



# Human Immunodeficiency Virus Epidemic among People who Inject Drugs and Female Sex Workers in North Africa: A Systematic Review

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## Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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## ABSTRACT

**Background:** Human immunodeficiency virus (HIV) and acquired immunodeficiency syndrome (AIDS) remain major health problems worldwide, with high mortality and morbidity rates, particularly in developing countries. The United Nations Programme on HIV/AIDS (UNAIDS) reported that there were 38.4 million individuals globally who had HIV. Around 1.5 million new HIV infections were recorded in 2021, while approximately 650,000 individuals worldwide lost their lives due to AIDS-related illnesses. The prevalence of HIV in people who inject drugs (PWID) and female sex workers (FSWs) has not been widely investigated. Information on the epidemiology of HIV infection among PWID and FSWs in North Africa is limited. The aim of the present study was to review the status of the HIV epidemic among PWID and FSWs in North African countries by explaining HIV prevalence. **Methods:** A comprehensive literature search was performed on studies related to the prevalence of HIV infection in PWID and FSWs published between 1990 and 2024 using search engines such as PubMed, Science-Direct, Google scholar. Reports that are entirely on North Africa were considered,

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including studies reporting HIV infection in high-risk groups, particularly PWID and FSWs, with the data organized into a customized database.

**Results:** A total of 3605 records were retrieved in the initial search, 10 relevant records HIV among PWID and FSWs were recognized and included in the study. The overall prevalence of HIV in PWID ranged from 0.15% to 87.1% and 0% to 15.7% in FSWs. Injection drug abuse and women engaged in sex work were commonly associated with HIV infection.

**Conclusion:** The findings of this study showed that the prevalence of HIV among PWID and FSWs in North Africa is high. PWID and FSWs has been identified as the dominant method of transmission in various North African countries like Libya, Egypt, Morocco and Tunisia.

The execution of initiatives designed to improve sanitation infrastructure, elevate educational standards, and enhance socioeconomic situations is crucial for decreasing the prevalence of HIV infections among PWID and FSWs.

**Keywords:** Human immunodeficiency virus; people who inject drugs; female sex workers; North Africa.

## 1. INTRODUCTION

Human immunodeficiency virus (HIV) is a member of the *Lentivirus* genus belonging to the *Retroviridae* family. In 1981, it was identified as the initial cause of the illness now referred to as acquired immunodeficiency syndromes (AIDS) (Gruters et al., 1987; Fauci, 1999). HIV is spread mainly from the body fluids of an infected person, including blood, breast milk, semen and vaginal fluids (World Health Organization [WHO], 2024a). HIV infection is characterized by mild immune system alterations that occur before any symptoms or negative emotions appear. Before seroconversion, which occurs when an individual has just been exposed to HIV, this stage lasts for up to three months after infection. Although the course of an infection and the amount of time it takes for clinical signs to appear might vary widely from person to person, the disease typically advances rather slowly. The onset of progressive HIV illnesses and immunosuppressive symptoms takes several years after the first infection (Naif, 2013). HIV targets cells of the human immune system, such as CD4+ T cells, macrophages, and dendritic cells. CD4+ cells play an important role in maintaining the immune system. Following infection, HIV utilizes CD4+ cells as a host to replicate and infect additional cells. This results in the decrease of CD4+ cells in the body, causing a complete breakdown of the immune system. The progression from HIV to AIDS is monitored by the sharp decrease in CD4+ cells (Yousaf et al., 2011). Chronic HIV infection is causing a deficiency in cellular immunity. The unexpected emergence of opportunistic infections characterizes this final stage of HIV infection. The main contributors to HIV-related morbidity and death are these last ones. The use

of cotrimoxazole and antiretroviruses can significantly lower the frequency of opportunistic infections and increase the life expectancy of HIV patients. The initiation of antiretroviral therapy for an individual with HIV is determined by their level of immune system weakness (Comlan et al., 2017). The sensitive enzyme immunoassays available today can identify antibodies as soon as one to two weeks following infection. Other tests are necessary to support antibody investigation (p24 antigen, PCR), corroborate positive antibody screens (Western blot, PCR), and give clinicians treating HIV- positive patients additional information (qualitative and quantitative PCR, genotyping) (Fearon, 2005). Two types of HIV have been described which are HIV-1 and HIV-2. Globally, HIV-1 infection is the leading cause of the AIDS pandemic, while the emergence of HIV-2 is concentrated in West African countries (Campbell & Gandhi, 2011). At present, HIV infection continues to be one of the most serious global health issues facing humans. According to statistics from the United Nations (UN), the global number of individuals living with HIV in 2021 tallied at approximately 38.4 million. Furthermore, an estimated 1.5 million new cases of HIV infections emerged. Additionally, in 2021, around 650,000 deaths were attributed to AIDS-related illnesses. The UN program on HIV/AIDS estimated that at the end of 2021 there were 20.6 million persons living with HIV infection in sub-Saharan Africa, which is the highest globally. Moreover, the lowest infection was in North Africa and the Middle East; roughly 180,000 individuals were estimated to be living with HIV. Infection with HIV remains a major cause of illness and death in developing nations, including North African countries (UNAIDS, 2022). People who inject drugs (PWID) are at increased risk of HIV; worldwide, about 11 million people inject

drugs, and around 1 in 8 (or 1.4 million) of these people are living with HIV. In addition, 10% of new HIV infections worldwide are due to the use of injection drugs (WHO, 2024b). Globally, sex workers are facing a greater impact from the HIV pandemic (WHO, 2012). Treatment abandonment among patients with HIV infection is a public health issue worldwide. At the end of December 2021, 75% of all people living with HIV were accessing treatment (UNAIDS, 2022). Adherence to antiretroviral therapy (ART) and loss of follow-up impact the prognosis of individuals living with HIV/AIDS in various regions globally (Lima et al., 2018). However, by the end of 2013, the ART coverage level in the North Africa and Middle East region remained the lowest in the world at 11%. HIV-positive individuals who inject drugs and sex workers who have discontinued treatment and follow-up contribute to increased morbidity, mortality risks, and HIV transmission, especially in North African countries (Gökengin et al., 2016). Although HIV/AIDS is a silent and fatal disease, little is known about its infection among PWID and FSW in North African countries. However, having updated literature on HIV prevalence is crucial for tracking the spread of infection and describing the burden on global public health. Hence, the aim of this study was to assess the status of the HIV prevalence among PWID and FSWs in North Africa to help understand the HIV epidemiology in this part of the African continent.

## **2. METHODOLOGY**

Present systematic review summarizes main results of the HIV epidemiology among PWID and FSWs in North Africa. A comprehensive literature search was performed using Pub Med, Science-Direct and Google Scholar, databases for articles published in English from 1990 until 2024. The data included in the present review were primarily conducted in the countries of North Africa. These data sources were recognized through a comprehensive search of pertinent studies and databases. The keywords used to question the databases included HIV in combination with prevalence, "PWID", "FSWs", as well as North Africa and country names. All articles were evaluated for pertinence before inclusion. The review involved all countries contained in the North Africa descriptions of the World Bank and WHO EMRO. These include Algeria, Libya, Egypt, Morocco, and Tunisia. In this article, the North Africa high-risk groups were including people who inject drugs (PWID) as well as female sex workers (FSWs). Eligibility and

evaluation of the studies: Each study was examined and thoroughly assessed for its inclusion in the studies: All the studies were examined and thoroughly evaluated for inclusion in the study. All descriptive/cross-sectional, case-control, and epidemiological studies were included. Letters to the editor, editorials, case reports, hypotheses, studies on animals or cell lines, and unpublished reports were excluded. Studies were eligible for review if they reported HIV epidemiology in PWID and FSW. Therefore, studies reporting the prevalence of HIV in prisoners, man who have sex with man, hemodialysis, HIV in patients with TB or cancer were excluded (Fig. 1). Data extraction: Relevant information from articles reporting the prevalence of HIV and its epidemiology in North African countries were extracted. Data on the number of participants in each eligible study, study country, prevalence of HIV infection population age group, and year of study were collected and classified in divide tables.

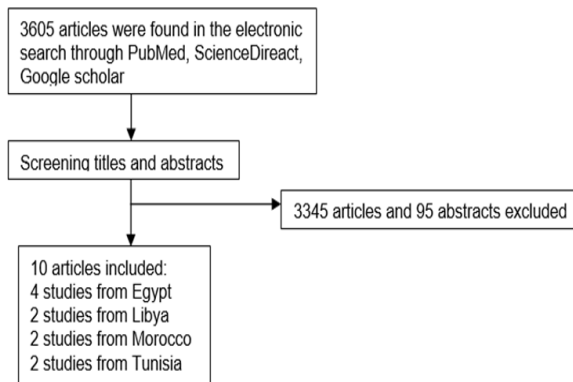
## **3. RESULTS**

A total of 3605 records were identified from three databases. Duplicates studies were identified and removed, leaving 166 potential records, after review of titles and abstracts records were excluded based on selection criteria, and a total of 10 reports on the prevalence of HIV among PWID and FSWs covering 4 countries were included. The review process is presented in Fig. 1.

Seven studies recorded HIV positive among PWID, 5 recorded the HIV positive among FSWs. Sample sizes ranged from 113 to 12,981 PWID, and 69 to 1447 FSWs. PWID and FSWs data were obtainable for 4 of the 5 NA countries. No studies were available for Algeria. Egypt contributed the largest number of data points of HIV prevalence measures where, there were 4 studies from Egypt, 2 from Tunisia, Morocco, and Libya, respectively.

The prevalence of HIV across the key populations such as PWID and FSWs reported by the 10 studies was range between 0 and 87.1%. When divided according to population categories, injecting drugs is a primary way HIV is transmitted globally (WHO, 2024b). Study population HIV prevalence ranged from 0.15% in a study from Egypt to 87.1% in a study from Libya (Table 1). The median HIV prevalence among PWID in all studies was 0.91%. Sexual

hazard behavior associated with HIV infection among FSWs, The country-specific estimate FSWs ranged from 0% in Tunisia to 15.7% in Libya. Egypt and Morocco had a prevalence estimate < 9% (Table 2). The median HIV prevalence among FSWs in all studies was 1.25%.



**Fig. 1. Flowchart of study selection**

Two studies were found in this review that recorded HIV/HCV and HIV/HBV co-infection, prevalence of HIV/HCV and HIV/HBV co-infections among PWID was 83.2% and 3.7%, respectively. Beside, the prevalence of HIV/HCV and HIV/HBV co-infections among FSWs was 3.7% and 0%, respectively.

#### 4. DISCUSSION

HIV infection among PWID and FSWs continues to be a major public health issue worldwide (Mirzoyan et al., 2013). Understanding the epidemiological characteristics of HIV infection are crucial and beneficial in defining the implications and problems of the infection. Injecting drugs is a primary way HIV is transmitted globally (WHO, 2024b). The findings revealed that the HIV prevalence among North African PWID population groups ranged from 0% to 87.1%, This results is higher than the previous estimates of global prevalence (Mathers et al., 2008; Rashti et al., 2020). It is also higher than the findings of studies conducted in Europe (Wenz et al., 2016; Handanagic et al., 2016; Hatzakis et al., 2015), China (Zhang et al., 2007), Bangladesh (Azim et al., 2008) and Brazil (Oliveira-Filho et al., 2020). By contrast, it is relatively low compared with other studies reported from the USA (Peters et al., 2016), and Estonia (Platt et al., 2006). The differences that were noticed in HIV prevalence among studies, nations, and areas could arise from diverse

factors like compliance with prevention methods and variations in community spread. In this study, HIV prevalence among PWID is high in the northern countries of Africa, particularly Libya (Mirzoyan et al., 2013). This occurrence can be ascribed to its geographical positioning, which borders three sub-Saharan nations, along with socio-political challenges that have significantly facilitated the spread of HIV and hindered the adherence to HIV control measures. These results highlight a need for continuing prevention of HIV transmission among PWID.

The HIV epidemic, similar to other epidemics, arises within an intricate social setting. Social norms impacting transmission include sexual behaviors. Between 75 and 85 percent of the approximately 28 million HIV infections that have happened thus far are due to transmission through sexual contact (Royce et al., 1997). Concerning the investigation of HIV and related sexual risk like sex work, this systematic review shows that the HIV prevalence amongst North African FSWs population groups ranged from 0% to 15.7%. These outcomes are similar to numerous other systematic reviews conducted (Paz-Bailey et al., 2016; Leili et al., 2021). However, it is low compared to what is observed in India (Wayal et al., 2011), Kenya (Luchters et al., 2008). Additionally, it is higher than the results of studies conducted in China (Wang et al., 2009), Central America (Soto et al., 2007), and the Democratic Republic of the Congo (Vandepitte et al., 2007).

Women engaging in sex work networks appear to be the main drivers of considerable HIV transmission in Libya, Morocco, and Egypt, which may have been due to the extensive scale of commercial sex networks in these environments, coupled with the elevated levels of hazard manners exhibited within these networks. FSWs and their male clients are at high hazardous for HIV and have been significant in starting the epidemic in many African countries (Hunter, 1993).

The HIV epidemic is very fluid and has expanded quickly; nearly every country worldwide is impacted. However, prevalence investigations have been conducted on a global level to gain understanding of HIV epidemiology. Monitoring prevalence changes is crucial for predicting pandemic evolution and developing a successful public health strategy (Bokazhanova & Rutherford, 2006).

**Table 1. Studies reporting HIV prevalence among people who inject drugs (PWID) across the North Africa**

<b>Study/references</b>	<b>Sampling location</b>	<b>Year of study</b>	<b>Study population</b>	<b>Age group</b>	<b>HIV prevalence among PWID</b>
Anan A et al. (2024)	Egypt	2019-2022	146	11-50	31.5%
Ghrabi A et al. (2018)	Tunisia	2017-2018	113	32-47	10%
Mirzoyan L et al. (2013)	Libya	2010	328	15-≥50	87.1%
Wahdan I et al. (2013)	Egypt	2012	338	<25->45	12.4%
Soliman C et al. (2010)	Egypt	2006	413	18-65	1%
Elmir E et al. (2002)	Morocco	1991-1999	12981	30-≥40	11.1%
Watts DM et al. (1993)	Egypt	1986-1990	1961	Any age	0.15%

**Table 2. Studies reporting HIV prevalence among female sex workers (FSWs) across the North Africa**

<b>Study/references</b>	<b>Sampling location</b>	<b>Year of study</b>	<b>Study population</b>	<b>Age group</b>	<b>HIV prevalence among FSWs</b>
Johnston L et al. (2013)	Morocco	2010-211	1447	18 ≥	8.3%
Valadez JJ, et al. (2013)	Libya	2010	69	15-≥50	15.7%
Wahdan I et al. (2013)	Egypt	2012	338	<25-45+	5.9%
Znazen A et al. (2010)	Tunisia	2007	188	14-≥34	0%
Watts DM et al. (1993)	Egypt	1986-1990	349	Any age	0%

Situation in North Africa and the Middle East regarding HIV/AIDS: according to statistics from the United Nations (UN), around 180,000 people were estimated to be living with HIV, approximately 14000 people became newly infected with HIV. Furthermore, roughly 5100 fatalities were linked to diseases related to AIDS in 2021 (UNAIDS, 2022). Sub-Saharan Africa, this region is the most heavily affected by HIV worldwide, accounting for 52.6 million people living with HIV and 42000 of AIDS deaths in 2021 (UNAIDS, 2022). This region borders North Africa, and many illegal immigrants come from it to north African countries. Therefore, individuals in communities with HIV may not know they are infected or carry the virus, leading to potential transmission to family members or other people.

On the basis of the geographical countries of North Africa, the results indicated that Libya (Mirzoyan et al., 2013), Egypt (Anan et al., 2024), Morocco (Elmir et al., 2002) and Tunisia (Ghrabi et al., 2018), respectively had higher prevalence HIV among PWID. Moreover, prevalence estimates at the country level indicate a high burden of infection in Libya (Valadez et al., 2013), Morocco (Johnston et al., 2013) and Egypt (Wahdan et al., 2013), respectively, among FSWs. The observed variation in the estimates of HIV prevalence among FSWs across various countries may be partially attributed to the diverse risk factors and spread pathways present in each nation. These results emphasize a continuous need for ongoing prevention of HIV spread among FSWs between North African countries.

In Africa, despite the high HIV prevalence, the reported occurrence of HIV infection among PWID and FSWs in North Africa was considerably lower compared with South Africa (Jones et al., 2023; Asher et al., 2013).

The North Africa region is still lacks sufficient HIV epidemiological information, leading to debates regarding the epidemic's prevalence in this part of the globe. It's crucial to have current HIV prevalence data for North African countries to understand the virus's spread. Hence, additional monitoring of HIV prevalence is necessary to evaluate and track the escalating HIV impact (Abu-Raddad et al., 2010).

The environments where the HIV pandemic is happening are becoming more varied. The epidemics are primarily influenced by social,

structural, and population-level risks and protections, which in turn affect the individual risks of HIV infection (Beyrer, 2007).

The field of HIV prevention is constantly changing, and there is now discussion about the potential for worldwide virtual eradication of HIV (Mutevedzi & Newell, 2014). Mitigation of HIV disease strategies will expected be required to decrease HIV prevalence in North Africa, where there might be restrictions on getting health care and accessing resources. The suitable approach can vary from one country to another and additionally have to be justifiably focused on prevention of HIV transmission. While countries must focus on addressing the underlying causes of HIV exposure risk, the main emphasis should be on addressing the immediate factors that increase individuals' risk of HIV exposure, as dealing with structural factors is time-consuming and outside the purview of the public health sector. Hence, there is an opportunity for prevention that should not be missed to control the epidemic in this region (Abu-Raddad et al., 2010). This systematic review offers the latest extensive assessment of HIV prevalence by carefully evaluating existing literature. When interpreting results, it's vital to consider and navigate through various constraints in order to gain a comprehensive and robust understanding of the outcomes. The primary limitations come from the data that is currently available, with a scarcity of studies on prevalence. Despite these limitations, the present systematic review demonstrated that there is a significant burden of HIV infection in PWID and FSWs in most of the North African countries. However, additional investigation is required to fill the knowledge gaps.

## **5. CONCLUSION**

The findings of this report provide a comprehensive overview of the prevalence of HIV among PWID and FSWs. Variation in prevalence of HIV observed in different regions in North Africa. PWID and FSWs has been identified as the dominant method of transmission in various North African countries like Libya, Egypt, Morocco and Tunisia. As the HIV pandemic is still evolving, more studies need to be conducted in this part of the African continent to comprehend the right burden of the illness. Studies in this region need to take into consideration societal and institutional factors. The extensive programs of monitoring of HIV prevalence are necessary to prevent these high-

risk groups from further spreading the infection of HIV. Emphasize health education as a means to reduce prevalence of HIV infections among PWID and FSWs. This review demonstrates epidemiological HIV infection in PWID and FSWs. These data can be used to develop customized strategies for reducing the prevalence of HIV in the North African regions.

#### DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

#### CONSENT AND ETHICAL APPROVAL

It is not applicable.

#### COMPETING INTERESTS

Author has declared that no competing interests exist.

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