

Investigation of HIV/AIDS prevalence and associated risk factors among female sex workers from 2010 to 2017: a meta-analysis study

This article was published in the following Dove Press journal:
HIV/AIDS - Research and Palliative Care

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Objectives: Female sex workers (FSW) are highly at risk of HIV, and can potentially transmit the human immunodeficiency virus (HIV) in different societies.

Study design: The aims of the present study were to investigate the prevalence of HIV/AIDS and associated risk factors among FSW between 2010 and 2017 using a systematic literature review and meta-analysis approach.

Methods: International databases were searched, including ISI Web of Science, Embase, PubMed, and Scopus. Using the appropriate keywords, relevant studies published on the HIV/AIDS prevalence among FSW between 2010 and 2017 were identified. Afterwards, the information was extracted and analyzed by STATA version 14.

Results: Thirty-seven studies were found eligible for inclusion in this research, encompassing a total of 46,657 subjects. The results revealed that the global prevalence of HIV/AIDS among FSW was 2.17 (95% CI=1.37–3.14).

Conclusion: These findings demonstrated the high prevalence of HIV/AIDS among FSWs worldwide. Accordingly, strict educational and interventional programs should be implemented globally to reduce HIV/AIDS prevalence among this group, as well as to prevent probable HIV transmission.

Keywords: prevalence, HIV/AIDS, risk factors, immunodeficiency, female sex workers

Introduction

The number of individuals infected with human immunodeficiency virus (HIV-1) continues to increase worldwide. Based on the latest statistics, there are nearly 40 million HIV-positive people in the world, while the developing countries contain 95% of them.¹ It is estimated that 14 thousand individuals are being infected with the HIV each day worldwide and more than 30 million people have lost their lives because of the AIDS, since the first HIV positive patient was identified. Many studies suggested that the most common mode of HIV transmission is associated with sexual affairs and relationships in the US; while, in Eastern Europe, especially Ukraine and Central Asia, intravenous drug use has been reported as the main mode of transmission.^{2,3} Moreover, more than half of the HIV-positive individuals were identified to be female. Intravenous illegal drug use and unprotected sex contribute as the main risk factors for HIV transmission among this group.^{4,5} However, various social, economic, and political factors can also further affect the prevalence of HIV/AIDS.⁶ For instance; the main source of HIV infection in developed countries such as the UK and the US is homosexuality, while high-risk sexual

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Table I Demographic characteristics of studies involved in meta-analysis

Authors	Year of publication	Country	Sample size	Age (years)	HIV prevalence in FSWs (%)	Condom use (%)	Used illicit drugs (%)
Abdelrahim ³⁰	2010	Sudan	321	28	0.9	66.3	6.9 33
Mahfoud et al ¹⁷	2010	Lebanon	135		0	39	
Todd et al ³¹	2010	Afghanistan	520	23.3	0.19	38.2	
Strathdee et al ³²	2011	Mexico	620	33	5.3	30	
Braunstein et al ³³	2011	Rwanda	397	24	3.5	18	
Vandepitte et al ¹⁶	2011	Uganda	482		38	33.9	
Xu et al ³⁴	2011	China	1,642		1.8		
Ramesh et al ³⁵	2012	India	2,042	<30	2.7		
Vuytsteke et al ²⁴	2012	Co [^] te d'Ivoire	1,110		26.6	26.4	
Goldenberg et al ³⁶	2014	Canada	508		11.22	21.24	
Schwartz et al ³⁷	2015	Co [^] te d'Ivoire	466		0.97	19	1.6 94.8
Deuba et al ³⁸	2016	Nepal	610		1	78	
Afzal et al ²⁵	2017	South Africa	97	36	32.9		
Pando et al ³⁹	2013	Argentina	1,255	33.5	2	17.6	
Qyra et al ⁴⁰	2011	Albania	90	28	1.08	35	
Argento et al ⁴¹	2017	Canada	455	36	2.69		
Corneli et al ⁴²	2016	Kenya	172	29	18	33.9	
Decker et al ⁴³	2012	Russia	147	17–40	4.8	78.9	
Decker et al ⁴⁴	2016	Cameroon	1,817	≥18	5.1	59.2	
Fan et al ⁴⁵	2015	China	622	>16	1.1	66.2	2.1 18.1 36.7 11 8.8
Forbi et al ²⁶	2011	Nigeria	900	18–35	37.2	46.7	
Couture et al ⁴⁶	2011	Cambodia	160	<29	23	85.7	
Le et al ⁴⁷	2015	Vietnam	5,298	≥18	1.76		
Dias et al ⁴⁸	2015	Portugal	853	≥18	7.4		
Magnani et al ⁴⁹	2010	Indonesia	5,947	28	10.5		
Medhi et al ⁵⁰	2012	India	426	≥18	11.6		
Wirtz et al ⁵¹	2015	Russia	754		6.7		
Silitonga et al ⁵²	2011	Indonesia	3,086		1.4		
Wang et al ⁵³	2011	China	751		4.9		
Wayal et al ⁵⁴	2011	India	326		26		
Kang et al ¹⁸	2013	China	3,326		0		
Platt et al ⁵⁵	2011	UK	268		1.1		
Chen et al ⁵⁶	2012	China	5,322	>16	0.54		
Zhu et al ⁵⁷	2017	China	589	>16	2.74		
Lu et al ⁵⁸	2017	Tibet China	2,000		5.81		
Okafor et al ⁵⁹	2017	Nigeria	1,050	15–24	15.5		
Kakchapati et al ⁶⁰	2016	Nepal	2,093		1.8		

relationships (including polygamy, having intercourse with sex workers, and unprotected sexual relationships) in African countries and intravenous drug use in Eastern and Southeastern countries mainly contributed to the transmission of HIV.^{7–10} Several studies have indicated high levels of HIV prevalence among female sex workers (FSW) who earn money in exchange for providing sexual services to their clients.¹¹ Compared with the general population, it seems that FSW are more susceptible to ADIS due to the different factors of unprotected sexual

intercourse, sex with multiple partners, and other probable high risk sexual relationships.¹²

Moreover, as is expected, FSW can extremely transmit HIV/AIDS. Thus, providing and implementing educational and interventional policies as well as preventive programs targeting this group could greatly reduce the prevalence of HIV/AIDS within different societies.¹²

Over the past two decades remarkable successes have been achieved in reducing the risk of contamination with HIV, as well as the associated morbidity, mortality, and

Table 2 The initial data on the prevalence of AIDS based on risk factors in the articles entered in the meta-analysis

Authors	Year	Prevalence in BD	Prev. in HBV	Prev. in HCV	Prev. in female	Prev. in male	Prev. in prisoners	Prev. in Thalassemia	Prev. in Hemophilia	Total prevalence	Sexual high risk	Injection drug users (IDUs)	Men who have sex with men (MSM)	FSWs	<25 years	26–30 years	31–35 years	36–40 years	>40 years
Scheibe	2015				18	13				14				34		2.1			
Emeka-Nwabunnia	2014				4.31	2.91				3.69	46			53					
Girardi	2011		4	10.3		15.2				15.2									
Forbi	2011									37.2				37.2					
Behzanpour	2012									75.5	62.8	88.4			0	3.8	15	5.6	0
Moradi	2012									4.2		4.2							
Haghdoust	2011				29.1	69.3				15.95		11.04		9.04					
Mmbaga	2013				6.3	7.7				7									
Mmbaga	2013				4.7	6.8				5.7									
Shahbazi	2014						2.7			2.7									
Ghafoori	2010	0								0									
Kolivand	2010									0.05									
Bani Aghil	2010	0.0015								0.0015									
Acar	2010						13.54			0.008									
Feng	2012									13.54	13.1								
Puglia	2015									87.7		52.8							
Carnicer-Pont	2015									0.14									
Grinberg	2015				4.6	12.1				7.62									
Haghighi	2015									11.8	11.4	59.3			5.9	12.6	19.2	17.7	14.4
Chipeta	2015				13.3	10.2				2.9	12.4								
Wang	2015									18.2		18.2							
Ghasemian	2011									0									
Sorouri	2013	0																	
Zanjani	2013																		
Maokhtarfar	2014		0	0.9						5.4				37.2	12.2				
Forbi	2012									25.6				25.6	6.2	35.6	18.8	3.1	1.6
Fayemiwo	2014									2.1				2.1					
Li	2014									23.13				23.13	13.3	28.9			
Couture	2010																		

(Continued)

Table 2 (Continued).

Authors	Year	Prevalence in BD	Prev. in HBV	Prev. in HCV	Prev in female	Prev in male	Prev. in prisoners	Prev. in Thalassemia	Prev. in Hemophilia	Total prevalence	Sexual high risk	Injection drug users (IDUs)	Men who have sex with men (MSM)	FSWs	<25 years	26–30 years	31–35 years	36–40 years	>40 years
Page	2013									9.2				9.2					
Priddy	2011									5.6				5.6					
Javadi	2014				0	21.4				1.1		1.1							
Yeganeh	2015								1.4	0.6									
Javadzadeh										1.4									
Shahshahani	2015							0		0									
Javadzadeh										4.8	4.3		24.8		2.6	6.4	6.4	6.4	4.8
Shahshahani					3.6	6.5				0									
De Castro	2010				0	0	0			8	31	33	30.4		10.8	24.7	24.7	27.1	36.4
Nokhodian	2012									24.4	25.4	24.4	10.9	8.3	1.22	1.72		1.45	1.43
Karimy	2013									1.46	35	56							
Kheirandish	2010									0.003									
Nasirian	2012									2.1	2.7	8.1	3.7		2.3	2.3	1.8	1.8	
Kupek	2014	2.75			0.9	1.85				0.29									
Dargahi	2013	1.05			1.9	1.05	2.1			0									
Navadeh						2.1	0.29			14.72									
Egger	2015									0.31	12.5	9.9							
Karabulut	2012									0									
Nikkhooy	2013									0.31							3.2	3.2	
Mittal	2010	4.6			0.5	2.4	2.7	0		3									
Ilami	2012	3																	
Kim	2014					0.05													
Wang	2012	0.33			0.04														
Jain	2012	0.0097			0.0014	0.004													
Zou	2013	0.02			0.02	0.02									0.038	0.073	0.073	0.042	0.26
Zhao Hua	2014	2.5													0.35	0.31	0.31	0.31	0.35
Malleki	2014	0.3													0.01	0.01	0.02	0.02	0.03
Nwokeukwu	2010				0	0.3					26.4	24.4	31.8	25.7	8.6	24.4	24.4	26.9	36.6
Hosseini										0.007									
Khattak	2011	0																	
Khan																			

(Continued)

Table 2 (Continued).

Authors	Year	Prevalence in BD	Prev. in HBV	Prev. in HCV	Prev in female	Prev in male	Prev. in prisons	Prev. in Thalassemia	Prev. in Hemophilia	Total prevalence	Sexual high risk	Injection drug users (IDUs)	Men who have sex with men (MSM)	FSWs	<25 years	26–30 years	31–35 years	36–40 years	>40 years
Khedmat Karimi	2009	0.2							0.36	0.2					0	4.2	3.5	3.5	9.9
Dayan	2001	0.0004													1.95	2.38	1.18	1.18	3.7
Noubiap	2013	4.1			3.1	4.1													
Nagalo	2013	2.21			2	2.28													
Mohamadali	2011	5.4																	
Fadhil	2014																		
Rahman	2011		15.3	25.4	10.5	10.7						10.7							
Rahimi																			
Movaghar	2010																		

Abbreviations: BD, blood donor; FSW, female sex workers; HBV, Hepatitis B Virus; HCV, Hepatitis C Virus; IDUs, Injection drug users; MSM, men who have sex with men; Prev, Prevalence.

stigma, and indisputable improvements have been made in the quality-of-life of people living with HIV.¹³ In this regard, the Joint United Nations has also developed a Program on HIV/AIDS (UNAIDS) with the approach to diagnose 90% of all HIV-positive individuals, provide antiretroviral treatments (ART) for 90% of diagnosed persons, and to attain viral suppression for 90% of treated individuals by 2020. It is believed that this could result in viral suppression in at least 73% of infected people, which is a necessary step in order to end the AIDS epidemic by 2030.² However, according to the recent reports by the national HIV program, it is indicated that the 90–90–90 targets agenda is unrealistic for 2020.¹⁴ About 2.1 million new HIV-positive cases were diagnosed in 2015, and such a high rate of incidence can further fuel the epidemics of this disease.

Since the treatment course of the disease and providing supportive care are difficult, highly costed, and complicated, the most important and feasible strategy could be the implementation of preventative measures such as education, counseling, and changing behavioral patterns.¹⁵ To achieve this goal, knowledge about the modes of disease transmission and awareness of target groups who are more vulnerable to AIDS or the groups who are mostly involved in the disease prevalence and other risk factors is needed. Thus, in the present study we aimed to determine HIV/AIDS prevalence rates in FSW, as well as to study the related risk factors from 2010 to 2017 by a systematic review of literature and meta-analysis approach.

Research method

Data sources and search strategy

The international databases of ISI Web of Science, Embase, PubMed, and Scopus were searched carefully to find English language studies which reported the HIV/AIDS prevalence and its associated risk factors among FSW between the years of 2010 and 2017. The searches were done using the appropriate keywords of HIV/AIDS, immunodeficiency, risk factors, sex workers, and female sex workers (FSW), along with all possible word combinations. Moreover, additional manual searches were performed using reference lists of relevant articles to find further papers which may be missed in the electronic searching process.

Study selection (inclusion and exclusion criteria)

All cross-sectional and descriptive or group studies investigating the relationship between each or a group

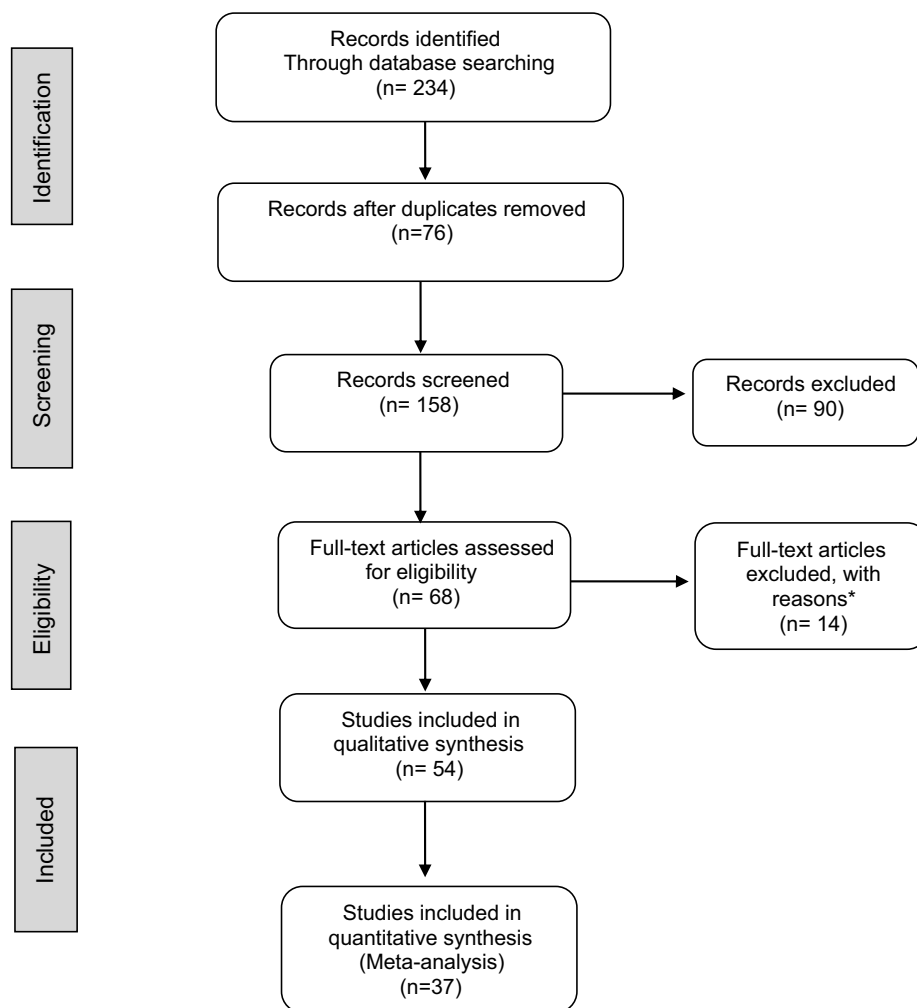


Figure 1 Prisma flow diagram illustrating selection of articles.

Note: 14 articles were omitted due to the inaccessibility of their full text.

of risk factors and HIV/AIDS prevalence were considered in order to review their full texts. We examined the selected articles for relevance in three phases of title, abstract, and full text review. The main inclusion criterion for this study was relevance for “HIV/AIDS prevalence and associated risk factors among FSWs”. Also, the studies with inadequate information, investigations other than descriptive research, review studies, abstracts published in congresses, non-English language published articles, systematic studies, meta-analyzes, and repeated investigations (duplications) were excluded from data analysis (Table 2). For all of the selected research articles, the data were extracted on name of the first author, the year of publication, study context, sample size, continent and the country of origin, and HIV/AIDS prevalence based on each of the risk factors (Table 1). Two of the authors searched for all the relevant articles and then provided a list of abstracts upon completion of the

search. At this stage, 234 potentially relevant articles on the HIV/AIDS prevalence and its associated risk factors among FSW were entered into the initial list. Afterwards, all the research articles were individually reviewed; and 76 of them were excluded because of being duplicates. Another 90 papers were also excluded because they were published before 2010. Moreover, 14 articles were omitted due to the inaccessibility of their full text, and 17 studies were excluded because they were found to be meta-analyses and review articles rather than original publications. Finally, 37 research articles were selected to be eligible to enter into this meta-analysis (Figure 1).

Data extraction

The 37 articles were selected as most relevant and high-quality studies for this meta-analysis. Then, a checklist of necessary information was provided for all the

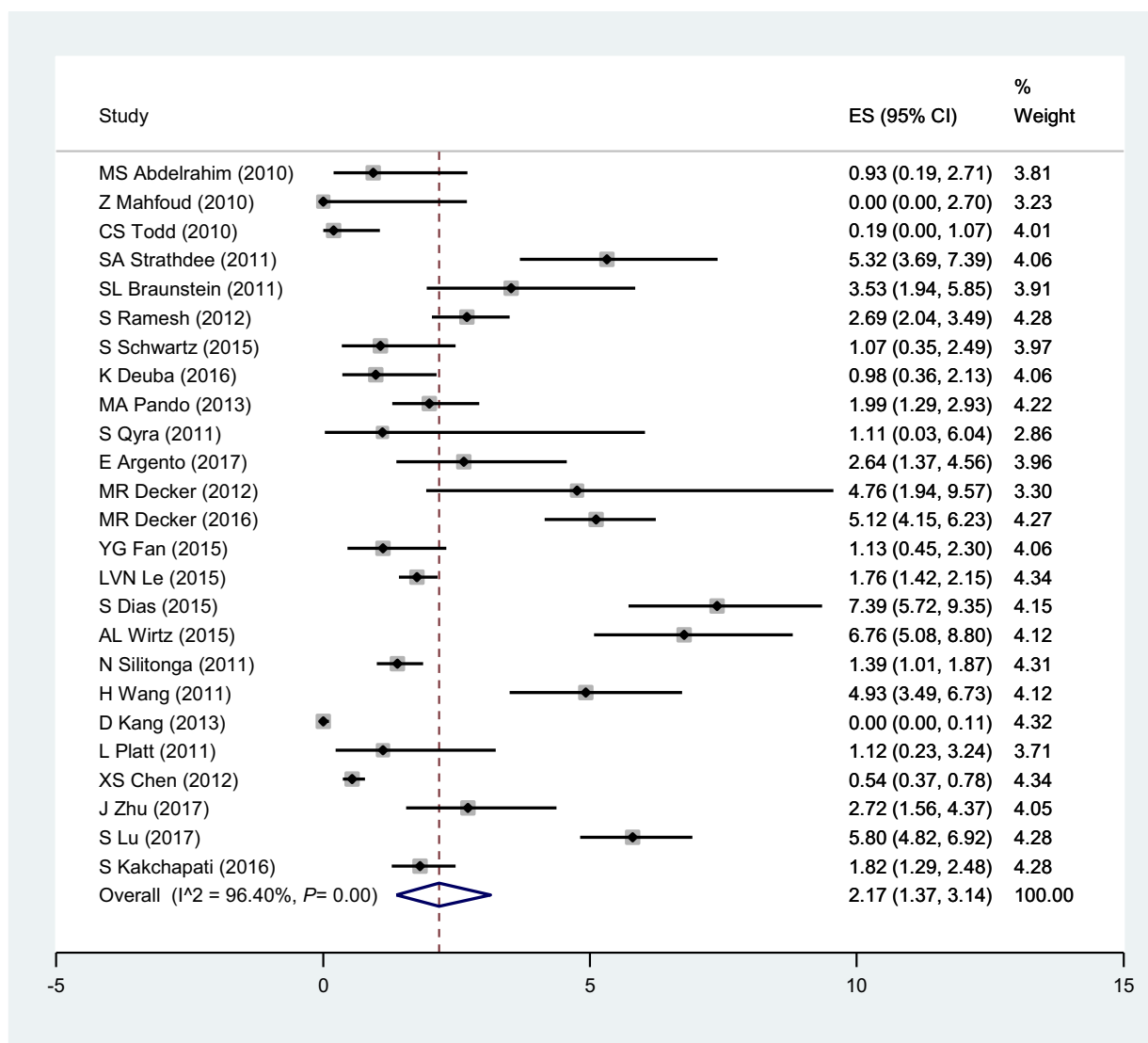


Figure 2 The prevalence of HIV among sex workers based on the random effects model. The midpoint of each section estimates the prevalence and length of the line, the 95% confidence interval in each study, and the diamond shows the prevalence of HIV among sex workers in this study.

studies. The checklist contained information on the different items needed for the study (the name of the first author, year of the publication, study context, sample size, a variety of risk factors, HIV/AIDS prevalence rate, etc.).

Statistical analysis

In order to calculate the variance of each study and the combination of HIV/AIDS prevalence and its risk factors in FSWs, binomial distribution and weighted mean were used, respectively. Thus, each study was weighted in accordance with its variance. Given the large differences in the HIV prevalence within the different studies (the heterogeneity of research articles) and significance of the heterogeneity

index (I^2), a random effects model was employed in this meta-analysis. We used metaprop command in STATA to perform random effects meta-analysis (meta-analysis of proportions) and calculate the pooled estimate of proportions with the corresponding 95% confident intervals. Moreover, the Freeman-Tukey Double Arcsine Transformation (Freeman, M. F., and Tukey, J. W. 1950) was used to stabilize the variances when the proportions were close to 0 or 1. Metaprop requires two variables in the format {n, N} such that $P=n/N$ to be declared.

Findings

In this meta-analysis, we examined 37 eligible original articles on HIV/AIDS prevalence among FSWs

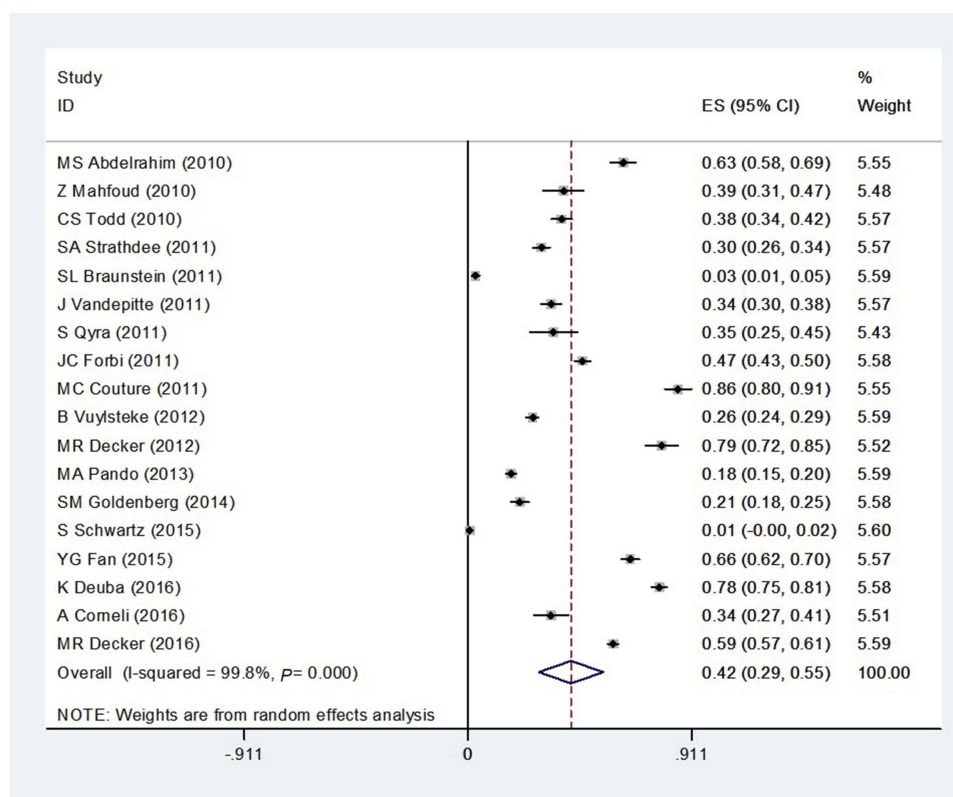


Figure 3 The prevalence of condom use in sex with clients by sex workers based on the random effects model. The midpoint of every line estimates the prevalence in each study, and the diamond shows the overall prevalence for all study.

published from 2010 to 2017, encompassing a total number of 46,657 FSWs. The overall findings showed that HIV/AIDS prevalence among FSWs was equal to 8%. But, after sensitivity analysis and deletion of outlier studies, the prevalence rate of HIV among FSWs was found to be 2.17 (95% CI=1.37–3.14) (Figure 2).

Herein, the prevalence of condom use among FSWs was obtained to be 0.42% (95% CI=0.29–0.55) (Figure 3). Moreover, the intravenous drug use prevalence in FSW was 0.07% (95% CI=0.01–0.14) (Figure 4).

Publication bias

The Begg's funnel plot was used to assess the presence of publication bias in the studies. To this end, the studies were sorted from the most precise to the least precise (according to standard error), and then a cumulative random effect meta-analysis was run to realize if there was any trivial change in effect size (Figure 5). Trim and fill analysis was done as well to check the effects of missing studies on the overall results and adjust the final pooled effect size.

Discussion

FSW have been considered as the most important group for HIV/AIDS transmission and propagation within societies; however, associated risk factors and the prevalence of HIV among this population have not been systematically evaluated in the past decade. In the present study, the overall HIV/AIDS prevalence among FSWs between 2010 and 2017 was obtained to be 2.17 (95% CI=1.37–3.14). The highest rate of HIV/AIDS prevalence among FSWs was reported as 38% by Vandepitte et al¹⁶ in Uganda. However, no HIV-positive individual was identified among FSW in the studies conducted by Mahfoud et al¹⁷ in Lebanon and Kang et al¹⁸ in China; the lowest HIV/AIDS prevalence among this group. Recently, antiretroviral therapy (ART) has been shown to be able to induce a high remission rate among HIV positive individuals. In this regard, it has been strongly confirmed that ART could result in desirable outcomes both in treatment and prevention of HIV by; 1) improving the health condition of individuals who already diagnosed with HIV and 2) preventing the

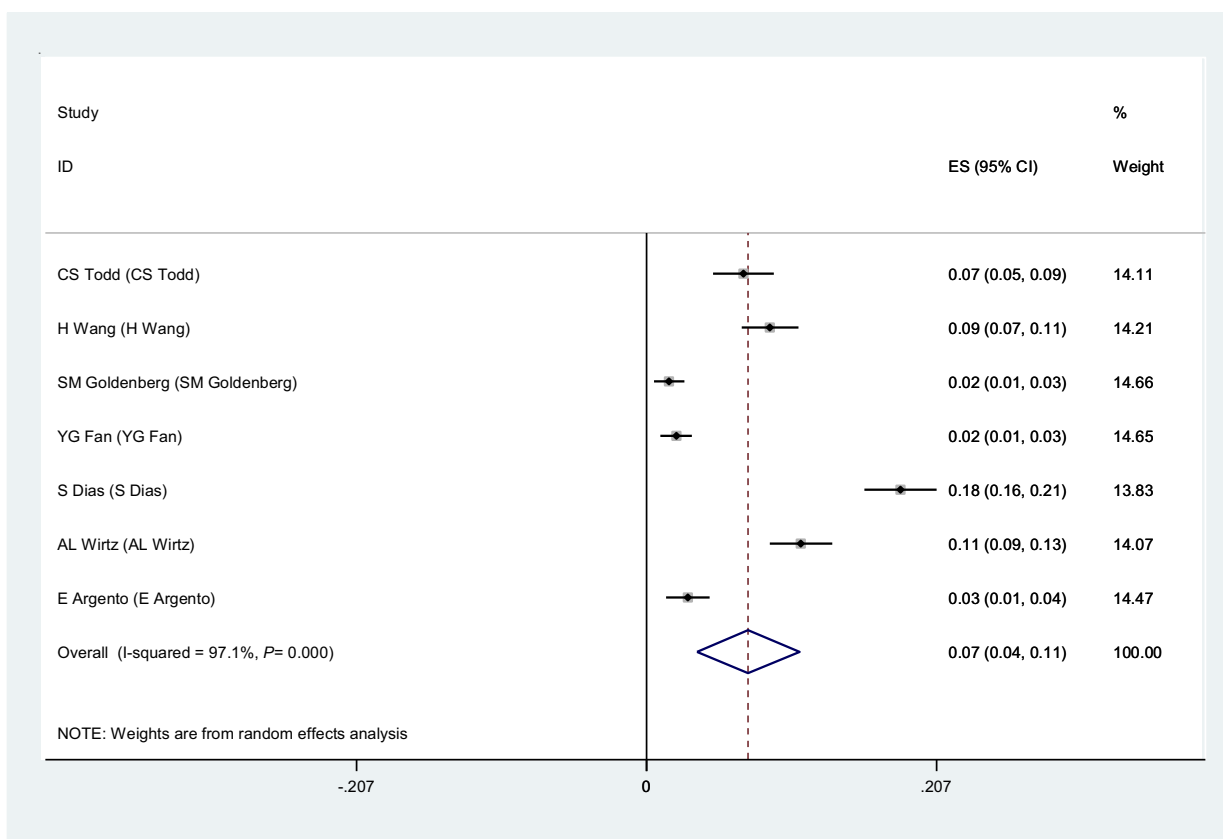


Figure 4 The prevalence of injecting drug use in sex workers based on the random effects model. The midpoint of each section of the line estimated prevalence in each study, and the diamond indicates the prevalence of injecting drug use for all studies.

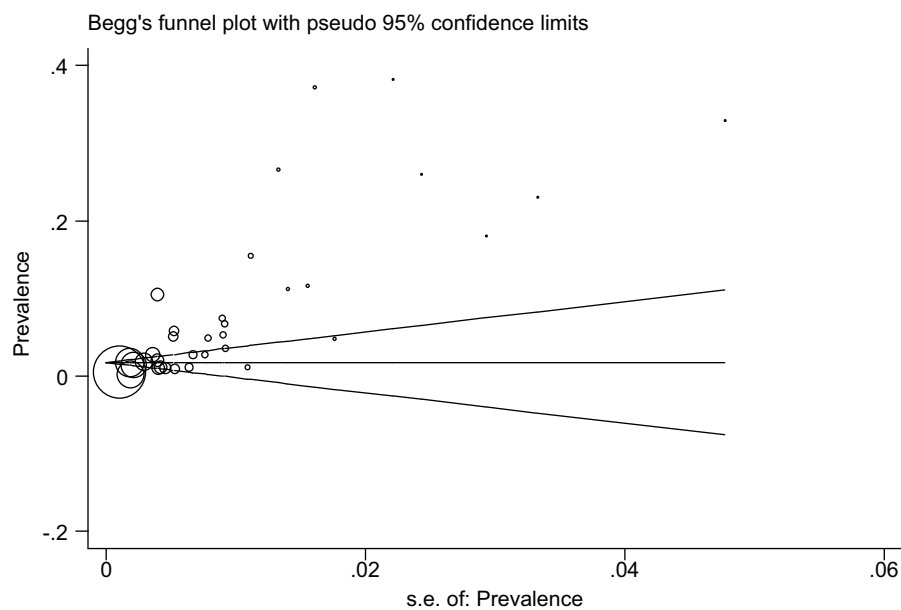


Figure 5 Begg's funnel plot for publication bias.

ongoing HIV transmissions.^{20,21} In accordance, universal coverage of ART was recommended for all HIV positive patients by WHO. However, our results showed a different pattern of HIV prevalence among FSW within different countries. According to these findings, we assumed that the preventive measures and treatment procedures should be applied context-specific and in compliance with national approaches to combat with HIV.¹⁹

Due to the criminal nature of sex work, a limited number of researches have developed on this subject and no special services are provided for FSW. To address this issue, the South African National AIDS Council, in 2013, launched the strategy of the National Strategic Plan for HIV Prevention, Care, and Treatment for Sex Workers, and it was updated in 2016 to provide more comprehensive coverage and access to anti-HIV treatments.^{22,23}

In recent years, the HIV/AIDS new cases were most widely found among FSW in Africa.^{16,24–26} Also, the same results were obtained in the meta-analysis study conducted by Baral et al,²⁷ who investigated the incidence of HIV/AIDS among FSWs in low-income countries. They found that the prevalence rate of the HIV/AIDS among FSWs in 50 low-income countries was equal to 11.8%, which was higher than the prevalence rate obtained in the present study. The discrepancy between these results may be explained by higher exposure to HIV/AIDS, as well as the poor educational and preventive measures implemented to combat HIV in low-income nations.

Previously, Zhang et al²⁸ investigated the prevalence of HIV/AIDS among FSWs across the six regions in China during 2000–2011 using meta-analysis. Their findings revealed that the prevalence of HIV/AIDS among FSWs has declined from 0.74% in 2000 to 0.40% with 95% confidence interval in 2011. Zhang et al²⁸ assumed that this declining trend may potentially be associated with interventional efforts and HIV prevention programs implemented in the country. According to the results of the present study and the study conducted by Zhang et al,²⁸ it is obvious that the HIV/AIDS prevalence among FSW of Asian countries is relatively low.

Moreover, a study conducted by Chow et al,²⁹ showed that comprehensive behavioral interventions were more effective, rather than health education only programs, to improve condom use and HIV testing uptake among FSW in China. According to their result, behavioral interventions improved condom use among FSW by 2.3–5.0-

times compared with the pre-intervention period. Also, they found that behavioral intervention has resulted in a 4.6-fold HIV testing uptake among FSW in the past 12 months. Such a comprehensive intervention program has also raised the awareness of FSW on the HIV transmission modes, as well preventive measures they should take to avoid probable HIV exposure. Our results indicate the high rate of intravenous drug use among FSW (0.07%) as an important risk factor for HIV transmission. Besides, infrequent use of condoms during their sexual intercourse with clients was also recognized as another important risk factor which makes them vulnerable to be infected with HIV.

Conclusion

The present study showed the high prevalence rate of HIV infection among FSWs. We assumed that FSW could act as a core group in HIV/AIDS transmission and propagation due to the high frequency as well as daily sexual relationships with different partners. Moreover, two important risk factors of infrequent condom use and prevalence of intravenous drug use among FSW highlights their role in HIV/AIDS transmission more than ever. Hence, comprehensive and global interventional programs need to be implemented to reduce the prevalence of HIV/AIDS among FSW and to prevent HIV propagation in societies.

One of the important limitations in this domain was the lack of access to some relevant studies, and some studies were not published in English. Unfortunately, it seems that the prevalence rate of HIV among FSW may be higher than that reported in the present study and in other studies, because the criminal nature of sex work in some countries as well as the Taboo make the results somehow unrealistic.

Ethical approval

Ethical approval was not required for this study; because this study is a meta-analysis.

Acknowledgments

The authors extend their gratitude to the Student Research Committee of Shahid Beheshti University of Medical Science for their kind support. No benefits in any form have been or will be received from a commercial party related directly or indirectly to the subject of this article.

Disclosure

The authors report no conflicts of interest in this work.

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