

Prevalence of HIV and Related Factors in Female Prisoners: A Retrospective Cross-Sectional Study



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Abstract:

Background: In most countries, the prevalence of HIV among prisoners, particularly women, is higher than in the general population due to various risk factors both before and during incarceration. This study aims to investigate the prevalence of HIV and its associated factors among female prisoners in Shahr-e Rey in the year 2016.

Methods: This retrospective cross-sectional study was based on file reviews among female prisoners admitted to the quarantine unit of Shahr-e Rey Women's Prison from september 2016 to february 2017. The participants were selected using a convenience sampling method. The study population consisted of women who visited the quarantine unit during the specified period. Data collection was conducted in two phases. First, after obtaining consent, participants were asked to respond to questions posed by the interviewer regarding their age and HIV-related risk factors. Then, a rapid HIV test was used, followed by ELISA and Western blot tests to confirm the diagnosis in HIV-positive patients. The collected data were entered into SPSS software version 26, and quantitative data were reported as mean and standard deviation, while qualitative data were reported as frequency and percentage. The chi-square and independent t-test were used to examine the association between various variables and HIV status.

Results: The prevalence of HIV infection among female prisoners was 1.7%. The prevalence of individual risk factors, including anal intercourse, injection drug use, and having sexual relations with more than one partner in the past six months, were 24%, 0.7%, and 21.6%, respectively. No significant relationship was found between age, history of injection drug use, anal intercourse, or having sexual relations with more than one partner in the past six months and HIV infection (P-value>0.05).

Conclusion: According to the present study, the prevalence of HIV infection among female prisoners is 1.7%, which is higher than that in the general population. This highlights female prisoners as a critical target group both for timely diagnosis and treatment of those infected and for preventing further spread of the infection.

Keywords: HIV, AIDS, Female prison, Injection drug use, Anal intercourse.

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1. INTRODUCTION

HIV is persisting as a significant worldwide health issue, with a predicted 39.9 million [36.1 million–44.6 million] people living with HIV (PLWH) and approximately 1.3 million [1.0 million–1.7 million] globally new infections in 2023 [1]. Despite the progress made in controlling the spread of the virus in many developed countries, the HIV pandemic still affects a large number of people. It takes lives, particularly in developing countries. Contrary to the global trend of decreasing transmission [2, 3], according to global statistics provided by UNAIDS, the number of new HIV infections increased by 116% between the years 2010 and 2023 in the Middle East and North Africa (MENA) region, where Iran is located, while the number of AIDS-related deaths decreased by 6%. It is important to note that, on a global scale, 39% fewer people acquired HIV in 2023 compared to 2010 [4].

The HIV epidemic in Iran currently affects more women than men. Although drug injection is the leading cause of HIV transmission, nowadays, the number of women getting HIV through unsafe sex with their injecting partners is on the rise [5–8].

Some marginalized communities and locations, like prisons, have been referred to as critical populations from a public health perspective due to legislative restrictions, social marginalization, and stigma that make access to health services difficult [9].

The rate of detected HIV infection among federal inmates in prisons in the United States was more than five times higher than the rate among non-incarcerated individuals (2.0%) [10]. The same trend exists in most countries around the world. Therefore, the prison population is separate from other specific groups and is more vulnerable [11, 12]. This is caused by several variables, notable among them being that prisons are high-risk environments with increased exposure to all forms of violence and infectious diseases transmission; triggers for inappropriate sexual behaviors brought on by enclosure and overpopulation, such as issues with access to the health care network; weak epidemiological surveillance; and unprioritized governmental programs intended to combat HIV in this community [13, 14].

Prisons are potential locations for the widespread transmission of HIV within the prison and the community at large due to the high proportion of HIV-positive inmates [15, 16]. This risk makes it even more critical to detect

behavioral high-risk characteristics in prisoners who are at risk of contracting HIV, especially female inmates [17, 18]. Given the average length of incarceration (3 months), the effects of HIV intra-prison transmission extend beyond those previously mentioned prisoners and into the wider community, as well as ex-offender re-entry programs [18].

Assessing and learning about the risks linked to the presence of the virus among particular populations can help recognize trends that can be used to address the concerns raised and the geospatial, socioeconomic, and cultural characteristics associated with the HIV pandemic in different regions of the world. This could result in planned measures intended to address that reality, which is founded on an understanding of its transmission dynamics [11, 19].

As a result, identifying risk factors for HIV transmission that are dealt with in prisons has an impact not only on the inmates but also on larger communities outside the jails [6, 15]. To our knowledge, most studies in the MENA region focused on male inmates, and most of them didn't focus on sexual transmission routes [16]. Understanding the prevalence of HIV and the risk factors associated with it in female prisons is crucial for combatting HIV transmission. The purpose of this study, then, was to provide a comprehensive overview of HIV prevalence and its correlates among Iranian women prisoners, especially in the MENA region.

2. METHOD

2.1. Study Design and Participants

The current study was conducted on 460 female prisoners from September 2016 to February 2017 in the Shahre-Rey Female Prison of Rey County, situated in the 20th district of Metropolitan Tehran, the capital city of Iran. The sample size of this study comprises 458 individuals. Out of the 460 individuals initially assessed, two were excluded from the study due to incomplete records. The individuals, who were female inmates serving out their sentences, were initially taken to the prison's "reception and identification unit (quarantine.)." The following inclusion criteria were used to determine whether inmates from the prison units would be eligible to participate in the study: a female prisoner starting her sentence at Rey prison's reception and identification unit (quarantine). If an inmate had a mental or brain condition like dementia, psychosis, or another specific mental

disorder that prevented them from understanding or responding to the study's questions or if they refused to participate in the survey at the time of data collection, they were excluded from the study. Having an HIV infection, having a history of anal intercourse, having a history of injection drug use, and having a history of sexual intercourse with more than one person in the past 6 months were qualitative variables, and age was a quantitative study variable.

2.2. Process Case Finding and Measurement

Nurses administered the tests between September 2016 and February 2017, and psychologists handled the counselling as part of the data-gathering process. Both groups were proficient in these techniques and had received the proper training. The study was conducted in two back-to-back stages. In the first, pre-test counselling and interviews were conducted on-site in a private room. To gather information on sociodemographic traits, important HIV-related variables, and typical HIV transmission routes (substance use, sexual risk behaviors, partners and condom use, history and treatment of sexually transmitted diseases, tattooing, knowledge and attitudes toward HIV/AIDS, and HIV testing history), all interviewers used a structured questionnaire. They maintained the confidentiality and uniqueness of the data submitted. Rapid HIV-1 and HIV-2 antibody detection testing was done in the second. Two different types of kits, were employed for the testing. Trinity Biotech Uni-Gold TM Recombigen ® HIV (sensitivity of 100% and specificity of 99.8%) gathered blood samples for an HIV rapid test. HIV ELISA screening (Pishtaz Teb, Iran) and Western blot (MP Biomedical Diagnostics, Germany) confirmed positive rapid test results. Each sample contained a label that matched the record form of the data's sequential numerical code.

2.3. Statistical Analysis

The collected data were entered into SPSS software version 26, with quantitative data presented as mean and standard deviation and qualitative data as frequency and percentage. To assess the association between various variables and HIV infection, chi-square, fisher exact test, and independent t-tests were employed.

2.4. Ethical Consideration

The study's population voluntarily signed informed consent forms after the data gathering team made an invitation to the participants. The prisoners were then informed of the research's goals, the advantages of early detection, and the low danger of the quick testing process. Inmates who expressed interest were led by prison officers from their cells in groups of up to five people and taken to the research location. Inmates who had their HIV tested had post-test counselling and were also made aware of the test's findings. The Institutional Review Board (IRB) of Tehran University of Medical Sciences (TUMS) also

approved the study with approval ethical code IR.TUMS.IKHC.REC.1400.428.

3. RESULTS

3.1. Descriptive Results

Among these women, age information was available with a mean age of 35.93, a median and mode of 35, and a standard deviation of 10.08. The participants' minimum and maximum ages were 17 and 70, respectively.

The findings of this study also indicated that, out of 458 female prisoners, 110 (24%) had a history of anal intercourse, while 348 (76%) reported no such history. Additionally, three women (0.7%) had a history of injection drug use, and 455 (99.3%) had no such history. Data analysis further showed that 99 prisoners (21.6%) had engaged in sexual relations with more than one partner in the past six months, whereas 359 prisoners (78.4%) had not. HIV infection was reported positive in 8 women (1.7%) and negative in 450 women (98.3%) (Table 1).

Table 1. Behavioral characteristics among female prisoners, Tehran, Iran, 2016.

Characteristics	n (%)
Having a history of anal intercourse	110 (24)
Having a history of injection drug use	3 (0.7)
Having a history of sexual intercourse with more than one person in the past 6 months	99 (21.6)
Having an HIV infection	8 (1.7)

3.2. Inferential Results

Using the independent t-test, the mean age of individuals infected with HIV was found to be 37 ± 7.85 years, while the mean age of HIV-negative prisoners was reported as 35.93 ± 1.14 years. No significant association was found between age and HIV infection ($P = 0.77$) (Table 2).

According to the chi-square test in this study, the prevalence of HIV infection among those with a history of anal intercourse was 1.8%, while it was 1.7% among those without such a history. No significant association was observed between anal intercourse and HIV infection ($P > 0.9$). HIV infection was not found in any of the individuals with a history of injection drug use, whereas 1.8% of those without a history of injection drug use tested positive for HIV. Again, no significant relationship was found between injection drug use and HIV infection ($P\text{-value} > 0.9$).

The findings also showed that among women who had sexual relations with more than one partner in the past six months, 4% were infected with HIV, compared to 1.1% among those who had not. However, no significant association was found between having multiple sexual partners in the past six months and HIV infection ($P = 0.07$) (Table 2).

Table 2. Age and behavioral characteristics in two groups of female prisoners based on HIV testing.

Characteristics		HIV infection		P-value
		Positive n (%)	Negative n (%)	
Age (mean $\pm$ SD)		8 (37 $\pm$ 7.85)	444 (35.93 $\pm$ 10.14)	0.77
Anal intercourse	Yes	2 (1.8)	108 (98.2)	>0.9
	No	6 (1.7)	342 (98.3)	
Injecting drug use	Yes	0 (0)	3 (100)	>0.9
	No	8 (1.8)	447 (98.2)	
history of sexual intercourse with more than one person in the past six months	Yes	4 (4)	95 (96)	0.07
	No	4 (1.1)	355 (98.9)	

4. DISCUSSION

The present study was conducted to determine the prevalence of HIV infection and its associated risk factors, as well as the relationship between them among female prisoners, a high-risk group. According to the results, the prevalence of HIV infection among female prisoners was found to be 1.7%. According to statistics provided by UNAIDS, the estimated number of women living with HIV in Iran is 15000 [20]. This indicates a higher prevalence of HIV infection among incarcerated women compared to the general population.

Since the start of harm reduction programs, especially methadone maintenance treatment, in Iran, which began in prisons in 2000, the prevalence of HIV in Iranian prisons has gradually decreased, from about 4% in 2000 to about 0.8% in 2024. In addition to harm reduction programs, increasing awareness among prisoners and reducing injection drug addiction have also been effective in reducing this prevalence [21, 22]. The prevalence of HIV in Iranian prisons is lower than in African countries and is almost the same as in developed countries [16].

In this study, the prevalence of specific risk factors for HIV infection, including a history of anal intercourse, injection drug use, and having sexual relations with more than one partner in the past six months, was reported at 24%, 0.7%, and 21.6%, respectively. In comparison, a study conducted by Nakhodian *et al.* in Isfahan in 2012 reported the prevalence of injection drug use among female prisoners as 3.2% (5 out of 158 participants) [23].

In a study previously conducted by Sarman Singh and colleagues on incarcerated individuals in northern India, 240 male prisoners and 9 female prisoners were examined, with ages ranging from 15 to 50 years and an average age of 24.08 Year. Among these individuals, only three men (1.3%) were conclusively diagnosed with HIV-1 based on Western Blot testing, one of whom was an IDU [24]. The results of this study are roughly consistent with our findings, although the gender distribution of the participants is somewhat different.

In the study by Barros *et al.* in Portugal, as well as in the study by Altice *et al.*, the prevalence of injection drug use was reported to be 44% and 22%, respectively [25, 26].

According to a systematic review and meta-analysis conducted by Fazel S. and colleagues in 2015, the pooled

prevalence of substance use disorder among female prisoners was reported to be 51%, with the range across different studies varying between 30% and 69% [27].

There is also a relationship between the reasons for incarceration and the prevalence of HIV, and part of the variance in HIV prevalence across different studies may be attributed to this factor. In a survey conducted in Indonesia by Blogg and colleagues in 2014, 900 men and 402 women were randomly included. The likelihood of HIV infection among individuals incarcerated for the use of illegal substances was nearly six times greater than that of those imprisoned for other reasons [28].

Additionally, among the 402 randomly selected female prisoners, 6% tested positive for HIV, and 6% reported a history of injection drug use. The prevalence of HIV among men was 1.1%, which underscores the importance of monitoring female prisoners [28].

In another study conducted in Indonesia in 2019, among 214 newly admitted female prisoners, 3.7% tested positive for HIV. Of these 214 individuals, 109 were incarcerated for drug-related offenses, while the remaining 105 were imprisoned for various other crimes [29].

In a study conducted in Canada in 2003 and 2015, the prevalence of injection drug use among female prisoners was reported as 42.6% and 26.6%, respectively, while the prevalence of HIV infection was reported as 8.8% and 0.8%, respectively [30].

Since the ultimate functional goal of this study is to reduce the prevalence of HIV infection, the declining trend in HIV prevalence observed in this study is noteworthy. In two other studies conducted in Brazil in 2000 and 2007, the prevalence of HIV infection among participating female prisoners was reported as 9.9% and 13.9%, respectively, while the prevalence of injection drug use was reported as 11% and 9%, respectively [31, 32].

Recent studies conducted in the same country in 2017 and 2020 reported the prevalence of HIV infection among female prisoners as 1.3% and 4.7%, respectively [23, 33]. Here, too, a declining trend in HIV prevalence among female prisoners is observed, which underscores the importance of this study in identifying strategies to reduce the spread of this disease.

In another study conducted in Bolivia in 2018, 219 out of 220 female prisoners participated. In addition to

completing a questionnaire regarding demographic information and risk factors, blood samples were collected for rapid HIV testing and confirmatory testing for the anti-P24 antigen-antibody. Ultimately, 3 out of the 219 female prisoners examined (1.4%) tested positive for HIV, which is comparable to the current study. Furthermore, similar to the present research, the number of sexual partners did not show a significant relationship with HIV prevalence [34].

In the present study, no significant association was observed between a history of injection drug use and anal intercourse with HIV infection. The prevalence of HIV infection among individuals who reported having sexual relations with more than one partner in the past six months was nearly four times higher than that of individuals who did not have such ties in the same period. However, no significant association was found between this variable and HIV infection, with a p-value of 0.07. Notably, the p-value is close to the threshold of significance (p-value = 0.05), which may warrant further attention. Additionally, no significant relationship was found between age and HIV infection.

In the study by Blogg *et al.* in 2014, the risk factors associated with HIV infection among female prisoners included convictions for drug-related offenses, a history of any drug use, a history of tattoos, and positive syphilis testing. Despite the identification of injection drug use as a significant risk factor among men in the same study, no such association was found among women, consistent with the present study. However, in contrast to the current study, an association was observed between age and HIV infection. Women aged 30 years or older were four times more likely to be infected with HIV compared to those under 30 years [28].

In the study by Estrada *et al.*, a significant relationship was found between HIV infection and the following variables: having a sexual partner infected with HIV, injection drug use, multiple sexual partners, and a history of other sexually transmitted diseases. The impact of having multiple sexual partners on the prevalence of HIV infection is consistent with the findings of the present study [32].

In a study conducted in 2007 in Morocco on 217 female prisoners, the average age of the individuals was 32 years. Additionally, in this study, 1.8% of the individuals were IDUs, and 4 (2%) of them were diagnosed with HIV. In this study, being married was identified as a protective factor, while having a large number of partners was considered a positive risk factor [35].

Another study conducted in Brazil linked being over 30 years of age, lower educational attainment, and limited knowledge regarding condom use with the prevalence of sexually transmitted diseases, including HIV [33].

In the study by Altice *et al.*, a relationship was also observed between having a sexual partner infected with HIV and injection drug use with HIV infection, similar to the findings in the study conducted in Brazil [26].

The fact that, unlike the above-mentioned studies,

injection drug use was not identified as a risk factor in our study may be due to the impact of Iran's extensive harm reduction programs, which have been associated with a decline in HIV prevalence since the early 2000s. It could also be due to the sample size. Regarding sexual risk factors, the differences between our findings and those of the aforementioned studies may be attributed to the low baseline prevalence of HIV and subsequently an insufficient sample size.

5. LIMITATIONS

Given that the study was based on file review, demographic information of the prisoners, apart from age, was not available in the records to examine the relationship between these variables and HIV infection. Additionally, other factors influencing HIV infection were not assessed in the prisoners' records. Furthermore, other sexually transmitted diseases were not investigated in this study.

CONCLUSION

According to the present study, the prevalence of HIV infection among female prisoners was 1.7%, which is higher than that in the general population. This highlights the female prisoner population as a target group for timely diagnosis and treatment of those affected, as well as for preventing further transmission of the infection. Moreover, the observed relationship between HIV infection and the risk factor of sexual relations with multiple partners underscores the necessity of educating on methods to prevent infection.

DECLARATIONS

Some parts of this manuscript have been edited for grammar and vocabulary using artificial intelligence (AI).

AUTHORS' CONTRIBUTIONS

The authors confirm their contribution to the paper as follows: study conception and design: S.A.S.A., E.M., B.F.; data collection: M.J., Z.R.A.; draft manuscript: P.M., M.M.R., S.J.; Methodology: S.D., S.A.S.A., B.F.; Data Curation: A.B. All authors reviewed the results and approved the final version of the manuscript.

LIST OF ABBREVIATIONS

PLWH	=	People living with HIV
MENA	=	Middle East and North Africa
IRB	=	Institutional Review Board
TUMS	=	Tehran University of Medical Sciences
AI	=	Artificial intelligence

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The Institutional Review Board (IRB) of Tehran University of Medical Sciences (TUMS) also approved the study with ethical code IR.TUMS.IKHC.REC.1400.428.

HUMAN AND ANIMAL RIGHTS

All procedures performed in studies involving human participants were in accordance with the ethical standards of institutional and/or research committee and with the 1975 Declaration of Helsinki, as revised in 2013.

CONSENT FOR PUBLICATION

Informed consent was obtained from all participants.

STANDARD OF REPORTING

STROBE guidelines were followed.

AVAILABILITY OF DATA AND MATERIALS

All data generated or analyzed during this study are included in this published article.

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CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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