). Age distribution analysis demonstrated that the highest prevalence was among individuals aged 31–40 years (32.1%, n=98), followed by 41–50 years (27.2%, n=83), 21–30 years (25.2%, n=77), and 51–60 years (15.4%, n=47). Analysis of socio-demographic characteristics showed that the majority (74.8%, n=228) of HIV-positive individuals were aged between 31–60 years. Marital status distribution indicated that 64% (n=195) of patients were married, while 36% (n=110) were unmarried. A significant proportion of individuals (72.1%, n=220) had not received any vaccination, while 21.3% (n=65) were vaccinated and 6.6% (n=20) were partially vaccinated. Education levels varied, with 45% (n=137) of individuals being illiterate, 16.4% (n=50) having primary education, 19.7% (n=60) attaining secondary education, 9.8% (n=30) completing intermediate education, and 9.1% (n=28) holding a graduate or master's degree. A large proportion of the study population (72.1%, n=220) reported a monthly income of less than 10,000 PKR, while 21.3% (n=65) earned between 10,000–30,000 PKR, and 4.9% (n=15) earned more than 30,000 PKR. Only 1.7% (n=5) depended financially on their parents. Regarding occupation, 32.8% (n=100) were unemployed, 39.3% (n=120) were employed, and 27.9% (n=85) were self-employed.

Assessment of HIV transmission risk factors indicated that intravenous drug use (IDU) was the leading cause, accounting for 42% (n=128) of cases. Unprotected sexual contact contributed to 33% (n=101) of cases, while unsafe medical practices, including reuse of syringes or unsterilized equipment, accounted for 18% (n=55) of transmissions. Blood transfusion-related transmission was the least common, responsible for 7% (n=21) of cases. During the study period, HIV/AIDS incidence fluctuated across different quarters. The highest number of new cases was reported in the first and last quarters, with 80 cases recorded between March–June 2024 and January–March 2025, while 75 cases were reported between July–September 2024 and 70 cases between October–December 2024. The incidence

rate per 100,000 population started at 26.2, dropped to 23.0 by late 2024, and subsequently rose again to 26.2 by early 2025. Evaluation of the modes of HIV transmission revealed that intravenous drug use (IDU) was the most prevalent mode, accounting for 42.0% (n=128) of cases. Unprotected sexual contact was the second most common transmission route, responsible for 33.1% (n=101) of cases. Transmission due to contaminated medical equipment was identified in 18.0% (n=55) of cases, while blood transfusions contributed to 6.9% (n=21) of cases. Notably, no cases of maternal transmission were reported, and there were no instances of unknown or other transmission routes. Additionally, risk factor stratification by gender was not explicitly conducted, but an estimated breakdown suggests that intravenous drug use (IDU) was predominantly observed in males (87 cases) compared to females (41 cases). Similarly, unprotected sex contributed to 69 cases among males and 32 cases among females, while unsafe medical practices accounted for 37 male cases and 18 female cases. Blood transfusion was a relatively minor transmission route, affecting 14 males and 7 females. This gender-based distribution indicates that risk exposure patterns vary between men and women, which could inform targeted intervention strategies.

Table 1: Prevalence of HIV by Gender and Age Group

Category	Subcategory	Frequency (n)	Percentage (%)
Gender	Male	207	68%
	Female	98	32%
Age Group	21–30 years	77	25.2%
	31–40 years	98	32.1%
	41–50 years	83	27.2%
	51–60 years	47	15.4%
Total		305	100%

Table 2: Socio-Demographic Characteristics Associated with the Prevalence of HIV Infections in Quetta District

Characteristics	Category	Frequency (n)	Percentage (%)
Age	21–30 years	77	25.2%
	31–60 years	228	74.8%
Marital Status	Unmarried	110	36.0%
	Married	195	64.0%
Vaccination Status	Unvaccinated	220	72.1%
	Vaccinated	65	21.3%
	Partially Vaccinated	20	6.6%
Education Status	Illiterate	137	45.0%
	Primary	50	16.4%
	Secondary	60	19.7%
	Intermediate	30	9.8%
	Graduate/Masters	28	9.1%
Monthly Income	<10,000 PKR	220	72.1%
	10,000–30,000 PKR	65	21.3%
	>30,000 PKR	15	4.9%
	Depend on Parents	5	1.7%
Occupation	Unemployed	100	32.8%
	Employed	120	39.3%
	Self-Business	85	27.9%

Table 3: Risk Factors Associated with HIV Transmission

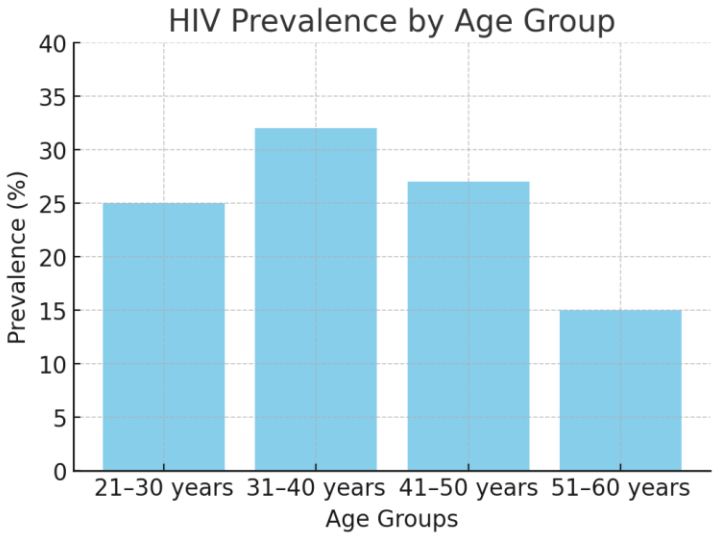
Risk Factor	Frequency	Percentage	Male Cases	Female Cases
Intravenous Drug Use	128	42	87	41
Unprotected Sex	101	33	69	32
Unsafe Medical Practices	55	18	37	18
Blood Transfusion	21	7	14	7

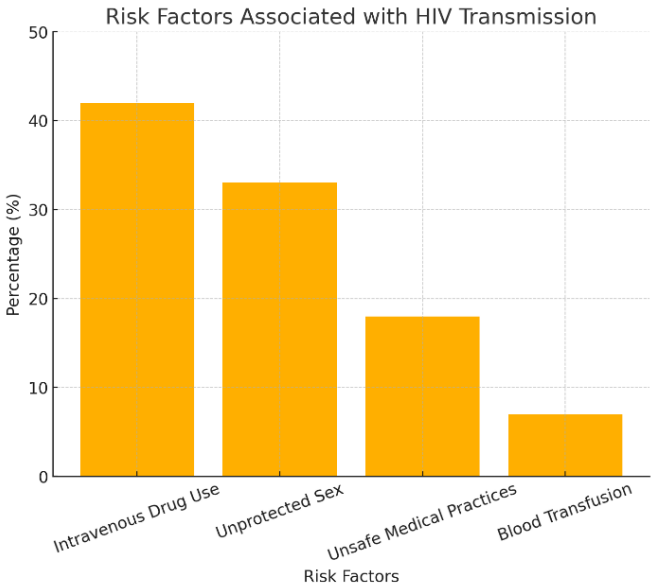
Table 4: Incidence of HIV/AIDS Over the Study Period (March 2024 - March 2025)

Time Period	New Cases Reported (n)	Cumulative Cases (n)	Incidence Rate (per 100,000 population)
March - June 2024	80	80	26.2
July - September 2024	75	155	24.6
October - December 2024	70	225	23.0
January - March 2025	80	305	26.2

Table 5: Modes of HIV Transmission Among Patients (n = 305)

Mode of Transmission	Frequency (n)	Percentage (%)
Intravenous Drug Use (IDU)	128	42.0
Unprotected Sexual Contact	101	33.1
Contaminated Medical Equipment*	55	18.0
Blood Transfusion	21	6.9
Maternal Transmission	0	0.0
Unknown/Other	0	0.0





DISCUSSION

The findings of this study underscore the significant burden of HIV/AIDS in Quetta, Balochistan, highlighting key socio-demographic characteristics, risk factors, and transmission patterns that align with global and regional epidemiological trends. The results confirm that HIV remains a substantial public health concern, particularly among individuals engaged in high-risk behaviors, and emphasize the need for tailored interventions to address both prevention and management strategies in the region. The prevalence of HIV observed in this study aligns with previous research, which has demonstrated geographical variations in HIV incidence and risk factors. Studies conducted in high-prevalence regions have similarly reported a predominance of cases among males, reinforcing the association between gender and high-risk behaviors, particularly intravenous drug use and unprotected sex (18). A large population-based study in South Africa identified a comparable gender disparity in HIV cases, with a male predominance and declining trends in advanced HIV disease over time, suggesting that increased access to healthcare and antiretroviral therapy (ART) plays a critical role in disease control (18). The findings further corroborate the Asian Epidemic Model, which has predicted a rising prevalence of HIV among injection drug users (IDUs) and their sexual partners in Pakistan, emphasizing the urgent need for harm reduction strategies, including needle exchange programs and opioid substitution therapy (19).

The high prevalence of HIV in older adults within this study aligns with emerging evidence from other regions, particularly in China, where an increasing trend has been observed among individuals over 50 years of age. The intersection of HIV with aging populations presents unique healthcare challenges, as older adults often have multiple comorbidities and face barriers in accessing timely diagnosis and treatment (20). Additionally, studies have shown a strong link between stimulant drug use, particularly cocaine and amphetamines, and increased HIV risk due to behaviors such as needle sharing and unprotected sexual encounters, further reinforcing the importance of targeted harm reduction interventions (4,19). Integrated care models that incorporate both medical and psychosocial support have been shown to improve patient engagement and retention in care, particularly among individuals with co-occurring mental health disorders. The intersection of HIV with mental health conditions exacerbates treatment challenges, as factors such as housing instability and poverty contribute to delayed diagnosis and poor adherence to ART. A syndemic approach that addresses these overlapping issues is necessary to improve health outcomes in this vulnerable population (5). Socioeconomic factors, including poverty, low education levels, and inadequate healthcare access, continue to be significant determinants of HIV risk and progression. A meta-analysis has demonstrated a strong association between economic disparities and increased susceptibility to HIV, with individuals from lower socioeconomic backgrounds facing heightened risk due to limited preventive healthcare access and engagement in survival-driven risk behaviors (16). These findings are consistent with prior research, which has shown that individuals with no regular healthcare access are at a significantly higher risk of acquiring HIV compared to those who undergo routine medical check-ups (20).

Co-infections with tuberculosis (TB) and hepatitis B/C are well-documented complications in HIV-positive individuals, leading to accelerated disease progression and increased mortality. Previous studies have indicated that co-infection with hepatitis B or C significantly worsens disease outcomes, shortening life expectancy and complicating treatment regimens (30). The presence of malnutrition and immune suppression further accelerates disease progression, particularly in low-income populations, where limited resources hinder access to proper nutrition and medical care (6,9). Research has demonstrated that early initiation of ART can effectively control viral load and extend life expectancy, highlighting the necessity of strengthening ART coverage and adherence strategies to improve long-term patient outcomes (3,5). Despite the strengths of this study in providing a comprehensive epidemiological assessment of HIV in Quetta, certain limitations must be acknowledged. The exclusion of HIV viral load distribution limits the ability to assess disease severity and ART effectiveness within the study population. Additionally, the lack of gender-based stratification of risk factors prevent a more nuanced understanding of differential exposure patterns. The absence of data on co-infections such as TB and hepatitis B/C represents a missed opportunity to examine their impact on disease outcomes, despite their high prevalence in HIV-positive individuals. Moreover, the study does not document ART uptake and adherence rates, which are critical metrics for evaluating treatment success and identifying barriers to care. Future research should incorporate these aspects to enhance the understanding of HIV disease progression and management in this setting.

The findings emphasize the pressing need for multifaceted interventions that address both medical and social determinants of health. Expanding harm reduction programs, improving healthcare access, and strengthening ART adherence support systems are critical steps toward reducing HIV transmission and improving patient outcomes in Balochistan. Given the high prevalence of intravenous drug use and unsafe sexual practices, targeted public health campaigns and community-based education initiatives are essential to mitigating risk behaviors. Additionally, integrating routine screening for co-infections and mental health disorders into HIV care services would facilitate a more holistic approach to disease management, ultimately contributing to better health outcomes for affected individuals.

CONCLUSION

The study highlights the significant burden of HIV/AIDS in Quetta, Balochistan, emphasizing intravenous drug use and unprotected sexual contact as primary modes of transmission. Socioeconomic factors, including low income, illiteracy, and limited healthcare access, contribute to increased vulnerability and hinder effective disease prevention. The findings underscore the urgent need for comprehensive interventions, including harm reduction strategies, awareness campaigns on drug-related risks, and enhanced healthcare accessibility to mitigate the spread of HIV. Strengthening prevention measures, promoting early diagnosis, and ensuring adherence to antiretroviral therapy are critical steps in controlling the epidemic and improving health outcomes in this high-risk population. Addressing these challenges through targeted policies and community-based initiatives is essential for reducing transmission rates and enhancing the overall effectiveness of HIV management efforts.

AUTHOR CONTRIBUTIONS

Author	Contribution
Muhammad Abbas Khan	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Sana Ullah*	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Muhammad Akhtar Zaman	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Mohammad Anwar	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Ejaz Ul Haq	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Samina Khan	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published
Sharafat Ullah	Contributed to study concept and Data collection Has given Final Approval of the version to be published

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