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Original Article

Seroprevalence of Human Immunodeficiency Virus Among Blood Donors in Kabul: An Analysis of Gender Effects on Infection Rates

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Abstract

Background: The global impact of human immunodeficiency virus (HIV) as a major public health problem emphasizes the importance of understanding its prevalence and spread for the development of effective prevention and control strategies. This study aimed to investigate the seroprevalence of HIV among blood donors in Kabul and to analyze possible gender differences and their effects on infection rates.

Methods: A cross-sectional analysis of blood donor data was conducted at the central blood bank in Kabul. The study encompassed data from January to December 2023, including male and female blood donors. HIV screening was performed using an enzyme-linked immunosorbent assay test. The data collected during the study were analyzed using SPSS to determine the prevalence of HIV and examine any differences in infection rates between men and women.

Results: Overall 12 445 blood donor samples were analyzed in this study, including 12 179 samples from male donors and 266 samples from female donors. The results indicated an overall HIV seropositive infection rate among blood donors in Kabul, which was determined to be 0.0883%. Subsequent analysis, stratifying the data by gender, demonstrated a seroprevalence rate of 0.0883% among male blood donors. No cases of HIV infection were detected in female blood donors.

Conclusion: This study provides information on the seroprevalence of HIV infection among blood donors in Kabul with an overall rate of 0.0883%. Gender analysis revealed a similar seroprevalence rate among male donors, while no cases of HIV infection were observed among female donors. These findings emphasize the need for continued monitoring, prevention, and education to maintain the safety and integrity of the blood supply, as well as further research to understand the underlying factors contributing to the observed HIV prevalence rates.

Keywords: HIV seroprevalence, Blood donors, Gender disparities, Kabul, Infection rates

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Introduction

Blood and blood component transfusions have helped save many lives worldwide. However, the unsafe administration of blood and blood components plays a crucial role in the transmission of blood-borne infections, such as the human immunodeficiency virus (HIV) (1). HIV, a disease of immense proportions, attacks the human body's immune system and impairs its ability to effectively fight further infections (2).

At the end of 2022, the estimated global prevalence of people living with HIV was 39.0 million, with an uncertainty range of 33.1–45.7 million, which has risen slightly in recent years due to increased life expectancy as a result of effective treatments and the persistence of new HIV infections. It is particularly noteworthy that 53% of those infected with HIV are women and girls. The majority of the population (65%) living with HIV reside in sub-Saharan Africa. However, only half of the new HIV infections documented in 2022 were from this geographic region, indicating greater progress in containing new infections compared to other regions of the world. Overall, 1.3 million new HIV infections have been recorded in 2022, with an uncertainty interval of 1.0–1.7 million. Although the number of new infections is declining, the pace of this reduction is insufficient to meet the targets of the United Nations Political Declaration on HIV/acquired immunodeficiency syndrome (AIDS), which aims to limit the number of new infections to less than 350 000 by 2030. Importantly, the number of new HIV infections continues to rise in two UNAIDS regions, namely, Eastern

Europe and Central Asia, and the Middle East and North Africa, with the increase occurring mainly in the male population in these regions (3). Despite advances in HIV prevention, treatment, care, and support, AIDS remains a major global challenge. It is estimated that approximately 50% of people infected with HIV, including both adults and children, will develop neurological symptoms such as mild cognitive impairment, peripheral neuropathies, HIV-associated dementia, and HIV encephalitis at some point during their illness, regardless of whether they receive antiretroviral treatment (4).

In addition, people living with HIV, regardless of their age, are particularly susceptible to developing invasive Haemophilus influenzae type B disease. This increased susceptibility to Haemophilus influenzae type B infection leads to higher morbidity and mortality rates compared to people without HIV infection (5).

In Afghanistan, a country facing an ongoing humanitarian crisis, the supply of blood transfusions does not always meet international standards. The Afghan National Blood Safety and Transfusion Service (ANBSTS) faces major challenges in terms of blood safety due to various factors such as the lack of blood safety legislation, inadequate infrastructure, financial constraints, insufficiently trained staff, poor data management, and the absence of a national donor selection and retention campaign (1). Available data on the prevalence of blood-borne infections among blood donors in Afghanistan are scarce. Existing studies and reports provide estimates of the prevalence of these infectious agents in the general population and high-risk groups but are hampered by limited sample sizes (6-8). Screening blood donors for blood-borne infections, particularly HIV, is of paramount importance in determining the prevalence and potential risks associated with such infections in the general population. In addition, this assessment provides valuable scientific evidence to inform the development of blood safety guidelines, policies, and standards (1). To the best of our knowledge, no study has yet been conducted to conduct an epidemiologic assessment in Kabul to determine the prevalence of HIV in the blood donor population, particularly in 2023. Therefore, this study seeks to investigate the seroprevalence of HIV among blood donors in the Kabul Blood Bank Center with a focus on analyzing possible gender differences in infection rates in 2023. The results of this study will shed light on the gender-specific burden of HIV infection among blood donors in Kabul.

Materials and Methods

Study Design

This cross-sectional study is based on retrospectively collected data from the central blood bank of the Afghan National Blood Safety and Transfusion Service. The ANBSTS was established in 2009 under the Ministry of Public Health and oversees all blood bank services throughout Afghanistan (9,10). The study population consisted of potential blood donors who visited the blood banks between January and December 2023. The inclusion criteria for donors were not based on occupation, religion, education level, or ethnic background. Instead, eligibility to donate blood was determined by meeting national criteria, including a minimum weight of 50 kg and an age range of 18–60 years, a hemoglobin level between 12.5 and 16.5 g/dL, a blood pressure in the range of 120/80 mm Hg, no history of hepatitis B or C, and no pregnancy, breastfeeding, or menstruation. The eligible blood donors underwent a behavioral examination, gave their written consent, and donated blood. A donor history questionnaire was completed as part of the behavioral screening. This questionnaire was designed based on the principles of cognitive psychology, with questions divided into specific time periods to help the donor understand and accurately recall relevant risk activities. To assess the donor's suitability for blood donation, additional questions were asked about medication and travel history (1).

Blood Sample Collection

Blood samples were collected from eligible blood donors during routine blood donation procedures, adhering to established protocols to guarantee appropriate handling and minimize the potential for contamination. Each collected blood sample was meticulously labeled with distinct identifiers and transported to the laboratory for subsequent analysis.

Laboratory Analysis

All blood samples collected from the donors underwent extensive testing to detect the presence of anti-HIV1/2 antibodies. The testing procedure involved a series of steps. First, 5 mL of blood was centrifuged from each donor to separate the plasma from the other components of the blood. After plasma isolation, the samples were analyzed using enzymatic immunoassays (ELISA). ELISA is a technique widely used in diagnostics that was developed specifically for the detection of specific antibodies or antigens in a sample. In this case, the ELISA test was utilized to detect the presence of anti-HIV1/2 antibodies in the plasma samples.

Statistical Analysis

The obtained data analyses were analyzed using the Statistical Package for the Social Sciences. Descriptive statistics were used to briefly summarize the demographic characteristics and calculate the overall seroprevalence rates of HIV infection in the blood donor population. A stratified analysis was performed to compare infection rates between male and female donors.

Results

Demographics

The study analyzed 12 445 blood donation samples and showed a clear gender imbalance within the participant population. Of the total participants, 97.9% were male

donors, while only 2.1% were female donors. The age of the participants ranged from 19 to 57 years, with the 30-39 age group being the most represented at 40.4% of the total participants. In terms of the education level, the majority of donors (38.9%) had at least a primary school degree, while a significant proportion had a secondary or higher education degree. In addition, the findings indicated that a notable proportion of blood donors (16.7%) were unemployed. This finding raises important considerations about the socioeconomic factors that influence blood donation behavior. Further, 83.3% of participants reported having a low monthly income, which may impact their ability to contribute to health initiatives such as community blood donation (Table 1).

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To determine the seroprevalence of HIV infection, all participants in the study were tested using the ELISA method. The results of the ELISA tests (Table 2) indicate that a total of 11 people tested positive for HIV infection, corresponding to approximately 0.1% of the total study participants. Of the male HIV patients who took part in the study, a clear majority (63.6%) belonged to the 30–39 age group. This age group had the highest proportion of the HIV-positive population. Within the subgroup of HIV-positive patients, eight people were identified as illiterate, implying that they had received no formal education or had a very low level of education. In addition, nine patients stated that they were unemployed, meaning that they were not currently in paid employment. Furthermore, these patients reported having a low monthly income, demonstrating limited financial resources (Table 3).

Table 1. Sociodemographic Characteristics of the Participants

Description	Frequency (N = 12 445)	Percent
Gender		
Male	12179	97.9
Female	266	2.1
Age		
20-29	1471	11.9
30-39	5031	40.4
40-49	3987	32.0
50-59	1956	15.7
Education level		
Illiterate	3416	27.5
Primary	4841	38.9
Secondary	2201	17.7
High school	1987	15.9
Job status		
Unemployed	2074	16.7
Employed	10371	83.3
Monthly income		
Low	7231	58.1
Intermediate	3432	27.6
High	1782	14.3

Discussion

Monitoring HIV transmission in a population is critical to managing HIV prevalence in that population in order to prevent spread and allocate resources efficiently. Although more than four decades have passed since the beginning of the HIV epidemic, HIV still poses a formidable challenge to global public health (11). Afghanistan struggles with significant difficulties in the availability and safety of blood due to the ongoing conflict, which has led to a humanitarian crisis. The administration of blood and blood components through transfusion is considered a potential source of blood-borne infections that pose a risk to recipients. This study sought to investigate the prevalence of blood-borne infections among blood donors in Afghanistan, covering six years (1). HIV was first documented in Afghanistan in 1989. According to official records, there were 2,923 reported HIV cases in the country in 2019. However, UNAIDS estimates that the actual number of people living with HIV in Afghanistan is around 11 000 (12).

The results of the present study revealed an overall seroprevalence rate of 0.0883% for HIV among blood donors in Kabul, indicating that a small but notable

Table 2. Distribution of HIV Among Blood Donors in Kabul Central Blood Bank (ELISA-based Assay Results)

Description	Frequency (N = 12 445)	Percent
Positive	11	0.0883
Negative	12,434	99.912

Note. HIV: Human immunodeficiency virus; ELISA: Enzyme-linked immunosorbent assay.

Table 3. The Relationship Between HIV Prevalence and Demographic Factors Based on Rapid-based Assay Results

Description	Frequency (N = 12 445)	Percent
Gender		
Male	11	100
Female	0	0
Age		
20-29	1	9.1
30-39	7	63.6
40-49	3	27.3
Education level		
Illiterate	8	72.7
Primary	2	18.2
Secondary	1	9.1
Job status		
Unemployed	9	81.8
Employed	2	18.2
Monthly income		
Low	9	81.8
Intermediate	2	18.2

Note. HIV: Human immunodeficiency virus.

proportion of the blood donor population in Kabul tested positive for HIV. The low seroprevalence rate suggests that the overall blood supply in the context studied was relatively safe, and the risk of HIV transmission through blood transfusion was limited. Interestingly, the study findings demonstrated that no cases of HIV infection were observed among female blood donors. This observation may indicate the presence of sociocultural or gender barriers that may have disproportionately discouraged females from participating in blood donation activities in the studied context. Such barriers could be rooted in social norms, gender roles, or access to health services, which may have limited the representation of women in the blood donor population and subsequently led to a lack of HIV-positive cases among female donors. Another factor that may have contributed to the observed seroprevalence rate is the presence of men in different settings. In Afghanistan, men often have better access to and greater participation in various social, economic, and behavioral activities compared to women. This gender inequality can lead to men being more exposed to potential risk factors for HIV infection, such as unprotected sexual contact, intravenous drug use, or high-risk occupations.

The majority (63.6%) of infected persons were between 30 and 39 years old. This age distribution skews toward middle-aged individuals, possibly reflecting factors such as increased health awareness, availability of time, or a greater sense of civic responsibility in this age group, which may have contributed to their higher proportion in the blood donor population. The preponderance of HIV infections in this age group could also be related to various socioeconomic and behavioral factors common among middle-aged individuals in the setting studied. In addition, a subgroup of patients (72.7%) were identified as illiterate, indicating a lack of formal education among a portion of the HIV-positive population. This finding highlights the potential link between education levels and health outcomes, as lower levels of education may be associated with limited access to health information, lower health literacy, and barriers to seeking appropriate medical care. Moreover, 81.8% of patients reported being unemployed, and the results showed that 83.3% of participants had a low monthly income. These socioeconomic indicators suggest that the blood donor population, including HIV-positive individuals, contained a significant number of individuals from lower socioeconomic backgrounds. This finding may reflect the influence of economic factors, such as financial incentives or the need for additional income, on blood donation participation, particularly in marginalized or disadvantaged communities. Overall, the sociodemographic characteristics of HIV-positive blood donors, including gender distribution, age profile, education level, and socioeconomic status, provide valuable insights into the social and economic factors that may influence the epidemiology of HIV infection within the studied blood donor population in Kabul.

The comparison between the historical data on HIV prevalence and the results of the current study provides valuable insights into the trends and changes in HIV infection rates over time. Examination of the historical data revealed that reported HIV prevalence among blood donors in Afghanistan was 0 from 1996 to 1998 (13) and 2006 (14), suggesting that HIV infection rates were relatively low or undetectable during these years. In the years with available data between 2000 and 2022, prevalence rates were between 0.01% and 0.06%. In 2000 and 2002 in particular, its prevalence was reported at 0.01% with relatively small sample sizes of 6,608 and 15,164, respectively. In 2001, the prevalence increased to 0.06% with 9716 donors (13), indicating a slight upward trend in HIV prevalence during this period. In 2006, the prevalence rate fell again to 0% (14). These lower infection rates reported in earlier years are in contrast to the seroprevalence rate of 0.0883% found in the present study. However, it should be noted that the available historical data are limited. They represent a snapshot of specific years, and there is a lack of detailed information on factors contributing to these fluctuations. Although HIV prevalence in Afghanistan is relatively low in the general population, there are certain subgroups such as drug users, sex workers, and prisoners. A significant proportion of people in Afghanistan under the age of 25 (around 63%) live in a difficult and complex environment characterized by conflict, poverty, and escalating insecurity. These circumstances limit their access to quality education. As a result, this population is more vulnerable to high-risk behaviors such as injecting drug use and unprotected sex with multiple partners. The economic need to meet basic needs has driven some women into prostitution, increasing their vulnerability to HIV/AIDS (15). The risk of HIV/AIDS transmission is exacerbated by the presence of large numbers of refugees within Afghanistan as well as Afghan refugees seeking safety in neighboring countries. These people may have adopted injecting behaviors in their countries of refuge, particularly Iran and Pakistan (16). According to UNAIDS estimates, the total number of people living with HIV in Iran in 2021 was approximately 53 000, including an estimated 17 000 women aged 15 years and older, 35 000 men aged 15 years and older, and 1400 children aged 0-14 years. In addition, the number of AIDS-related deaths in Iran in 2019 was about 2500, with about 2000 of these deaths occurring in men aged 16-40 years (17). Pakistan is estimated to have around 210 000 people living with HIV (18), of whom 210 000 are adults aged 15 years and older, including an estimated 41 000 women and 170 000 men, while the number of children under the age of 15 living with HIV is around 4600 (18, 19). Nearly 2 349 000 people were estimated to be living with HIV/AIDS in India in 2019, with a prevalence rate of 0.22% among adults. Of the total population living with HIV/AIDS, 3.4% were children, while about 44% were females aged 15 years and above (20).

Conversely, inadequate and all-encompassing prevention strategies to effectively curb HIV transmission

and limitations within the health care system, such as limited availability of antiretroviral drugs, counseling, and diagnostic tests, have contributed to inadequate access to comprehensive prevention, diagnosis, and treatment services. The stigmatization associated with HIV/AIDS, both among the general population and medical professionals, exacerbates this problem. In addition, the social exclusion of many people living with HIV and AIDS makes access to appropriate care and support difficult. The cost of HIV/AIDS treatment is estimated to be between US$ 1800 and 4500 per month over a person's lifetime. This places a significant financial burden on middle-class people in Afghanistan, who typically earn an average annual income of USD 18,505 and struggle to afford such costs. Further, low levels of HIV literacy among the general population and key demographic groups, as well as cultural barriers that hinder the dissemination of information and the expansion of prevention efforts, contribute to the existing challenges (15).

Conclusion

This study examined HIV seroprevalence among blood donors in Kabul, Afghanistan, at a rate of 0.0883%. Due to the small sample size of female blood donors, our findings revealed no HIV-positive cases among female blood donors, indicating possible sociocultural or gender barriers. The socio-demographic characteristics of HIV-positive individuals demonstrated that middle-aged donors (30-39 years) were the most affected due to factors such as health awareness, time availability, and civic responsibility. The high proportion of individuals with low education and socioeconomic status also highlights the overlap between socioeconomic vulnerabilities and susceptibility to HIV infection. The findings underline the need for a comprehensive, gender-sensitive approach to tackling the HIV epidemic in Kabul. Targeted interventions should aim to address the barriers women face in accessing and participating in blood donations while addressing the broader social determinants of health that contribute to the disproportionately high burden of HIV in marginalized communities. Further surveillance and research are needed to understand the complex interplay of socio-cultural, economic, and gender factors that influence HIV infection in Kabul.

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Authors' Contribution

Conceptualization.
Data curation: Ehsan Ahadi.
Investigation: Sayed Jawad Asghari.
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Competing Interests

The authors declare no competing interests or conflict of interests.

Ethical Approval

The research adhered to the ethical guidelines and regulations for studies involving human subjects. These guidelines ensure that the rights, welfare, and privacy of participants are protected. Before being enrolled in the study, all participants were given detailed information about the aims of the study, the procedures, and the potential risks or benefits, and their informed consent was obtained accordingly. Strict measures were taken throughout the study to ensure the confidentiality and anonymity of participants' data. These included the use of secure data storage systems, the use of unique identifiers instead of personal identification data, and the restriction of access to the data to authorized personnel.

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