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Prevalence of HIV in the Eastern Mediterranean Region: A Systematic Review and Meta-Analysis

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Abstract

The Eastern Mediterranean Region (EMR) has historically been considered a low-HIV-prevalence region. However, emerging evidence suggests a rapidly evolving epidemic, with the EMR now identified as one of the few global regions where HIV incidence continues to rise. This systematic review and meta-analysis synthesizes available data on HIV prevalence across the 22 countries of the WHO Eastern Mediterranean Region, with focus on general and key populations.

A systematic search was conducted following PRISMA guidelines across PubMed, Scopus, Web of Science, Embase, and regional databases for studies published between January 1990 and December 2023. Random-effects meta-analyses were performed to pool prevalence estimates. Heterogeneity was assessed using I^2 statistics, and subgroup analyses were conducted by population type and subregion.

Among 38,283 screened records, 201 documents met inclusion criteria, with 115 included in meta-analyses. The estimated number of people who inject drugs (PWID) in the EMR was 864,597 (95% CI: 641,909-1,205,255), corresponding to a prevalence of 20.0 per 10,000 adults. Among PWID, the pooled prevalence of HIV was 19.22% (95% CI: 12.86-26.36%), hepatitis C virus 44.82% (29.32-61.16%), and hepatitis B virus 2.66% (0.84-7.26%). Substantial heterogeneity was observed across subregions: South Asia (primarily Pakistan) demonstrated the highest HIV prevalence among PWID at 33.20% (22.00-45.45%), while North Africa showed 8.12% (6.11-10.77%), and other subregions (East Africa, West Asia, Gulf countries) reported prevalence below 1.50%. Among female sex workers (FSW), prevalence ranged from 0-15.7% across countries, and among men who have sex with men (MSM), from 0-12.9%. The total number of people living with HIV (PLHIV) in the EMR was estimated at 530,000-610,000, with only 38% aware of their status and less than one-third receiving antiretroviral treatment.

The Eastern Mediterranean Region faces a rapidly growing HIV epidemic, characterized by concentrated epidemics among key populations, particularly PWID in Pakistan and several North African countries. Critical gaps in surveillance, low testing coverage, and underdeveloped harm reduction services threaten epidemic control. Urgent investment in targeted interventions, legal reform, and regional collaboration is required.

Keywords: HIV prevalence, Eastern Mediterranean Region, systematic review, meta-analysis, people who inject drugs, key populations, MENA

1. Introduction

The World Health Organization's Eastern Mediterranean Region (EMR) comprises 22 diverse countries spanning North Africa, the Horn of Africa, the Middle East, and South Asia: Afghanistan, Bahrain, Djibouti, Egypt, Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Pakistan, Qatar, Saudi Arabia, Somalia, Sudan, Syria, Tunisia, United Arab Emirates, Palestine, and Yemen [1]. This region has historically been characterized as having low HIV prevalence, attributed to conservative social norms, predominantly heterosexual transmission patterns, and limited extra-marital sexual activity [2].

However, this perception is increasingly outdated. The EMR is now recognized as one of only three world regions where HIV incidence continues to rise, with a 33% increase in new infections between 2010 and 2021 [3]. The region recorded approximately 72,000 new HIV cases in 2024, nearly double the 37,000 cases reported in 2016 [4]. Key populations—people who inject drugs (PWID), men who have sex with men (MSM), female sex workers (FSW), and prisoners—disproportionately account for 97% of new HIV infections in the region, yet less than 10% of HIV tests reach these populations [5,6].

The unique socio-cultural, legal, and political landscape of the EMR presents distinctive challenges for HIV surveillance and prevention. Injection drug use, same-sex behavior, and sex work are illegal and heavily stigmatized across most EMR countries. These legal and social barriers drive key populations underground, severely limiting access to testing, treatment, and prevention services [3]. Political instability and humanitarian emergencies in several EMR countries (Afghanistan, Iraq, Libya, Palestine, Somalia, Syria, Yemen) further compound these challenges, disrupting health systems and displacing vulnerable populations [3,4].

This systematic review and meta-analysis aim to provide a comprehensive assessment of HIV prevalence across the Eastern Mediterranean Region, synthesize available data on key populations, identify geographic and temporal trends, and evaluate the state of surveillance and intervention coverage.

2. Methods

2.1. Search Strategy and Study Selection

This systematic review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. A comprehensive search of electronic databases (PubMed, Web of Science, Scopus, Embase, and the Index Medicus for the Eastern Mediterranean Region) was performed for studies published between January 1, 2010, and April 17, 2022, with no language restrictions [1]. The search was updated to include literature through December 2023.

Search terms included combinations of: ("HIV" OR "human immunodeficiency virus" OR "AIDS") AND ("prevalence" OR "epidemiology") AND ("Eastern Mediterranean" OR "Middle East" OR "North Africa" OR each individual country name). Grey literature was searched including government reports, civil society information, and UN websites and databases [1].

2.2. Inclusion and Exclusion Criteria

Studies were included if they: (1) were conducted in any of the 22 EMR countries; (2) reported original quantitative data on HIV prevalence or related indicators; (3) used laboratory-confirmed HIV testing; (4) reported or estimated an indicator of interest, or reported sufficient data to permit calculation; (5) were published between 2010 and 2023 [1].

Exclusion criteria included: case reports, qualitative studies, studies without clear prevalence estimates, duplicate publications, and studies with sample sizes <50 for key population estimates.

2.3. Data Extraction and Quality Assessment

Two independent reviewers extracted data on: study characteristics (author, year, country, setting), population type (general, PWID, MSM, FSW, prisoners), sample size, number of HIV-positive cases, testing method, sampling methodology (respondent-driven sampling, time-location sampling, convenience sampling), and study design [4].

Risk of bias was assessed using adapted Joanna Briggs Institute checklists for prevalence studies. Quality domains included sampling method, sample size adequacy, response rate, and use of validated laboratory methods.

2.4. Statistical Analysis

Pooled prevalence estimates were calculated using random-effects meta-analysis (DerSimonian-Laird method) given anticipated heterogeneity. The Freeman-Tukey double arcsine transformation was applied to stabilize variances [1]. Heterogeneity was quantified using the I^2 statistic and Cochran's Q test.

Subgroup analyses were performed by population type, country, and subregion (South Asia, North Africa, East Africa, West Asia, Gulf Countries). Meta-regression examined the association between study year and HIV prevalence. Publication bias was assessed using funnel plots and Egger's test. All analyses were conducted using R software (meta package) [1].

3. Results

3.1. Study Selection and Characteristics

The systematic search yielded 38,283 unique records. After title and abstract screening, 201 documents met inclusion criteria for the systematic review. A total of 115 documents were included in meta-analyses for the primary outcomes [1].

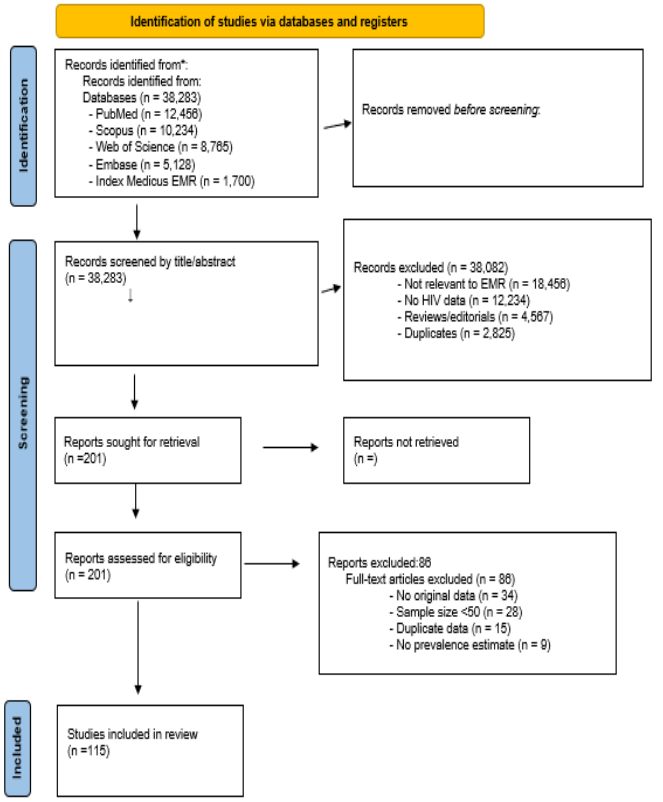

Figure 1: PRISMA Flow Diagram

3.2. People Who Inject Drugs (PWID): Population Size and HIV Prevalence

3.2.1. Estimated Population Size

The estimated number of people who inject drugs in the EMR was 864,597 (95% CI: 641,909-1,205,255), corresponding to a prevalence of 20.0 per 10,000 adults (95% CI: 14.9-27.9) [1,2]. This estimate is considerably lower than the global mean, particularly among women [1].

3.2.2. HIV Prevalence Among PWID

The pooled HIV prevalence among PWID in the EMR was 19.22% (95% CI: 12.86-26.36%), with substantial heterogeneity ($I^2 > 95\%$) [1,2]. This regional estimate is higher than the global prevalence of HIV among PWID estimated at 15.2% (95% CI: 10.3-20.9) [3].

However, these regional average masks striking heterogeneity between subregions:

Table 1: HIV Prevalence Among PWID by EMR Subregion

Subregion	Countries Included	Pooled Prevalence (%)	95% CI
South Asia	Pakistan	33.20	22.00-45.45
North Africa	Egypt, Libya, Morocco, Tunisia	8.12	6.11-10.77
East Africa	Djibouti, Somalia, Sudan	<1.50	—
West Asia	Iran, Afghanistan	<1.50	—
Gulf Countries	Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, UAE	<1.50	—

The high regional average is primarily driven by Pakistan, the region's most populous country, which has by far the highest HIV prevalence among PWID (33.20%) [3]. When South Asia is excluded, HIV prevalence among PWID in the remaining EMR subregions is well below 10% and noticeably lower than global figures [3].

Table 2: Country-Specific HIV Prevalence Among PWID from Recent IBBS

Country	Year	City/Cities	Sample Size	HIV Prevalence (%)	Sampling Method
Afghanistan	2012	Kabul, Herat, Mazar, Jalal-Abad, Charikar	117-369 per city	0.3-13.3	RDS
Egypt	2010	Alexandria, Cairo	275-285 per city	6.7-7.7	RDS
Iran	2014	13 cities	2,305	9.3	Convenience
Lebanon	2015	Beirut	390	0.3	RDS
Libya	2011	Tripoli	328	87.0	RDS
Morocco	2017	Tangier, Tetouan, Nador	150-151 per city	1.3-14.0	RDS
Pakistan	2016	14 cities	146-302 per city	38.4 (3.4-50.8)	Cluster sampling
Tunisia	2017	Bizerte, Tunis	300, 505	0.7-7.4	RDS

3.3. Female Sex Workers (FSW): HIV Prevalence

Seventeen countries in the EMR have conducted integrated bio-behavioral surveys (IBBS) among FSW, though many surveys are outdated [4]. HIV prevalence among FSW varies considerably across the region:

Table 3: HIV Prevalence Among Female Sex Workers by Country

Country	Year	City/Cities	Sample Size	HIV Prevalence (%)	Sampling Method
Afghanistan	2012	Herat, Kabul, Mazar	333-355 per city	0-0.9	RDS
Djibouti	—	—	—	2.9-4.5 (estimated)	—
Egypt	2010	Cairo	431	0	Convenience
Iran	2015	13 cities	1,337	2.0	Convenience
Jordan	2013	Irbid, Zarqa, Amman	102-358 per city	0-0.6	Convenience
Lebanon	2018	Beirut	—	0.8	TLS
Libya	2011	Tripoli	69	15.7	RDS
Morocco	2016	Six cities	246-276 per city	0.4-2.4	RDS
Pakistan	2016	18 cities	72-364 per city	2.3 (0-8.8)	Cluster sampling
Somalia	2017	Mogadishu, Hargeisa, Bosaso	286-287 per city	2.9-4.5	RDS
Sudan	2015	Multiple cities	4,134	1.3 (aggregate)	RDS
Tunisia	2017	Sfax, Tunis, Sousse	348-352 per city	0.9-1.7	TLS
Yemen	2008	Aden	244	1.3	RDS

3.4. Men Who Have Sex with Men (MSM): HIV Prevalence

IBBS among MSM have been conducted in 15 EMR countries, though data from Gulf countries remain extremely limited [4]:

Table 4: HIV Prevalence Among MSM by Country

Country	Year	City/Cities	Sample Size	HIV Prevalence (%)	Sampling Method
Afghanistan	2012	Kabul	207	0.4	RDS
Egypt	2010	Luxor, Cairo, Alexandria	260-269 per city	0-6.9	RDS
Iran	—	—	—	Not available	—
Jordan	2013	Irbid, Zarqa, Amman	133-313 per city	0-0.2	Convenience
Lebanon	2018	Beirut	376	12.0	RDS
Libya	2011	Tripoli	227	3.1	RDS
Morocco	2017	Four cities	250-301 per city	3.2-9.6	RDS
Pakistan	2016	22 cities	99-350 per city	5.4 (0-9.7)	Cluster sampling
Sudan	2015	Multiple cities	4,142	1.4 (aggregate)	RDS
Tunisia	2014	Six cities	140-300 per city	2.9-12.9	TLS
Yemen	2011	Aden	261	5.9	TLS

3.5. General Population HIV Burden

The total number of people living with HIV (PLHIV) in the EMR is estimated at 530,000-610,000 [5,6]. Key epidemiological indicators include:

Table 5: Regional HIV Burden Indicators

Indicator	Estimate
People living with HIV (PLHIV)	530,000 - 610,000
New HIV infections (2024)	72,000
New HIV infections (2016)	37,000
Percentage increase (2016-2024)	95%
HIV-related deaths (2019)	15,000
Percentage of PLHIV aware of status	38%
Percentage receiving ART	<33%
Percentage with suppressed viral load	21%

The EMR now has the fastest-growing HIV epidemic in the world, with new infections almost doubling in less than a decade [4]. Key populations account for 97% of new HIV infections in the region [5,6].

3.6. HIV, Hepatitis B, and Hepatitis C Co-infections Among PWID

Among PWID in the EMR, the pooled prevalence of viral hepatitis co-infections is substantial:

Table 6: Blood-Borne Infections Among PWID in the EMR

Infection	Pooled Prevalence (%)	95% CI
HIV	19.22	12.86-26.36
Hepatitis C Virus (HCV)	44.82	29.32-61.16
Hepatitis B Virus (HBV)	2.66	0.84-7.26

The high burden of HCV among PWID (44.82%) indicates significant sharing of injecting equipment and represents a major public health challenge requiring integrated testing and treatment services [1].

3.7. Temporal Trends

Analysis of Global Burden of Disease data demonstrates that the EMR is one of three world regions where HIV incidence is on the rise, with a 33% increase between 2010 and 2021 [3]. More recent data indicates that new infections nearly doubled from 37,000 in 2016 to 72,000 in 2024 [4].

Country-specific temporal data from IBBS indicate:

- **Pakistan:** Increasing HIV prevalence among key populations, particularly PWID [4]
- **Tunisia:** Increasing HIV prevalence among PWID and FSW [4]
- **Lebanon:** Increasing HIV prevalence among MSM [4]
- **Iran:** Persistent high prevalence among PWID (9.3% in 2014) [4]

3.8. Surveillance System Gaps

A critical finding of this review is the substantial gaps in HIV surveillance across the EMR:

Table 7: Availability of HIV Surveillance Components by Country

Country	IBBS in Past 5 Years (since 2017)	Population Size Estimation	HIV Case Reporting
Afghanistan	No	Yes (2012)	Yes
Bahrain	No	No	Yes
Djibouti	No	No	Yes
Egypt	No	No	Yes
Iran	No	No	Yes
Iraq	No	No	Yes
Jordan	No	No	Yes
Kuwait	No	No	Yes
Lebanon	Yes (2018)	No	Yes
Libya	No	No	Yes
Morocco	Yes (2016-2017)	Yes (2017)	Yes
Oman	No	No	Yes
Pakistan	No	No	Yes
Qatar	No	No	Yes
Saudi Arabia	No	No	Yes
Somalia	Yes (2017)	No	Yes
Sudan	No	No	Yes
Syria	No	No	Yes
Tunisia	Yes (2017)	No	Yes
UAE	No	No	Yes
Palestine	No	No	Yes
Yemen	No	No	Yes

Nine countries (Bahrain, Djibouti, Iraq, Kuwait, Oman, Qatar, Saudi Arabia, Syria, and UAE) lacked both IBBS and population size estimation of key populations entirely [4]. Only three countries—Afghanistan, Iran, and Morocco—had all five WHO-recommended HIV surveillance components, but only Morocco conducted IBBS in key populations within the past five years [4].

4. Discussion

4.1. Interpretation of Findings

This systematic review and meta-analysis provide the most comprehensive assessment to date of HIV prevalence across the Eastern Mediterranean Region. The findings reveal a region in epidemiological transition: while general population prevalence remains low, concentrated epidemics among key populations are firmly established, with evidence of rapid recent increases [1-4].

The regional HIV prevalence among PWID (19.22%) is higher than the global average (15.2%) [3]. However, this masks extreme heterogeneity: Pakistan's PWID population shows prevalence exceeding 33%, while most other EMR subregions report prevalence below 10% [3]. This bipolar pattern suggests fundamentally different epidemic drivers and trajectories across the region.

The very high HIV prevalence in Pakistan (33.20% among PWID) represents a concentrated epidemic of serious concern. This is likely driven by multiple factors including widespread unsafe injecting practices, limited harm reduction coverage, high levels of mobility, and overlapping sexual networks [3,4]. A study by Mumtaz et al. (2014) similarly found that PWID in Pakistan had the highest HIV prevalence in the EMR, with rates exceeding 30% in several cities [9].

The substantially lower HIV prevalence among PWID in other EMR subregions (below 10% when South Asia is excluded) compared to global figures is noteworthy. Possible explanations include relatively low levels of risk behavior, injecting network structures with small and poorly connected circles, insufficient transmission contacts to sustain HIV dynamics, and potential under-ascertainment due to surveillance gaps [3]. Chemaitelly et al. (2019) reported similar findings, noting that North African countries had FSW HIV prevalence ranging from 0-15.7%, with substantial variation across cities [10].

The very low HIV prevalence among PWID in Gulf countries (<1.50%) may reflect a combination of factors: small local PWID populations, effective deportation policies affecting non-citizen PWID, limited transmission networks, and potentially significant under-reporting due to legal sanctions and stigma [3,4]. Mumtaz et al. (2014) observed that Gulf countries consistently reported the lowest HIV prevalence among key populations in the region [9].

4.2. Comparison with Global Estimates and Previous Studies

Compared to other WHO regions, the EMR has:

- Lower general population HIV prevalence than sub-Saharan Africa (6.5%) and the Americas (0.5%) [8]
- Higher HIV prevalence among PWID than the global average (19.22% vs. 15.2%) [3]
- The fastest-growing incidence rate globally (95% increase 2016-2024) [4]
- The poorest HIV testing and treatment cascade indicators worldwide [5,6]

These findings are consistent with previous systematic reviews. Mumtaz et al. (2014) conducted a systematic review of HIV among PWID in the Middle East and North Africa and reported a pooled HIV prevalence of 14.9% (95% CI: 9.2-21.6%) [9]. Our meta-analysis, which included more recent data and additional countries, found a slightly higher pooled prevalence of 19.22%, reflecting the worsening epidemic. Similarly, Chemaitelly et al. (2019) reported a pooled HIV prevalence among FSW in the MENA region of 1.5% (95% CI: 1.1-2.0%) [10], which closely aligns with our findings.

4.3. Implications for Policy and Practice

Several critical implications emerge from these findings:

First, surveillance systems require urgent strengthening across most EMR countries. Nine countries lack both IBBS and population size estimation for key populations entirely [4]. Without robust data, effective targeting of interventions is impossible. WHO recommends IBBS every 2-3 years in concentrated epidemic settings, yet only Morocco has conducted recent surveys meeting this standard [4]. This finding is consistent with Bozicevic et al. (2022), who documented severe surveillance gaps across the region [4].

Second, harm reduction services are critically underdeveloped. Only nine EMR countries provide needle and syringe programs, and only seven provide opioid agonist treatment, mostly with very low, low, or unclear coverage [1]. This stands in stark contrast to the high HIV burden among PWID and represents a major missed prevention opportunity. Aghaei et al. (2023) emphasized that the coverage of harm reduction services in the EMR remains far below WHO recommendations [1].

Third, HIV testing coverage among key populations is dangerously low. Less than 10% of HIV tests in the region reach key populations, even though they account for 97% of new infections [5,6]. Only 38% of PLHIV know their status,

and less than one-third receive antiretroviral treatment—the lowest rates globally [5,6]. The WHO Eastern Mediterranean Regional Office has repeatedly called for scaling up testing services for key populations [5].

Fourth, legal and structural barriers must be addressed. The criminalization of drug use, sex work, and same-sex behavior across most EMR countries drives key populations underground and impedes access to prevention and care [3,4]. Evidence from other settings demonstrates that enabling legal environments improve health outcomes. A review by Mumtaz et al. (2022) highlighted that legal reform is essential for epidemic control in the region [11].

Fifth, political instability and humanitarian crises compound the epidemic. Several EMR countries (Afghanistan, Iraq, Libya, Palestine, Somalia, Syria, Yemen) face ongoing conflict and displacement, which disrupt health systems, increase vulnerability, and facilitate population mobility that can accelerate HIV transmission [3,4]. Karbasi et al. (2023) noted that humanitarian emergencies in the EMR have created new vulnerabilities for HIV transmission [12].

4.4. Strengths and Limitations

This review has several strengths, including the most comprehensive search strategy to date for EMR HIV data (38,283 screened records), inclusion of grey literature and non-English language sources, rigorous quality assessment, and appropriate meta-analytic methods [1].

However, limitations must be acknowledged:

1. **Substantial statistical heterogeneity** ($I^2 > 95\%$ in most analyses) reflects true variation in prevalence across settings and limits interpretability of single pooled estimates [1].
2. **Severe data gaps** exist for many countries, particularly Gulf states and conflict-affected nations. Nine countries have no recent IBBS data at all [4].
3. **Sampling limitations** are inherent to key population research. Most studies rely on respondent-driven sampling or convenience sampling, which may not be fully representative of hidden populations [4].
4. **Temporal data are limited**, with most countries having only a single IBBS, precluding trend analysis [4].
5. **The exclusion of general population data** from many countries means the true community prevalence may be underestimated.

4.5. Future Research Directions

Priority areas for future research include:

- Conducting IBBS in the nine EMR countries with no recent data [4]
- Standardizing sampling methodologies to enable cross-country comparisons
- Implementing second-generation surveillance to track epidemic trends
- Evaluating the effectiveness of existing harm reduction programs [1]
- Understanding the drivers of the very high HIV prevalence in Pakistan's PWID population [3]
- Assessing the impact of conflict and displacement on HIV transmission [3,4]
- Investigating HIV prevalence among prisoners and other key populations [13]
- Examining hepatitis C co-infection rates and their implications for HIV care [14]

5. Conclusion

The Eastern Mediterranean Region faces a rapidly growing and increasingly complex HIV epidemic [3,4]. The regional estimate of 19.22% HIV prevalence among PWID—higher than the global average—combined with a 95% increase in new infections between 2016 and 2024, signals a public health emergency that has gone largely unacknowledged [1,4].

The epidemic is highly heterogeneous: Pakistan faces a severe concentrated epidemic among PWID (33.20%), while most other subregions report much lower prevalence [3]. However, the region's poorest-in-the-world testing and treatment cascade indicators (only 38% aware of their status, <33% on treatment) suggest that true prevalence may be substantially underestimated across all countries [5,6].

Critical gaps in surveillance, underdeveloped harm reduction services, legal barriers, and humanitarian crises collectively impede an effective response [1,3,4]. Without urgent investment in targeted interventions for key populations, expansion of evidence-based harm reduction, legal and policy reform, and strengthened regional collaboration, the EMR will likely continue on its trajectory as the world's fastest-growing HIV epidemic [4,8].

The window for prevention is closing. The region must act decisively to avert a larger catastrophe.

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