REVIEW PAPER

Prevalence of HIV infection among female sex workers in the Eastern Mediterranean Region countries: a systematic review

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Abstract

Female sex workers (FSWs) are one of the groups most affected by human immunodeficiency virus (HIV) infection. In Eastern Mediterranean (EM) countries, HIV prevalence among FSWs is often extremely high. However, no review has been conducted on FSWs in EM countries. The purpose of this systematic review was to estimate the prevalence of HIV infection among FSWs in EM countries.

Articles published on the prevalence of HIV infection among FSWs in EM countries were searched until September 10, 2020. Appropriate keywords were used in Web of Science, Scopus, PubMed, EMBASE, Ovid, and IMEMER databases. References of each paper and conference abstracts were additionally searched. Papers were selected according to inclusion and exclusion criteria.

In total, 21 studies were selected, which were performed in 8 EM countries. The reported prevalence of HIV infection ranged from 0 to 16% among FSWs. The average time women worked as FSWs ranged from 2 to 6 years, and in some papers, FSWs never or rarely used condoms during sexual contact. However, the consistency of using condoms among FSWs was reported as high as 65% in Pakistan, 64% in Lebanon, and 62% In Iran. The prevalence of drug use was high among FSWs, and it ranged from 5% in Pakistan and Sudan, to 91% in Iran and 96.2 % in Egypt. Heterogeneity among the studies and sub-groups was very high, and meta-analysis was not done due to high heterogeneity.

The reported prevalence of HIV infection varied differently among female sex workers' populations in the Eastern Mediterranean Region. More studies are needed from different EM countries.

HIV AIDS Rev 2021; 20, 4: 235-256
DOI: https://doi.org/10.5114/hivar.2021.111233

Key words: Eastern Mediterranean Region, FSWs (female sex workers), HIV infection, prevalence, review.

Introduction

Human immunodeficiency virus (HIV) is still an important public health issue, even though three decades has passed since its emergence. Currently, nearly 36.7 million people live with HIV infection around the world. In 2016, approximately 2.1 million new cases of HIV infections were identified [1]. According to the World Health Organization (WHO), only 19.5 million patients (52%) out of 36.7 million HIV-infected individuals are treated with antiretroviral drugs [2]. One way of HIV infection transmission is sexual contact, and female sex workers (FSWs) are among the at-risk groups [3].

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Article history:
Received: 22.10.2019
Received in revised form: 26.08.2020
Accepted: 30.09.2020
Available online: 25.11.2021

FSWs are usually marginalized and deprived of many things in their living environments, and are perceived as criminals. Therefore, they are more vulnerable to HIV infection [3]. According to the WHO, FSWs are 13.5% more likely to be infected with HIV than other women in the age of fertility. In Asia, this probability reaches nearly 30% [4].

In low- to medium-income countries, the prevalence of HIV infection is estimated to be 12% among FSWs [5]. In the Eastern Mediterranean (EM) countries in 2016, approximately 230,000 people lived with HIV infection, with 21,000 new cases of HIV infection identified, and the prevalence rate was 0.1% among adults [2]. A study indicated that the probable world prevalence of HIV infection ranged from 0.3% in the Middle East and North Africa to 29.3% in sub-Saharan Africa [6]. In 2012, the prevalence of HIV infection was reported 5% in the Middle East and North Africa, in which the infection was mainly transmitted by FSWs [7, 8]. In Morocco, a review study showed that the prevalence of infection was 2% among FSWs, and FSWs played a major role in the transmission of HIV infection in comparison with intravenous drug addicts and homosexual men [9]. According to previous studies, FSWs are exposed to many risk factors, such as having various sex partners, and not using or rarely using condoms [10]. In Libya, the prevalence of HIV infection among FSWs was 15.7%, and it was mainly due to their high number of sex partners and not using condoms [11].

Studies have reported that the frequency of using condoms is higher among customers who pay for sex than those who do not pay for it. Moreover, the prevalence of HIV infection is higher among FSWs who were intravenous drug addicts compared with those FSWs who used non-intravenous drug [12, 13]. Such individuals are usually infected by a common syringe or unprotected sex [14].

Many review studies have been conducted on the prevalence of AIDS in different parts of the world [15-17]. However, no review has been performed on FSWs in the EM countries. The aim of this systematic review was to investigate the prevalence of HIV infection among female sex workers in the EM countries.

Material and methods

Search strategy

In this review, articles published on the prevalence of HIV infection among FSWs in the Eastern Mediterranean (EM) countries until September 10, 2020, were searched. The information was retrieved from both electronic databases and WHO reports [8]. Appropriate keywords were searched in the Web of Science, Scopus, PubMed, EMBASE, Ovid, Google Scholar, and IMEMER (Index Medicos for Eastern Mediterranean Region) databases.

First, the words "Prevalence", "Incidence", and "Frequency" were searched by using an 'OR' operator. In the second step, "Human Immunodeficiency Virus", "Immunodeficiency", "Virus", "Human", "Human Immunodeficiency Viruses", "AIDS Virus", "AIDS Viruses", "Acquired Immune Deficiency Syndrome", and "Acquired Immunodeficiency Syndrome Virus" were searched with 'OR' operators. In the third step, "FSWs" was searched. In the fourth step, the names of 21 Eastern Mediterranean countries were searched through an 'OR' operator. Finally, the searches of previous steps were joined using 'AND' operators to narrow down the results. Additionally, references at the end of each paper were verified. Conferences abstracts were also searched in Scopus, SID, and Embase databases.

Eligibility criteria

The retrieved papers were evaluated, and duplicate papers were deleted by checking the names of authors, publication year, place of study, and sample size. Then, the titles and abstracts of papers were screened according to the inclusion and exclusion criteria to remove irrelevant papers. Later, the entire texts of remaining papers were evaluated. Table 1 demonstrates the flowchart of papers' selection.

The inclusion criteria for the papers included in this review were studies conducted in EM countries, which reported the prevalence of HIV infection among the population, including FSWs who had sex in return for money, drugs, or goods, and their HIV infection had been diagnosed by laboratory tests. Papers that had reported HIV infections based on self-reports, and review papers were deleted. The texts of the papers were evaluated according to STROBE checklist [18]. The items of STROBE checklist were ranked zero (poor), one (medium), or two (good). The poor-quality papers included articles with a total score of 30 or lower. The medium-quality group consisted of the papers with a score between 31 and 35, and the good-quality group included the papers with a score of 36 or higher.

Classification and analysis of published articles

Key information was extracted from the included papers. A test of heterogeneity was performed before meta-analysis. In order to test heterogeneity, χ^2 test and I^2 test were used along with Galbraith chart. In the c^2 test, a small p-value indicated a significant difference in the results of included studies. The I^2 test was introduced by Higgins, and it shows what percentage of differences in study results are due to heterogeneity among the results rather than sampling. Generally, values higher than 50% showed significant heterogeneity among the studies. We assessed the potential for publication bias by using Egger's bias test for regression asymmetry [19]. The Galbraith chart graphically indicates if the results are homogenous by plotting each study's log transferred effect size divided by its SE (Z score) on y-axis and the inverse of SE on x-axis [20]. After observing substantial heterogeneity across the studies, meta-regression was performed to identify potential sources of heterogeneity for years of data collection, and sample size. Sub-group analysis was performed according to years of data collection categories (2010 and before, after 2010), laboratory methods (DBS [dried

Table 1. Key characteristics of female sex workers (FSWs) in the Eastern Mediterranean Region by 2020

Location, author/s, year [Ref.]	Years of data collection	HIV prevalence, *n*/*N* tested, 95% CI	Study design and sampling strategy	Sampling frame	Eligibility criteria	HIV testing method	Demographics	Proportion with any drug use	Setting and characteristics of sex workers	Research quality (score)	
Iran											
Iran Mirzazadeh *et al*., 2014 [14]	2010	4.5% (37/817) 95% CI: 3.1-5.9	Study design: national survey	FSWs seeking routine services at each recruiting site[a,b] were selected	• Age ≥ 18 years • Selling sex for money, drugs, or goods in the last 12 months • A history of doing sex work for at least 6 months	Dried blood spot (DBS) specimen	Mean age: 31.6 years Education: illiterate – 14.7%, university degree – 4.3% Mean age at first sex: 24.9 years Mean age at commercial sex: 24.9 years	• Using illicit drugs (69.6%) and injecting drugs (37.6%)	• Mean number of sexual contacts with both commercial and non-commercial partners in the last 7 days was 3.8 (95% CI: 2.8-4.8) • On average, condoms were used in 2.9 (95% CI: 2.2-3.6) of contact • FSWs sold sex for a mean of 3.7 days (95% CI: 3.1-4.3) a week Number of clients in last 7 days were 2.3 clients	Average	32
Iran, Kerman Navadeh *et al*., 2012 [24]	2010	0 (0/139)	Study design: cross-sectional Sampling strategy: respondent-driven sampling (RDS)	FSWs were recruited through 12 seeds[c]	• Having more than 18 years • Selling sex for at least 6 months during their life • Having at least one sexual contact with clients in the recent 12 months	Serum specimens	Age group: < 20 years – 4.5%, 20-29 years – 60.2%, ≥ 30 years – 35.3% Mean age at first sex: 17.35 years	• Almost 18% of FSWs had used injected drugs	Average years working as FSW was 3.05 years In last week, mean number of clients was 3 persons 36% of participants had a history of STIs in the last year Non-condom use in the last sexual act with paying and non-paying partners was reported as 17% and 22%, respectively	Average	34

Table 1. Cont.

Location, author/s, year [Ref.]	Years of data collection	HIV prevalence, *n/N* tested, 95% CI	Study design and sampling strategy	Sampling frame	Eligibility criteria	HIV testing method	Demographics	Proportion with any drug use	Setting and characteristics of sex workers	Research quality (score)	
Iran											
Iran, 14 cities Sajadi *et al.*, 2013 [13]	2010	3.7% (30/817); 95% CI: 2.3-4.9	Study design: national survey Sampling strategy: convenient sampling	Selected FSWs were selling sex for money, drugs, or goods in the last 12 months; a history of doing sex work for at least 6 months	• Age ≥ 18 years • Selling sex for money, drugs, or goods in the last 12 months • A history of practicing sex work for at least 6 months	Dried blood spot (DBS) specimen	Mean age (SD): 31.8 (9.1) years Age at first commercial sex: ≤ 15-47 (7.7), 16-20 – 223 (28.8), 21-25 – 216 (25.9), ≥ 26 – 313 (37.6)	• Almost 20.5% of FSWs had intravenous drug injection • Almost 26.6% of participants were active injecting drug users • The percentage of FSWs who reported high-risk injection (i.e., shared syringes or equipment) at their last injection was 11.6%	• Almost 22.1% of FSWs had never used condoms • Nearly 37.6% of FSWs had more than 26 years at first commercial sex	Good	37
Iran, Shiraz, Kazerooni *et al.*, 2013 [23]	2010-2011	4.7% (13/278); 95% CI: 2.2-7.2	Study design: national survey Sampling strategy: respondent-driven sampling (RDS)	FSWs were selected through 14 seeds with maximum eight waves	FSWs who were 17 years or older performed sexual intercourse for money, drugs or other goods for at least six months during their life-time or at least once within the last 12 months	Serum specimens	Age group: < 20 years – 7.3%, 20-29 years – 30.8%, ≥ 30 years – 61.9% Age at first intercourse: ≤ 15 years – 40.7%, > 15 years – 59.3% Age at first commercial sex: ≤ 15 years – 5.7%, > 15 years – 94.3%	• Drug abuse and injecting drugs was 69.6% and 16.4%, respectively • Almost 4.3% of IV drug users, used unsterile needles • 44% of FSWs used drug and alcohol together; 13.7% of them only used alcohol	• More than half of FSWs used condom with clients during last sex • Condoms were used occasionally by 30.1% of FSWs • FSWs reported having vaginal sex (91%), anal sex (7%), and oral sex (16.2%) in previous month • FSWs reported abnormal genital discharge (72.2%) and genital ulcers (18.5%) during the previous year	Good	36

Table 1. Cont.

Location, author/s, year [Ref.]	Years of data collection	HIV prevalence, n/*N* tested, 95% CI	Study design and sampling strategy	Sampling frame	Eligibility criteria	HIV testing method	Demographics	Proportion with any drug use	Setting and characteristics of sex workers	Research quality (score)	
Iran											
Iran, Tehran Moayedi-Nia *et al.*, 2016 [34]	2012-2013	5% (8/161) 95% CI: not mentioned	Study design: cross-sectional Sampling strategy: respondent-driven sampling (RDS)	Not reported	Sex trading during the 12 months prior to this study, and selling sex for at least 6 months in participants' life-time	Dried blood spot (DBS) specimen	Mean age (SD): 37.43 (8.9) years Mean age (SD) of first sex: 16.3 (3.6) years Mean age (SD) of first commercial sex: 27.5 (9.5) years	• About 90.7% of FSWs used drugs at least once in their life-time • Of these, 55.9% were active drug users at the time of participation • Methamphetamine was the most prevalent drug used • Among active drug users, 25.5% reported injecting drugs intravenously at least once in their life-time	• Among FSWs who traded sex within seven days prior to the interview, the average number of clients was 4.9 (SD ± 7.7); • 65.2% of FSWs reported using a condom with their prior client, while only 49% reported using condoms with their significant other clients, respectively; • Approximately three-fifth of FSWs had contracted at least one sexually transmitted infections (STIs) symptom over the one year prior to the study; • 32.9% of FSWs reported being tested for HIV in 12 months prior to this study, and knew the results of the test; • HIV-infected FSWs were significantly more likely to test positive for HS type 1/ type 2 (75% vs. 35.9%) than HIV-negative FSWs; HIV-positive participants were significantly younger than HIV-negative participants (31.25 ± 8.2 vs. 37.75 ± 8.8); • History of having at least one of STIs symptoms in 12 months prior to the study has been found significantly more frequent among HIV-positive participants (100% vs. 59.6%)	Bad	22

Table 1. Cont.

Location, author/s, year [Ref.]	Years of data collection	HIV prevalence, *n*/*N* tested, 95% CI	Study design and sampling strategy	Sampling frame	Eligibility criteria	HIV testing method	Demographics	Proportion with any drug use	Setting and characteristics of sex workers	Research quality (score)	
Iran											
Iran, Sari Taghizadeh *et al*., 2015 [27]	2014	4% (6/154) 95% CI: 0.84-6.95	Study design: cross-sectional Sampling strategy: census	Female SWs participated in the DIC	Eligibility criteria: not reported	Serum specimens tested with rapid test	Median age: 33 years (range, 19-54)	Almost 59% of participants were drug users The percent addicted to Iranian crack or heroin, opium and methamphetamine, only methamphetamine, and methamphetamine with alcohol among FSWs were 16%, 16%, 25%, and 13%, respectively 1.1% of FSWs were intravenous drug users	Almost 61%, 44% of FSWs had candidiasis, cervicitis, respectively 62% of them regularly used condoms Number of sexual acts per day was from 1 to 3 Forty eight percent of FSWs consumed psychiatric drugs	Average	32

Table 1. Cont.

Location, author/s, year [Ref.]	Years of data collection	HIV prevalence, *n*/*N* tested, 95% CI	Study design and sampling strategy	Sampling frame	Eligibility criteria	HIV testing method	Demographics	Proportion with any drug use	Setting and characteristics of sex workers	Research quality (score)	
Iran											
Iran, 13 cities Shahesmaeili *et al.*, 2018 [35]	2015	2.1% 95% CI: 0.9-4.6	Study design: cross-sectional Sampling strategy: not reported	Women who came to the non-governmental organizations and sexually transmitted disease clinic	Iranian women aged ≥ 18 years who resided or worked in the city Women who self-reported having vaginal, anal, or oral sex with more than 1 male client in exchange for money, goods, drugs, or a favor during the previous year	Serum specimens tested with rapid test	Mean age (SD): 35.6 (9.3) years Education: illiterate – 10.1%, university degree – 6.3% Median age at first sex: 17 years Median age at first commercial sex: 25 years	Not reported	Only 32.9% of women reported consistent condom use Nearly 49% of FSWs had at least 1 STI The prevalence of laboratory-based of STI: syphilis – 0.4%, gonorrhea – 1.3%, *Chlamydia* – 6%, trichomoniasis – 11.9%, HPV – 41.9%	Bad	30

Table 1. Cont.

Location, author/s, year [Ref.]	Years of data collection	HIV prevalence, *n*/*N* tested, 95% CI	Study design and sampling strategy	Sampling frame	Eligibility criteria	HIV testing method	Demographics	Proportion with any drug use	Setting and characteristics of sex workers	Research quality (score)	
Iran											
Iran, Tehran Karami et al., 2017 [28]	2016	4.6% (17/214) 95% CI: not reported	Study design: cross-sectional Sampling strategy: convenient sampling	All FSWs registered through trained researchers and peer health educators	Eligibility criteria: not reported	Not reported	Age group: < 15 years – 0.8%, 15-24 years – 22.5%, 25-39 years – 45.5%, ≥ 40 years – 31.1%	Not reported	More than 89% of participants engaged in sex prior to age 20 About 43.9% of participants did not use condom in the last sexual contact 8.67% of them never used condom during sexual intercourse About 23.58% of them had sex with IDUs	Average	31
Pakistan											
Pakistan, Karachi Baqi et al., no date [36]	1993-1994	1.23% (1/81) 95% CI: –1.17 to 3.63	Medical clinic in Karachi was established All FSWs registered in this clinic were enrolled	Females who worked as CSWs any time within the past 10 years and were registered at a medical clinic established from 1993-1994	Females who worked as a CSW (commercial sex worker) any time within the past 10 years who were registered at a medical clinic from 1993-1994	Serum specimens	Mean age: 30 years (range, 10-50) Illiteracy rate: 78% Mean age at first sex: 14 years	Not reported	9% of FSWs rarely used condoms 27% of them had a medical history of STI 30% of FSWs had pelvic inflammatory disease	Bad	27

Table 1. Cont.

Location, author/s, year [Ref.]	Years of data collection	HIV prevalence, *n/N* tested, 95% CI	Study design and sampling strategy	Sampling frame	Eligibility criteria	HIV testing method	Demographics	Proportion with any drug use	Setting and characteristics of sex workers	Research quality (score)	
Pakistan											
Pakistan, Karachi and Lahore Bokhar et al., 2007 [37]	2004	0.24% (2/827) 95% CI: –0.09 to 0.57	Study design: cross-sectional Sampling strategy: cluster sampling	Women who were engaged in selling sex at least once in the past three months	Women who were engaged in selling sex at least once in the past three months	Serum specimens	Mean age, median (range): Karachi: 35 (15-66), Lahore: 35 (15-70)	Almost 1.4% of FSWs had injected drugs during the last 12 months	More than half of FSWs had had a one-time client during the last week Almost 81.7% of FSWs had regular clients during the last week Nearly more than a quarter of FSWs used condom during vaginal sex with the last one-time client Condom use among FSWs with last regular client during vaginal sex was 37%	Bad	28
Pakistan, Karachi, Hyderabad, and Sukkur Altaf *et al.*, 2012 [39]	2005-2006	0.26% (3/1,158) 95% CI: –0.03 to 0.55	Study design: cross-sectional Sampling strategy: snowball sampling	Any female who undertook sexual activity with a man for money or other financial benefits irrespective of the site of operation, i.e., street, call girls, brothel, or home, was classified as an FSW	Females that were between 15-45 years old and were willing to participate	Dried blood spot (DBS) specimen	Mean (SD) age: 27.3 (6.7) years	In the past six months, 15% of FSWs, used injection for taking illicit drugs	Almost 27.9% of FSWs used condoms at last sexual act	Average	35

Table 1. Cont.

Location, author/s, year [Ref.]	Years of data collection	HIV prevalence, *n*/*N* tested, 95% CI	Study design and sampling strategy	Sampling frame	Eligibility criteria	HIV testing method	Demographics	Proportion with any drug use	Setting and characteristics of sex workers	Research quality (score)	
Pakistan											
Pakistan, Lahore Khan *et al.*, 2011 [22]	2007	0.7% (5/730)	Study design: cross-sectional Sampling strategy: respondent-driven sampling (RDS)	FSWs in three areas (referred to as "A", "B", and "C") of Lahore. In "Area A", FSWs were "home-based". In areas "B" and "C", FSWs were "kothi-khana"-based	Not reported	Serum specimens	Median age: 30 years (range, 13-50)	Three participants (0.4%) reported injecting drugs, and one among these reported sharing needles or syringes in a group	The prevalence of *T. pallidum*, *N. gonorrhoeae*, *C. trachomatis*, and *T. vaginalis* were 4.5%, 7.5%, 7.7%, and 5.1%, respectively FSWs had been selling sex for a median period of seven years, and had a median of three clients per day Sixty-five percent of the participants reported that they "Always use condom" Ninety-one percent of the participants cited poverty and financial reasons for reason to start selling sex Almost all participants (99%) said that they continued to sell sex for economic survival	Good	38
Pakistan, Punjab, Sind, Khyber, Pakhtun-khwa, Baluchi-stan Emmanuel *et al.*, 2013 [41]	2011-2012	0.8 (35/4,298) 95% CI: 0.5-1	Study design: 4 rounds of SGS[a] conducted in 20 cities Sampling strategy: systematic random sampling	Brothel-based FSWs, street-based FSWs[b], kothi-khana FSWs[c], and home-based FSWs[d]	Eligibility criteria: not reported	Dried blood spot (DBS) specimens	Mean age (SD): 26.9 (6.4) Duration of sex work (SD) (years): 5.3 (6.6) years Mean age (SD) at first sex: 21.9 (5.6) years	In the past 6 months, 4.9% of FSWs used injecting drugs	Condom use was lower when the sexual partner was a non-paying regular partner	Average	34

Table 1. Cont.

Location, author/s, year [Ref.]	Years of data collection	HIV prevalence, *n*/*N* tested, 95% CI	Study design and sampling strategy	Sampling frame	Eligibility criteria	HIV testing method	Demographics	Proportion with any drug use	Setting and characteristics of sex workers	Research quality (score)	
Pakistan											
Pakistan, Faisalabad Waheed *et al.*, 2017 [38]	2015-2016	9.6% (37/387) 95% CI: 6-12	Study design: cross-sectional Sampling strategy: respondent-driven sampling (RDS)	FSWs of brothels, hair/beauty salons, hotels, and private homes were enrolled	FSWs involved in commercial sex for money or goods during the past 2 months FSWs were ≥ 16 years old	Serum specimens	Median (range): 22.5 (17-35) years	Not reported	About 32.7% of FSWs had syphilis infection HIV as co-infection was in 20% of FSWs	Bad	30
Sudan											
Sudan, Khartoum Abdelrahim, 2010 [34]	2008	0.9% (3/321) 95% CI: –0.12 to 1.98	Study design: cross-sectional Sampling strategy: respondent-driven sampling (RDS)	FSWs were recruited through seeds	Paid for sex during the last 3 months Age: 18-49 years Living in Khartoum State at least for 1 year	Dried blood spot (DBS) specimen	Mean age, SD: 18-22 years – 32.2, 23-27 years – 35.7, 28-32 years – 15.1, 33-37 years – 8.7, ≥ 38 years – 8.3 years Age at first sex: ≤ 14 – 21.6%, 15-18 years – 45%, ≥ 19 years – 33.4%	Not reported	More than half of FSWs had their first selling sex in 19-25 years; Forty-four percent of FSWs were in sex work for 2-4 years; In the last 30 days, 36% of participants always used condoms with clients; The three most common reasons for not using a condom at last commercial sex were: Did not think of it (34.3%); Partner refused (21.8%); Using of other contraceptive methods (18.8%)	Average	
Sudan, 14 states, (names of states not reported) Elhadi *et al.*, 2013 [38]	2011-2012	1.53% (63/4,049) 95% CI: 1.1-1.9	Study design: national survey Sampling strategy: respondent-driven sampling (RDS)	FSWs were selected through 8 to 14 seeds in RDS sites	15-49 years old, lived or worked in the area, sold sex or exchanged sex for goods in the last 3 months	Serum specimens	Median age per site: 21-28 years Started selling sex at less than 18 years of age (range): 3.3-50.1%	Almost 5% of FSWs had injected drugs	Condom used at last sex with a client varied from 4.7% to 55.1%	Good	

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Libya											
Libya, Tripoli, Valadez et al., 2013 [11]	2010	15.7% (11/ 69) 95% CI: (0.73-25%)	Study design: Cross-sectional Sampling: Peer-driven chain-referral method of RDS	Females were over 15 years and earned all or part of their income through the exchange of money for vaginal or anal sex	Participants had to be born females; They had earned all or part of their income through the exchange of money for vaginal or anal sex with more than one client in the last six months. Participants had to be ≥ 15 years old; They had to have a valid referral coupon;	Serum specimens	Age group: 15-29 years, 53.6% 30-50 years, 42.03% > 50 years, 0.04% Country of origin: Libya (12.4%); Abroad (87.6%)	None of the FSWs had ever injected drugs or consumed alcohol	Almost 8.2% of FSWs had sex during the past year; 42.8% of FSWs had 10–50 sex partners during the past six months and 30.5% of them had 50 or more; 63.4% of FSWs reported consistent condom use during sex with one-time clients, and 56.8% during sex with regular clients; 27.8% of FSWs experienced STI symptoms in the past year;	Good	37
Lebanon											
Lebanon, Beirut, Mahfoud et al., 2010 [32]	2007-2008	0% (0/ 135)	Study design: Cross-sectional Sampling: Respondent-driven sampling (RDS)	Women who had sold sex, within the past 12 months	Residents of Lebanon; ≥ 16 years old; Engaged in an HIV risk behavior within the past 12 months	Serum specimens tested with rapid test	Age group: 16–24: 42% ≥25years: 58% Age at first sexual intercourse (years): 11–15 years, 36% (45/ 134); 16–17 years, 27% (35/134); ≥ 18 years, 37% (54/ 134)	None of FSWs had ever injected drugs	In the last month, 97% of FSWs had sold sex; Majority (96%) of them had five or more clients in the last month; 48% of FSWs had used condoms with their non-commercial partner; Almost 92% and 98% of FSWs stated that they used a condom in the last time for regular male clients and no regular male client, respectively; Sixty-four percent of the respondents stated they always use condoms with their non-commercial partner	Average	34

Table 1. Cont.

Location, author/s, year [Ref.]	Years of data collection	HIV prevalence, *n/N* tested, 95% CI	Study design and sampling strategy	Sampling frame	Eligibility criteria	HIV testing method	Demographics	Proportion with any drug use	Setting and characteristics of sex workers	Research quality (score)	
Egypt											
Egypt, Greater Cairo, Kabbash et al., 2012 [33]	2009-2010	0% (0/ 431)	Study design: Cross-sectional Sampling strategy: Convenience sampling	Street FSWs; FSWs at bars and night clubs; Dancers; FSWs at brothels; FSWs at coffee houses; FSWs at hotels	Participants needed to be residents of Lebanon; At least 16 years old, women who had sold sex, within the past 12 months;	Serum specimens	Mean age: 29.38 years (median, 27 years) Mean age (SD) at first sex: 22.28 years (median, 6.66) years. Duration of sex work (years): Range, 1–35; Mean (SD), 6.32 (6.42); Median, 4.0	Abuse of hashish was (96.2%) by FSWs; Injecting drug abuse was 5.6% among FSWs in the last year	15.5% of FSWs had genital ulcers; 22.4% of FSWs had used condoms with the last client; In the past month,32.8% of participants had used condoms; The main reasons for not using male condom were: Not thinking about it (40.6%) Client refused (20.5%) Do not like it (19.3%) Using another contraceptive method (13.5%)	Average	33
Aphganistan											
Afghanistan, Jalalabad, Kabul, and Maser–Sharif, Todd et al., 2010 [40]	2006-2008	0.19% (1/ 520) 95%CI: (-0.18-0.56%)	Study design: Cross-sectional Sampling strategy: Convenience sampling	Only individuals previously identified as SWs through outreach or other prior programs were considered for participation	Reporting sex work within the past six months; Able to provide informed consent; Aged 18 years or greater	Serum specimens	Median age: 29 years; Mean age (SD) at first sex: 23.3 years (5.1)	Using illicit drugs, alcohol, and injected drugs among FSWs was 6.9%, 4.7% and 0.4%, respectively	More than half of FSWs had ever used a condom; In the last 6 months, 38.2% of participants used condoms with clients; 29.8% of FSWs reported genital sores, warts, or itching; 75% of them worked as a sex worker at least for 5 years	Average	33

Table 1. Cont.

Location, author/s, year [Ref.]	Years of data collection	HIV prevalence, *n/N* tested, 95% CI	Study design and sampling strategy	Sampling frame	Eligibility criteria	HIV testing method	Demographics	Proportion with any drug use	Setting and characteristics of sex workers	Research quality (score)	
Somalia											
Somalia, Hargeisa, Somaliland, Kriitmaa et al., 2010 [25]	2008	5.2% (13/ 237) 95%CI: (2.5-8.5%)	Study design: Cross-sectional Sampling: Respondent-driven sampling (RDS)	Women who had sold sex, within the past 3 months	Respondents had to be 14 years or older; Having exchanged sexual intercourse (vaginal and/ or anal) for money, a gift, or a favor in the past 3 months; FSWs were currently living and trading sex in Hargeisa, and were able to give informed consent	Serum specimens	Age group: 15-19 years, 6.9%; 20-24 years, 18%; 25-29 years, 33.5%; 30-34 years, 7.7%; 35-39 years, 23.7%; > 40 years, 8.9% Education: Never attended school, 86.6%; Attended some primary, 0.7%; Completed primary, 12.7%	No injecting drug use was reported	The prevalence of syphilis was 3.1%; Co-infection with HIV and syphilis occurred in one woman (0.4%); Over two-thirds (67.4%) of FSWs reported 2–4 transactional sex clients in the past 7 days; Less than one-quarter (24.0%) of FSWs reported using a condom at last transactional sex; Only 4.3% of them reported consistent condom use with clients over the past 1 month; 24% did use a condom at last sexual intercourse with a client; Self-report STI symptoms (genital discharge, genital ulcer, or sore) in the past 12 months among FSWs was 7.8%; Almost one-third (29.5%) of FSWs reported the reason for not using a condom with a client was due to not knowing where to obtain condoms; At last sex with a non-transactional partner, 1.8% of FSWs reported using a condom, a considerably lower proportion than with clients	Average	31

[a] - *second-generation surveillance;* [b] – *those who solicit clients in public places through cruising sites or pick-up points;* [c] – *those who live in small premises/houses rented by a network operator and entertain clients;* [d] - *sex workers who live at home with their families and are involved in covert sexual activities through contacts with network operators*

[e] - *seeds had strong social networks with the population of FSWs in the city, and had good collaboration with the interview site staff*

blood samples] and serum groups), and sample size categories (387 and lower, over 387). Stata version 11 (Stata Corp., College Station, TX, USA) was used to analyze the data.

Results

In this study, 156 papers were retrieved by searching the databases, conference abstracts, reference lists, and reports published by the WHO. Eventually, 21 papers were selected for the review (Figure 1). Table 1 shows the information extracted from these 21 papers, in which 17,205 FSWs were investigated.

The results of quality assessment revealed that 5 (23.8%) studies were of good-quality [11, 13, 21-23], 11 (52.4%) were of medium-quality [5, 24-33], and 5 (23.8%) were of poor-quality [34-38].

The study designs of 16 papers were cross-sectional [11, 22, 24, 25, 27, 28, 31-40], and the rest of them were national surveys for AIDS [13, 21, 23, 26, 41]. Out of 21 Eastern Mediterranean countries, only 8 countries had conducted studies on the prevalence of HIV infection among FSWs. The majority of these studies were conducted in Iran [13, 23, 24, 26-28, 34, 35] and Pakistan [22, 29, 30, 36-38].

Moreover, 13 papers were exclusively about FSWs [13, 21, 23-25, 27-29, 31, 33-35, 40], and the rest of them classified FSWs as a sub-group of the population under study [11, 32, 36-38, 41]. Nearly 16 papers had been published in the last 10 years [11, 13, 21-24, 26-28, 30, 33-35, 38-40].

In 11 studies included in this systematic review, the average age of FSWs was 30 and lower [11, 21, 22, 24, 25, 31, 33, 38-41]. FSWs had different education levels, and more than a quarter of FSWs had elementary or junior high school education in 11 papers [11, 13, 21, 23, 24, 26, 27, 31, 33, 35, 37]. Moreover, in other studies, more than half of FSWs were illiterate [22, 25, 30]. The rest of the papers had not reported education levels [28, 34, 36, 38, 39].

The onset age of sexual contact had not been reported in 12 studies [5, 13, 21, 23, 24, 26, 30-36]. Studies reported that the mean age of FSWs at first sex was after 15 years [13, 23, 31, 36], before 18 years [21, 34, 35], at 18 years [24], 22 ± 5.6 years [30], 23 ± 5.1 years [33, 40], or 25 years [26]. The average time, in which women worked as FSWs ranged from 2 to 6 years in five studies [21, 26, 27, 32, 36, 40]. Some other papers reported the frequency of genital infectious diseases [11, 22, 24, 25, 34-36, 38], candidiasis and cervicitis [27], genital ulcers [23, 33, 40], and pelvic inflammation [36] among FSWs. In several papers, FSWs never or rarely used condoms during sexual contact [24, 28, 36]. However, the consistency of using condoms among FSWs were as high as 65% in Pakistan, 64% in Lebanon, and 62% In Iran [22, 27, 32]. Condom use among regular and non-regular clients was reported to be respectively, 92% and 98% in Lebanon [32], and 63.4% among non-regular clients in Libya [11] and 57.1% in Iran [13]. A study from Sudan reported that 36% of FSWs used condoms for all clients [31], and in one study from Kerman, Iran, not using condoms was reported to be 17% and 22% with paying and non-paying partners, respectively [24]. Studies in Egypt and Sudan have mentioned that the main reasons for not using male condoms were not knowing where to obtain condoms [25], client refusal, not liking it, using another contraceptive method, not

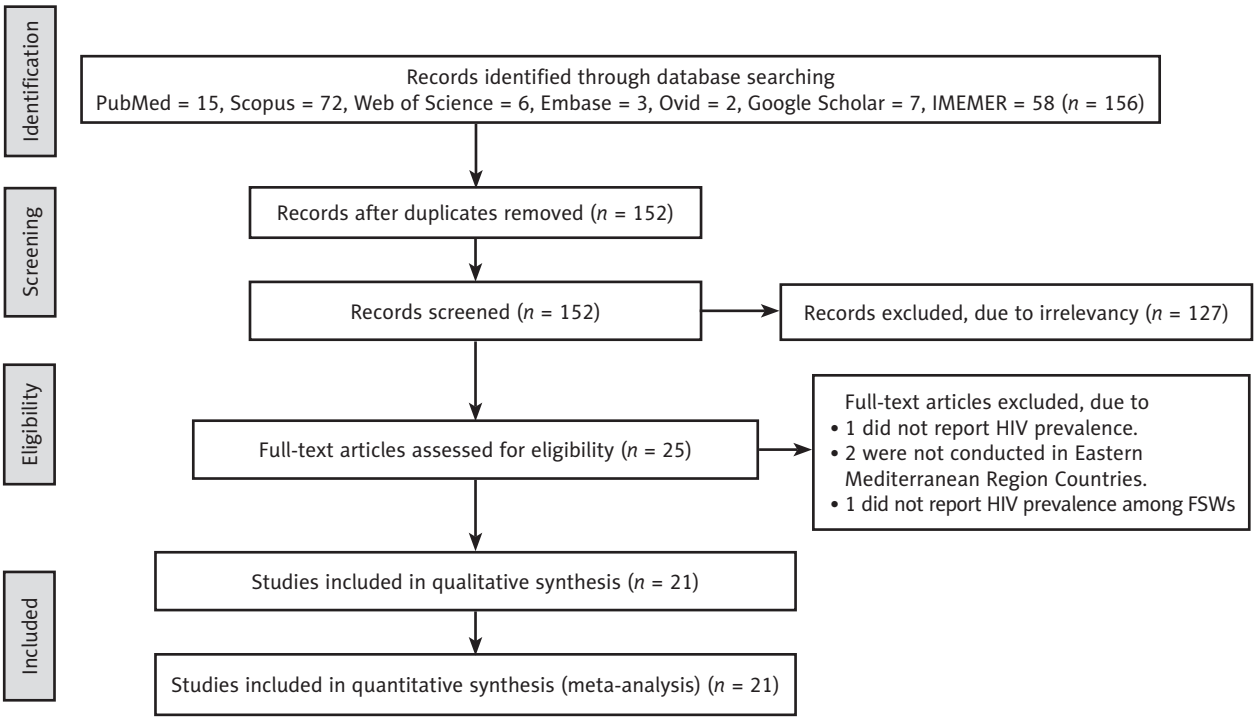

Figure 1. Flow diagram of the search strategy for systematic review on the prevalence of HIV among female sex workers (FSWs) in the Eastern Mediterranean Region by 2020

Table 2. Egger's test for detection of publication bias for studies included in HIV infection among FSWs in the Eastern Mediterranean Region by 2020

Std_Eff	Coef.	Std. error	*t*	*P* > |*t*|	(95% CI)
Slope	–0.00015	0.002	–0.07	0.945	(–0.00472, 0.004)
Bias	3.38	0.73	4.61	< 0.001	(1.84, 4.92)

Table.3. Meta-regression of some covariates on the prevalence of HIV infection among FSWs in the Eastern Mediterranean Region by 2020

Model	Prevalence of HIV infection				
	Coefficient (95% CI)	τ^2	Adj. R^2	I^2	*p*-value
No covariates	0.025 (0.0043-0.038)	0.00059	–	89.99%	0.001
Univariate					
Sample size	–5.89e-06 (–0.0000173, 5.49e-06)	0.0006	–2.66%	89.97%	0.292
Years of data collection	0.0028 (–0.00015, 0.0055)	0.0004	27.06%	87.43%	0.04
All covariates	–	0.000389	35.01%	87.75%	
Sample size	–7.65e-06 (–0.0000172, 1.86e-06)				0.11
Years of data collection	0.0239032 (–0.0033577, –0.051164)				0.01

thinking about it, and partner's refusal [31, 33]. The most common reported reason for starting to work as FSWs was poverty and financial problems [22].

The prevalence of drug use was high in the included papers and it ranged from 5% in Pakistan [30] and Sudan [21], to 91% in Iran [34] and 96.2% in Egypt [33]. The drugs abused included Iranian crack or heroin (in 16%), opium with methamphetamine (in 16%), methamphetamine (in 25%), methamphetamine with alcohol (in 13%) in Iran [27], and only alcohol in 4.7% [40], to 14% in Afghanistan and Iran, respectively [23]. In these studies, intravenous drug abuse ranged from 0.4% in Pakistan [22] and Afghanistan [40], to 38% in Iran [26]. One study in Iran reported that 11.6% of intravenous drug-addicted FSWs used non-sterilized syringes [13]. However, no statistics were reported on the use of drugs and alcohol in three other studies [11, 25, 32].

In all the studies, laboratory methods were used to identify HIV infections, and six studies used DBS [13, 26, 29, 31, 34, 41]. The rest of the papers used direct blood sampling methods to diagnose HIV infection.

The prevalence of HIV infection ranged from 0% to 16% in the 21 papers reviewed. The prevalence of HIV infection was zero in three papers published from Iran [24], Lebanon [32], and Egypt [33]. The results of Egger's test for the funnel plot were statistically significant ($p < 0.001$), which means that publication bias was likely to occur (Table 2).

Heterogeneity of the reported prevalence was very high among the studies ($I^2 = 89.9\%$, Q = 199.77, df = 11, $p < 0.001$), and therefore a meta-analysis was not applicable to perform [42]. Moreover, the studies were plotted on Galbraith chart (Figure 2). Some study results were out of the 95% CI, and this showed high heterogeneity. It was neither reasonable nor logical to remove specific studies to make the remaining results homogeneous for a meta-analysis.

Table 4. Characteristics of sub-group analysis of the included studies on HIV infection among FSWs in the Eastern Mediterranean Region by 2020

Sub-group	Number of studies	I^2	*p*-value
Years of data collection			
≤ 2010	13	86.24%	< 0.001
> 2010	8	90.70%	< 0.001
Laboratory method			
DBS	6	92.17%	< 0.001
Serum	14	89.23%	< 0.001
Sample size			
≤ 387	11	85.82%	< 0.001
> 387	10	91.54%	< 0.001

The result of meta-regression demonstrated that no significant relation was observed between the sample size and the prevalence of HIV, but there was a significant relation between the year of research and the prevalence of HIV (Table 3).

Authors used "visual binning" in SPSS v. 22, and divided the studies into sub-groups according to the years of data collection. The studies were divided into two groups (2010 and before, and after 2010), and in each category, heterogeneity was assessed. Heterogeneity in the 2010 and before group was $I^2 = 86.2\%$, Q = 87.23, df = 12, $p \leq 0.001$, and in the after 2010 group, it was $I^2 = 90.7\%$, Q = 75.30, df = 7,

$p < 0.001$ (Table 4). Therefore, meta-analysis was not done in these sub-groups because of high heterogeneity.

The studies were also divided according to the laboratory methods used, into DBS and serum groups. In the DBS method group, heterogeneity was high and $I^2 = 92.1\%$, Q = 63.85, df = 5, and $p < 0.001$. Heterogeneity in the serum method was also high and $I^2 = 89.23\%$, Q = 120.71, df = 13, and $p < 0.001$ (Table 4). Therefore, meta-analysis was not performed in these sub-groups due to high heterogeneity.

The studies were divided according to the sample size, into 387 and lower and more than 387. In the 387 and lower group, heterogeneity was high and $I^2 = 85.82\%$, Q = 70.53, df = 10, and $p < 0.001$. Heterogeneity in the more than 387 group was high and $I^2 = 91.54\%$, Q = 106.34, df = 9, and $p < 0.001$ (Table 4). Again, meta-analysis was not done in these sub-groups because of high heterogeneity.

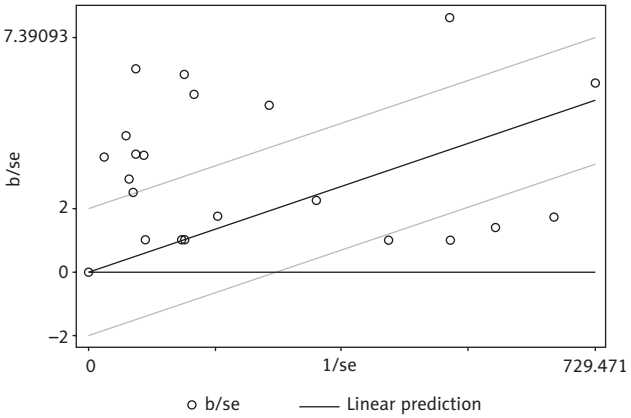

Figure 2. Galbraith plot for assessment of heterogeneity of articles on the prevalence of HIV among female sex workers (FSWs) in the Eastern Mediterranean Region by 2020

Discussion

The reported prevalence of HIV infection varied differently in the studies on female sex workers in the EM countries, ranging from 0% to 16%. The majority of FSWs had never or rarely used condoms during sexual contact. Also, genital infectious diseases, candidiasis, cervicitis, genital ulcers, warts, or itching and pelvic inflammation were reported among FSWs. The prevalence of drug use was high, and heroin, opium, methamphetamine, and alcohol were the drugs with the highest use among FSWs.

In the Eastern Mediterranean (EM) countries, only three countries, including South Sudan, Djibouti, and Somalia, have generalized epidemics; the remaining countries have an estimated HIV infection prevalence of below 1% in the general population, with either low-level epidemics or HIV infection epidemics concentrated in at-risk of HIV infection populations, and with limited spread to the general population [43].

Findings of our study showed that the prevalence rate of HIV infection among FSWs in the EM countries is different. Review studies in Europe (from 2005-2011) showed that there was a wide variation in HIV infection among FSWs at city level, and HIV infection prevalence among FSWs was highest in Eastern Europe in 2006, 2007, and 2009, within high HIV infection prevalence countries, such as Russia and Ukraine [12]. Also in the US (during 1984-2007), the prevalence of HIV infection among FSWs ranged from a minimum of 0.3% (1996-1998) to as high as 32.1% (1992-1994), and the pooled prevalence was 17.3% [42]. A review from Latin America and the Caribbean (from 1986 to 2010) showed that the median of HIV infection prevalence was 2.6% (IQR: 0.6-4.2) among FSWs [15].

HIV infection surveys among FSWs in the eleven Eastern Mediterranean (EM) countries demonstrated that the prevalence rate was below 4% in all countries, with the exception of Somalia (5.2%, 2007), Iran, and Djibouti [43]. The HIV infection prevalence among FSWs in Iran revealed an HIV infection prevalence of 4.5% in 2011 [13], whereas it was 2.6% in 2007; in Morocco, it was 2.7% in 2010, and 19.7% in 2007 and 15.4% in 2009 in Djibouti [44]. However, data on HIV infection prevalence among FSWs is unavailable from several low- or high-income countries, including Bahrain, Iraq, Kuwait, Libya, Oman, Qatar, Saudi Arabia, South Sudan, Syria, and United Arab Emirates (UAE), and the existing evidence do not portray the real picture of HIV infection in this region [43, 44]. On the other hand, HIV infection surveillance for evaluating HIV infection trends were performed in only four countries, included Djibouti, Iran, Morocco, and Pakistan. These countries have developed functioning HIV infection surveillance programs with national-level coverage. However, in the other 10 countries, HIV infection surveillance has been insufficient [43]. A review from the Middle East and North Africa showed a very low prevalence of HIV infection among FSWs in Afghanistan, Egypt, Jordan, Lebanon, Pakistan, Tunisia, and Yemen [45]. Despite the overall relatively low prevalence of HIV infection among FSWs, commercial heterosexual sex networks appear to be a cause of HIV infections in some countries, probably because of the larger size of these networks compared with other high-risk groups, such as homosexual men [45]. For example, in Morocco, commercial heterosexual sex networks contributed to about half of the HIV infection incidences, despite a rather low prevalence (2%) of HIV infection among FSWs [21].

Studies have demonstrated the significance of sex work in the ongoing transmission of HIV infection and other sexually transmitted infections (STIs). In the EM countries, genital infectious diseases, candidiasis, cervicitis, genital ulcers, warts or itching, and pelvic inflammation were reported among FSWs. A review study done in Europe indicated that the prevalence of gonorrhea was reported to be 5% or less across the region in FSWs, with the exception of Georgia (12-18%), and the prevalence of chlamydia was just over 20% in 2004-2006 [12]. Another review study from China reported that the prevalence of active syphilis ranged from 0.8% to 12.5%, herpes from 29.7% to 70.8%, chlamydia from 3.9% to 58.6%, gonorrhea from 2.0% to 85.4%, and trichomoniasis from 7.1% to 43.2% among FSWs [46].

Our review showed that the usage of condoms during sexual contact among FSWs was rare, and condom use among regular and non-regular clients was different. Several studies in African countries [47-49], China [50,51], various Asian countries [52,53], Latin America [54,55], and Europe [56] have shown that FSWs use condoms less frequently with their steady sex partners than with other clients [57].

The studies included in this review demonstrated that the prevalence of drug use among FSWs was high. A review showed that in Iran, over 70% of FSWs had ever used drugs, and around 15% had ever injected drugs. Moreover, older age, longer duration (> 5 years) of involvement in sex work, and a history of alcohol drinking were associated with a lifetime history of drug injection among FSWs [58]. In Iran, about 15% of FSWs reported injecting drugs, and these were over three times more likely to be infected with HIV compared with FSWs who never injected drugs [13].

It is possible that most HIV infections among FSWs in Iran are due to drug injection rather than sexual transmission [45]. Drug injection was the main cause of HIV infection among female sex workers in Europe, and the prevalence of HIV infection was higher among FSWs intravenous drug abusers. The prevalence of syphilis was highest among samples taken from FSWs in Eastern Europe [42].

Putting FSWs under surveillance is critical because their behaviors are usually considered illicit, and they are frequently stigmatized, deprived from health services, and exposed to sexual diseases and violence [12]. Between 1989 and 2007, less than 1 percent of HIV infection tests performed in the region were for these key populations [59]. In the EM countries, condoms are unpopular and rarely used. Reasons for such low use are the fact that some men do not believe they are at risk of STIs or HIV infection, they do not like the feeling of condoms, and FSWs are worried about their clients reactions to their suggestion of using a condom. Some believe condoms may be hazardous to use, some are embarrassed about buying and using condoms, or lacking the skills to use them [60].

Some of the essential ways of controlling HIV infection and AIDS include raising awareness in the society through training, consulting, and changing behaviors [61]. According to the WHO, the only effective way for controlling AIDS is training, especially among vulnerable groups [62]. Therefore, comprehensive knowledge about HIV infection and AIDS as well as using condoms should be seriously and actively provided to FSWs [63]. Studies have also shown that health training plans designed according to health belief models, can be effective in preventing AIDS [62, 64]. One of the other educational methods for behavior change is theory of planned behavior (TPB), which considers intention as the main determinant of behavior. Studies have suggested that TPB can be used in education programs for HIV prevention [65], and it is necessary to provide free education and condoms to FSWs [62, 64].

In Tunisia, some forms of commercial sex are legal, and condoms are made available within regulated establishments. Around half of female sex workers in Morocco and Tunisia reported using a condom with their most recent client. However, in general, condom use is still largely tabooed in the region [59]. Four countries, including Pakistan, Egypt, Lebanon, and Tunisia, have provided HIV infection prevalence estimates for FSWs [66]. Different harm reduction programs, such as consistent condom use during high-risk sex and providing clean syringes, have been implemented in many EM countries, such as Egypt, Morocco, Tunisia, Bahrain, Iran, Lebanon, and Oman [66]. In Egypt, harm reduction interventions targeting PWID (people who inject drugs) and FSWs were established in 2008, and included education about safe sex and safe injection, HIV infection counseling, testing using rapid test kits, medical services for the management of sexually transmitted infections, and distribution of behavior-change booklets and brochures, needles, and condoms free of charge [67].

MENA region has had the lowest rate of antiretroviral treatment (ART) globally (11%) [68]. In the UNAIDS 2017 and global AIDS update reports in 2019 [69], none of these countries reported using ART for FSWs. Although some countries, such as Bahrain, Djibouti, Iran, Egypt, and Tunisia, have used ART for patients based on the latest WHO guidelines, which are CD4+ counts under 500 cells/mm^3; but Iraq, Qatar, and Yemen did not report ART use [70].

There was a high-rate of heterogeneity among the papers included in this study. The difference in studies might be due to the difference in sampling, demographic characteristics of the participants, place of study, type of risky behaviors, and application of different laboratory kits for HIV diagnosis. Previous reviews have also reported high heterogeneity [6, 42]. In this review, the included papers, except for one paper from Pakistan [36], were conducted between 2004 to 2016. During this time period, different methods might have been used to investigate the prevalence. However, meta-regression showed no relation between the prevalence and the year of research.

Most of the studies included in this review were conducted in Iran (8 papers) [13, 23, 24, 26-28, 34, 35], Pakistan (6 papers) [22, 29, 36-38, 41], and Sudan (2 papers) [21, 31]. There was only one study conducted on the prevalence of HIV infection among FSWs in Afghanistan, Egypt, Lebanon, Libya, and Somalia. In the other 13 countries of the EM, such as Bahrain, Djibouti, Iraq, Jordan, Kuwait, Morocco, Palestine, Oman, Saudi Arabia, Syria, Tunisia, UAE, and Qatar, no studies were conducted. However, it is necessary to survey female sex workers in these countries in regard to HIV infection, risky behaviors, problems in performing diagnostic tests, antiretroviral therapy coverage, and HIV prevention programs.

The present review had several limitations. First, the included studies were different in regard to sample size, study implementation dates, and sampling strategies. The prevalence rates reported from Pakistan, Afghanistan, and Lebanon were from before 2008, but the prevalence rates reported for Iran and Libya were after 2010. Moreover, the high heterogeneity of these studies excluded undertaking a pooled analysis. Also, it was not possible to evaluate geographical diversity due to small number of studies and lack of information from countries, such as Bahrain, Iraq, Jordan, Kuwait, Qatar, Saudi Arabia, Oman, Syria, Tunisia, UAE, Yemen, Morocco, and Djibouti. National studies were only conducted in a few coun-

tries of that region [13, 21, 26, 30, 35, 38], and other studies were limited to only some cities [11, 22-25, 27-29, 31-34, 36-38, 40]. Another limitation was that different HIV infection diagnosing tests had been used in the included studies, which makes the results even more incomparable. The specimens collected in the studies were different (plasma, serum, whole blood, DBS, and oral fluid), and this depended on the logistics, populations, sites, HIV infection testing strategies, and algorithms. In this review, the majority of tests were performed based on serum and DBS samples.

Acknowledgments

We would like to thank Prof. Maryam Okhovati, who help us in searching the databases.

Conflict of interest

The authors declare no conflict of interest with respect to the research, authorship, and/or publication of this article.

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Appendix A. Search strategy details in each database by 2020

Name of database	Search strategy	Yielded number of articles	Number of duplicate articles	Number of screened articles	Number of articles assessed for eligibility criteria
PubMed	(((Prevalence [Title/Abstract] OR frequency [Title/Abstract] OR Incidence [Title/Abstract]) AND ("Human Immunodeficiency Virus" [Title/Abstract] OR "Immunodeficiency Virus Human" [Title/Abstract] OR "Human Immunodeficiency Viruses" [Title/Abstract] OR "AIDS Virus" [Title/Abstract] OR "AIDS Viruses" [Title/Abstract] OR "Acquired Immune Deficiency Syndrome Virus" [Title/Abstract] OR "Acquired Immunodeficiency Syndrome Virus" [Title/Abstract])) AND ("female sex worker" [Title/Abstract])) AND (EMRO [Title/Abstract] OR "Eastern Mediterranean Regional" [Title/Abstract] OR Afghanistan [Title/Abstract] OR Bahrain [Title/Abstract] OR Djibouti [Title/Abstract] OR Egypt [Title/Abstract] OR Iran [Title/Abstract] OR Iraq OR Jordan [Title/Abstract] OR Kuwait [Title/Abstract] OR Lebanon [Title/Abstract] OR Libya [Title/Abstract] OR Morocco [Title/Abstract] OR "occupied Palestinian territory" [Title/Abstract] OR Oman [Title/Abstract] OR Pakistan [Title/Abstract] OR Qatar [Title/Abstract] OR "Saudi Arabia" [Title/Abstract] OR Somalia [Title/Abstract] OR Sudan [Title/Abstract] OR " Syrian Arab Republic" [Title/Abstract] OR Tunisia [Title/Abstract] OR "United Arab Emirates" [Title/Abstract] OR Yemen [Title/Abstract])	9	1	0	0
Web of Science	TITLE: (prevalence OR frequency OR incidence) AND TITLE: ("Human Immunodeficiency Virus" or "Immunodeficiency Virus Human" or "Human Immunodeficiency Viruses" or "AIDS Virus" or "AIDS Viruses" or "Acquired Immune Deficiency Syndrome Virus" or "Acquired Immunodeficiency Syndrome Virus") AND TITLE: (female sex worker) AND TITLE: (EMRO or "Eastern Mediterranean Region" or Afghanistan or Bahrain or Djibouti or Egypt or Iran or Iraq or Jordan or Kuwait or Lebanon or Libya or Morocco or "Occupied Palestinian Territory" or Oman or Pakistan or Qatar or "Saudi Arabia" or Somalia or Sudan or "Syrian Arab Republic" or Tunisia or "United Arab Emirates" or Yemen)	6	0	1	1
Scopus	(TITLE-ABS-KEY (prevalence OR frequency OR incidence) AND TITLE-ABS-KEY ("Human Immunodeficiency Virus" OR "Immunodeficiency Virus Human" OR "Human Immunodeficiency Viruses" OR "AIDS Virus" OR "AIDS Viruses" OR "Acquired Immune Deficiency Syndrome Virus" OR "Acquired Immunodeficiency Syndrome Virus") AND TITLE-ABS-KEY (female AND sex AND worker) AND TITLE-ABS-KEY (emro OR "Eastern Mediterranean Regional" OR afghanistan OR bahrain OR djibouti OR egypt OR iran OR iraq OR jordan OR kuwait OR lebanon OR libya OR morocco OR "occupied palestinian territory" OR oman OR pakistan OR qatar OR "saudi arabia" OR somalia OR sudan)	72	1	23	19

Appendix A. Cont.

Name of database	Search strategy	Yielded number of articles	Number of duplicate articles	Number of screened articles	Number of articles assessed for eligibility criteria
Embase	(prevalence:ti,ab,kw OR frequency:ti,ab,kw OR incidence:ti,ab,kw) AND ('human immunodeficiency virus':ti,ab,kw OR 'immunodeficiency virus human':ti,ab,kw OR 'human immunodeficiency viruses':ti,ab,kw OR 'aids virus':ti,ab,kw OR 'aids viruses':ti,ab,kw OR 'acquired immune deficiency syndrome virus':ti,ab,kw OR 'acquired immunodeficiency syndrome virus':ti,ab,kw) AND 'female sex worker':ti,ab,kw AND (emro:ti,ab,kw OR 'eastern mediterranean regional':ti,ab,kw OR afghanistan:ti,ab,kw OR bahrain:ti,ab,kw OR djibouti:ti,ab,kw OR egypt:ti,ab,kw OR iran:ti,ab,kw OR iraq:ti,ab,kw OR jordan:ti,ab,kw OR kuwait:ti,ab,kw OR lebanon:ti,ab,kw OR libya:ti,ab,kw OR morocco:ti,ab,kw OR 'occupied palestinian territory':ti,ab,kw OR oman:ti,ab,kw OR pakistan:ti,ab,kw OR qatar:ti,ab,kw OR 'saudi arabia':ti,ab,kw OR somalia:ti,ab,kw OR sudan:ti,ab,kw OR 'syrian arab republic':ti,ab,kw OR tunisia:ti,ab,kw OR 'united arab emirates':ti,ab,kw OR yemen:ti,ab,kw)	2	1	0	0
Google Scholar	(Prevalence OR Frequency OR Incidence) AND ("Human Immunodeficiency Virus" or "Immunodeficiency Virus Human" or "Human Immunodeficiency Viruses" or "AIDS Virus" or "AIDS Viruses" or "Acquired Immune Deficiency Syndrome Virus" or "Acquired Immunodeficiency Syndrome Virus") AND " female sex worker" AND (EMRO or "Eastern Mediterranean Regional" or Afghanistan or Bahrain or Djibouti or Egypt or Iran or Iraq or Jordan or Kuwait or Lebanon or Libya or Morocco or "occupied Palestinian territory" or Oman or Pakistan or Qatar or "Saudi Arabia" or Somalia or Sudan or " Syrian Arab Republic" or Tunisia or "United Arab Emirates" or Yemen)	7	0	0	0
Ovid	(Prevalence OR Frequency OR Incidence) AND ("Human Immunodeficiency Virus" or "Immunodeficiency Virus Human" or "Human Immunodeficiency Viruses" or "AIDS Virus" or "AIDS Viruses" or "Acquired Immune Deficiency Syndrome Virus" or "Acquired Immunodeficiency Syndrome Virus") AND " female sex worker" AND (EMRO or "Eastern Mediterranean Regional" or Afghanistan or Bahrain or Djibouti or Egypt or Iran or Iraq or Jordan or Kuwait or Lebanon or Libya or Morocco or "occupied Palestinian territory" or Oman or Pakistan or Qatar or "Saudi Arabia" or Somalia or Sudan or " Syrian Arab Republic" or Tunisia or "United Arab Emirates" or Yemen)	2	0	1	1
Index Medicus for the Eastern Mediterranean Region (IMEMsR)	Female sex worker AND prevalence of HIV	58	1	0	0