

Prevalence of HIV infection among high-risk groups in Iran: a systematic review and meta-analysis

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Abstract

Introduction: In Iran, data relating to an updated prevalence of human immunodeficiency virus (HIV) infection among high-risk groups are lacking. Therefore, this study aimed to determine the prevalence of HIV infection among high-risk groups in Iran through meta-analyses.

Material and methods: Electronic scientific databases, including PubMed, SCOPUS, and Web of Knowledge were explored to identify relevant studies. Random effect model was used to estimate the pooled prevalence.

Results: A total of 1,113 records were identified in initial search, out of which 43 reports were finally included in the study. The estimated overall prevalence among high-risk groups was 0.06%, which ranged from 0 among drug addict prisoners in the North to 0.2 among drug addicts in the South of Iran.

Conclusions: Prevalence of HIV among high-risk groups in Iran is relatively low. The prevalence of HIV in high-risk groups in different parts of Iran has a different pattern. Due to significant prevalence of HIV in injecting drug users compared to other high-risk groups, there is a need to pay serious attention to this high-risk group and adopt preventive strategies.

HIV AIDS Rev 2021; 20, 1: 1-9

DOI: <https://doi.org/10.5114/hivar.2021.105107>

Key words: HIV, prevalence, drug users, sex workers, prisoners, meta-analysis, Iran.

Introduction

Risky behaviors, such as substance abuse, alcohol consumption, high speed driving, attempting/committing suicide, and illegal sexual contacts are considered major health problems worldwide. Unfortunately, unhealthy and risky

behaviors are increasing, causing a serious concern for community health and policymakers [1]. Among them, illegal injection drug use (IDU) and unsafe sex with infected partner or sex with multiple partners are two of the most common routes of transmission for hepatitis B virus (HBV),

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Article history:
Received: 21.01.2020
Received in revised form: 10.02.2020
Accepted: 01.09.2020
Available online: 30.03.2021



hepatitis C virus (HCV), and human immunodeficiency virus (HIV) [2].

Nowadays, HIV infection is estimated to occur in 40 million chronic cases around the world [3]. But the prevalence of this disease differs in various sub-groups of population as compared with general population; for example, in a study conducted in Chennai, India, the prevalence of HIV among IDUs was 29.8% [4], whereas in Miami, Florida, the prevalence of HIV among sex workers was 22.4% [5]. Results on the review from 75 low-income and middle-income countries revealed that in 10 countries, the prevalence of HIV among prisoners was greater than 10% [6].

The estimated prevalence of HIV infection in the general population of Iran is < 0.2% [6], but in high-risk groups, the prevalence rate is much higher. In Tehran, capital of Iran, results of a study indicated that the prevalence of HIV among male injecting drug users was 23.5% [7]. Kazerooni *et al.* found that prevalence of HIV among FSWs in Shiraz was 4.7% [8]. Due to dreadful conditions of prisons, inmates are more susceptible to infectious diseases, as shown in a survey conducted on prisoners in Southern Khorasan [9].

There is growing number of studies about HIV infections among high-risk groups in different regions of Iran. However, many of these studies result in different or occasionally contradictory conclusions; therefore, the generalizability of any single study to all its sub-groups is limited. Considering the enormous number of drug users and increasing trend of extramarital sex among Iranian youth [10], the aim of this study was an attempt to provide comprehensive and reliable epidemiological characteristics of HIV infection among high-risk groups in Iran, to assist developing prevention strategies for policy makers, and to guide further research within this field.

Material and methods

Search strategy

A comprehensive literature search of international electronic bibliographic databases was performed, including PubMed, Scopus, EMBASE and Science Direct and National databases, with Magiran, Iranmedex, and SID from inception to November 20, 2016. In addition, to identify further relevant studies, hand searches were also performed.

Key search terms included terminology for “Prostitute”, “FSW” or “Sex Worker”, “Intravenous Drug Users”, “Drug Addicts”, “IDU” or “Injection Drug Users”, “Prisoner”, “Jail”, “Inmate” or “Prison”, “HCV”, “Human Immunodeficiency Virus” or “Blood-Borne Infection” and “Iran”. Studies restricted to those performed in 2000 and after, and all published studies in English and Persian languages conducted in Iran were considered for the study. The reason studies have been reviewed from 2000 onwards was that HIV is an emerging disease and serological studies on high-risk groups, such as prisoners, have been considered in recent years in Iran.

We defined sex work as exchanging sex for money, drugs, or goods [2]. Also, IDUs were defined as people who inject narcotic substances into the body with a hollow needle and a syringe, which is pierced through the skin into the body, usually intravenously [11]. We only included articles that determined HIV infection in patients by laboratory criteria according to country guideline definitions [12]. Case reports, case series, letters to the editors, review articles, animal studies, and conference records were excluded from the study.

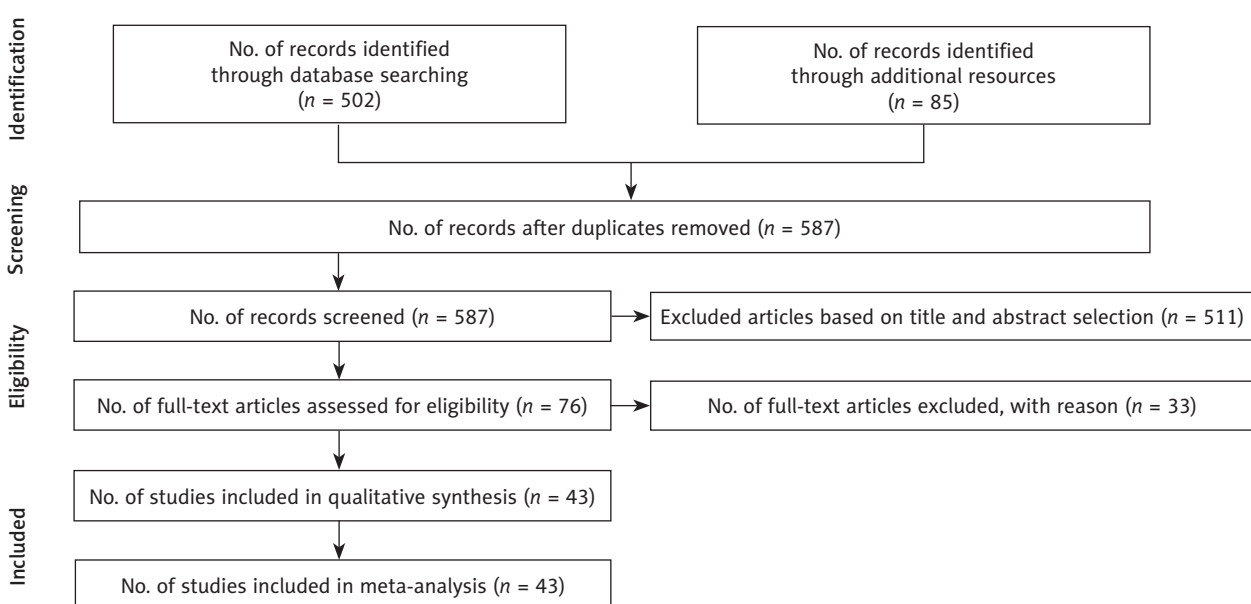


Figure 1. Flow diagram of the meta-analysis

Table 1. Description of the studies included in the meta-analysis

First author (year)	Sample size	Location	High-risk group	Recruitment setting	Recruitment method	Age group	Gender
Mirahmadizadeh <i>et al.</i> (2000)	1,061	Shiraz	IDUs	Camp	Census	34.4 ± 8.5	Male
Khani <i>et al.</i> (2003)	346	Zanjan	Drug addict prisoners	Prison	N.A.	33.7 ± 10.2	Male
Naderi <i>et al.</i> (2004)	144	Tehran	IDUs	Hospital	Census	26.0-30.0	Both
Rowhani Rahbar <i>et al.</i> (2004)	101	Mashhad	IDUs	Prison	Convenience sample	32.8	Male
Ghanbar Zadeh <i>et al.</i> (2004)	199	Birjand	Prisoners	Prison	Volunteers	35.0 ± 12.3	Female
Alizadeh <i>et al.</i> (2005)	427	Hamadan	Drug addict prisoners	Prison	Random number generator	N.A.	Both
Zamani <i>et al.</i> (2006)	207	Tehran	IDUs	DIC	Consecutive sample	Median, 32	Male
Azarkar <i>et al.</i> (2006)	400	Birjand	Prisoners	Prison	Stratified random sampling	34.1 ± 11.7	Both
Talaie <i>et al.</i> (2007)	214	Tehran	Drug addicts	Hospital	Sequential sampling	37.9 ± 14.9	Both
Saleh <i>et al.</i> (2007)	94	Hamadan	IDUs	Forensic medicine	Census	N.A.	Both
Sodbakhsh <i>et al.</i> (2007)	60	Tehran	IDUs	Hospital	Census	35.3 ± 9.7	Male
Mashkati <i>et al.</i> (2007)	98	Isfahan	IDUs	Behavioral consulting center	Census	30.0-40.0	Male
Afsar Kazerooni <i>et al.</i> (2007)	360	Shiraz	IDUs	Community	Random sampling	33.0 ± 7.3	Male
Amin-Zadeh <i>et al.</i> (2007)	70	Tehran	IDUs	Hospital	Volunteers	34.4 ± 9.6	Male
Tajbakhsh <i>et al.</i> (2007)	600	Shahre kourid	Prisoners	Prison	Census	25.4	Male
Pourahmad <i>et al.</i> (2007)	1,431	Isfahan, Lorestan, Chaharmahal	Prisoners	Prison	N.A.	25.0-60.0	Male
Khodabakhshi <i>et al.</i> (2007)	121	Gorgan	Drug addict prisoners	Prison	Random sampling	N.A.	Both
Imani <i>et al.</i> (2008)	133	Shahre kourid	IDUs	Voluntary rehabilitation center	Census	31.3 ± 7.1	Both
Sharif <i>et al.</i> (2009)	200	Kashan	IDUs	Hospital	Volunteers	36.5 ± 10.2	Both
Mirahmadizadeh <i>et al.</i> (2009)	936	Shiraz	IDUs	DIC	Systematic random sampling	33.1 ± 8.9	Both
Alavi <i>et al.</i> (2009)	142	Ahvaz	IDUs	Hospital	N.A.	26.3 ± 5.7	Both
Mirzendehtdel <i>et al.</i> (2010)	118	Tehran	Drug addicts	DIC	Census	35.1 ± 1.2	Female
Mohamad-Khani <i>et al.</i> (2010)	220	Tehran	IDUs	MMT center	Census	N.A.	Both

Table 1. Cont.

First author (year)	Sample size	Location	High-risk group	Recruitment setting	Recruitment method	Age group	Gender
Zamani <i>et al.</i> (2010)	118	Isfahan	IDUs	Community	Peer-driven sampling	29.0 ± 6.6	Both
Kheirandish <i>et al.</i> (2010)	459	Tehran	IDUs	Prison	Census	N.A.	Male
Hosseini <i>et al.</i> (2010)	417	Tehran	IDUs	Temporary detention center	Census	N.A.	Male
Ghasemian <i>et al.</i> (2011)	88	Sari, Ghaemshahr	IDUs	Hospital	Census	35.01 ± 11.5	Both
Navadeh <i>et al.</i> (2012)	177	Kerman	FSWs	RDS	Responding driven sampling	30.8	Female
Moradi <i>et al.</i> (2012)	118	Hamadan	IDUs	Prison	Peer-driven sampling	32.0 ± 8.1	Male
Majidi <i>et al.</i> (2012)	104	Tehran	IDUs	Hospital	N.A.		Both
Nokhodian <i>et al.</i> (2012)	161	Isfahan	Prisoners	Prison	Census	34.5 ± 11.2	Female
Sofian <i>et al.</i> (2012)	153	Arak	Prisoners	Prison	Census	30.7 ± 5.9	Male
Sajadi <i>et al.</i> (2013)	872	Countrywide	FSWs	N.A.	Facility-based survey	31.6	Female
Khajehkazemi <i>et al.</i> (2013)	2,290	Countrywide	IDUs	Combined	Facility-based sampling	34.6 ± 8.9	Male
Navadeh <i>et al.</i> (2013)	4,536	Countrywide	Prisoners	Prison	Multistage random sampling	N.A.	Both
Kazerooni <i>et al.</i> (2014)	278	Shiraz	FSWs	RDS	Respondent-driven sampling	32.9 ± 8.7	Female
Ramezani <i>et al.</i> (2014)	100	Arak	IDUs	MMT center	Census	17.0-58.0	Male
Alihoseinpoor <i>et al.</i> (2014)	679	Khoram Abad	IDUs	Camp	N.A.	34.7	Both
Zamani <i>et al.</i> (2014)	305	Alborz	IDUs	Drug treatment centers	N.A.	25.0-34.0	Both
Ziaei <i>et al.</i> (2014)	881	Southern Khorasan	Prisoners	Prison	Random sampling	34.7 ± 11.4	Both
Salehi <i>et al.</i> (2015)	1,327	Shiraz	Drug addicts	DIC	Census	33.4	Both
Moayedi-Nia <i>et al.</i> (2015)	161	Tehran	FSWs	N.A.	Respondent-driven sampling	37.4 ± 8.9	Female
Malekinejad <i>et al.</i> (2015)	544	Tehran	IDUs	RDS	Respondent-driven sampling	36.5 ± 9.2	Both

Data extraction and quality assessment

Two independent authors (SK and KM) reviewed the retrieved studies, and the following information was extracted: 1) name of the first author; 2) year of publica-

tion and location of study conduction; 3) total sample size; 4) reported prevalence of infection; 5) recruitment setting; 6) recruitment method; 7) age group; 8) high-risk group (IDUs, FSWs, or prisoners). Kappa statistics (95%) was used to identify the inter-authors reliability. The third au-

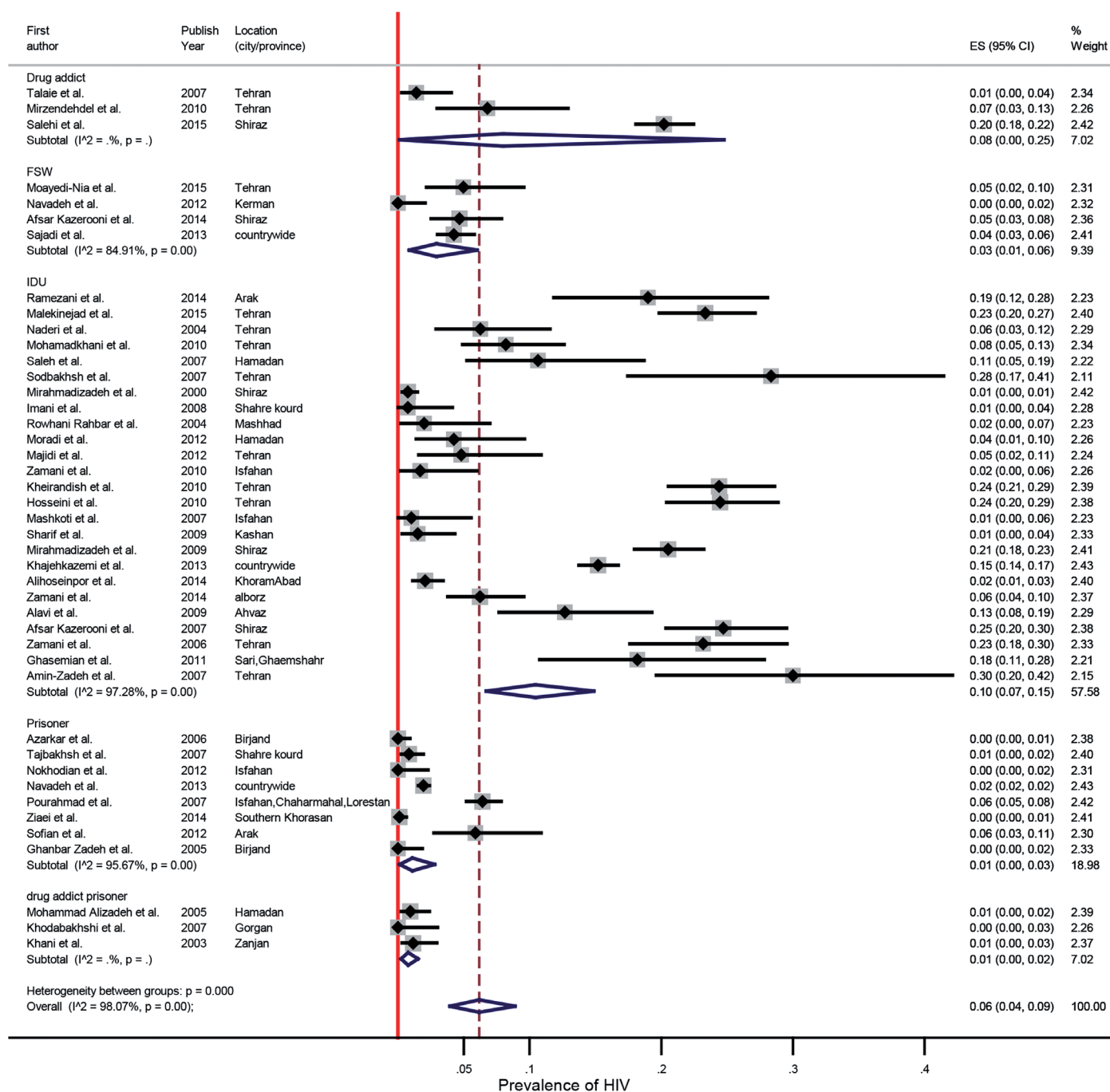


Figure 2. Forest plot of the prevalence of HIV infection in high-risk groups in Iran

thor (EA) was considered as arbiter to resolve any disagreements. STROBE statement was applied to assess the quality of studies.






Statistical analysis

At first, the variance of each study was calculated through the variance of binomial distribution, given that the prevalence rate has a binomial distribution. Then, each

study was given a weight, and was inversely proportional to the variance.

The heterogeneity of results across the studies was checked using Cochran's Q test (with *p*-value < 0.10), and it was quantified by *I*² statistic. The *I*² statistic greater than 50% was considered as significant heterogeneity across the studies. Tau-squared (*t*² or Tau²) statistic and Egger's linear regression test were used to investigate the between-study variance and to examine publication bias, respectively. For

Table 2. Meta-analysis of the prevalence of HIV infection based on high-risk groups in different geographic area of Iran

Geographic location		No. of study (sample size)	Drug addicts (range)	FSWs (range)	IDUs (range)	Prisoners (range)	Drug addict prisoners (range)
	North	2 (209)	–	–	0.18 (0.10-0.28)	–	0 (0.00-0.03)
	West	6 (1,806)	–	0.06 (0.02-0.14)	–	0.01 (0.00-0.02)	–
	South	6 (4,139)	0.2 (0.18-0.22)	0.02 (0.01-0.04)	0.12 (0.00-0.36)	–	–
	Center	22 (6,017)	0.03 (0.01-0.05)	0.05 (0.02-0.10)	0.11 (0.06-0.17)	0.02 (0.00-0.07)	–
	East	4 (1,581)	–	–	0.02 (0.00-0.07)	–	–

detecting source of heterogeneity, sub-groups analysis was conducted on the basis of infection type, high-risk group, and geographical regions. To examine the impact of moderator variables on prevalence rate, meta-regression analysis was used.

In order to estimate a weighted-mean estimate of prevalence for mentioned infections across the included studies, prevalence estimates by each study were pooled using a random-effects meta-analysis model at a confidence level of 95%. All meta-analysis and meta-regression were performed with Stata software version 12 (StataCorp, College Station, TX, USA). PRISMA statement was utilized as a guide to enhance quality reporting of the review [13].

Results

The results of the literature search and the selection process are showed in Figure 1. A total of 1,113 potentially rel-

evant articles were identified from the initial search. After removing duplicates, 587 articles remained and then, out of which 511 articles were excluded by screening titles and abstracts. Finally, 43 studies [8, 9, 12, 14-53] met eligibility criteria for meta-analysis, which involved 1,746 HIV-positive patients.

Study characteristics

Studies' characteristics and results are displayed in Table 1 and Figure 2. These studies were published between 2000 and 2015. The sample size of included articles varied from 70 to 4,536, with a total of 21,450 cases with high-risk behavior, including FWS (3 studies), IDUs (25 studies), prisoners (8 studies), drug addicts (3 studies), and drug addict prisoners (3 studies). In five studies, the prevalence rate of HIV/AIDS among high-risk groups were 0%, and the highest prevalence was related to Amin-Zadeh *et al.* among IDUs in Tehran (30%) [52].

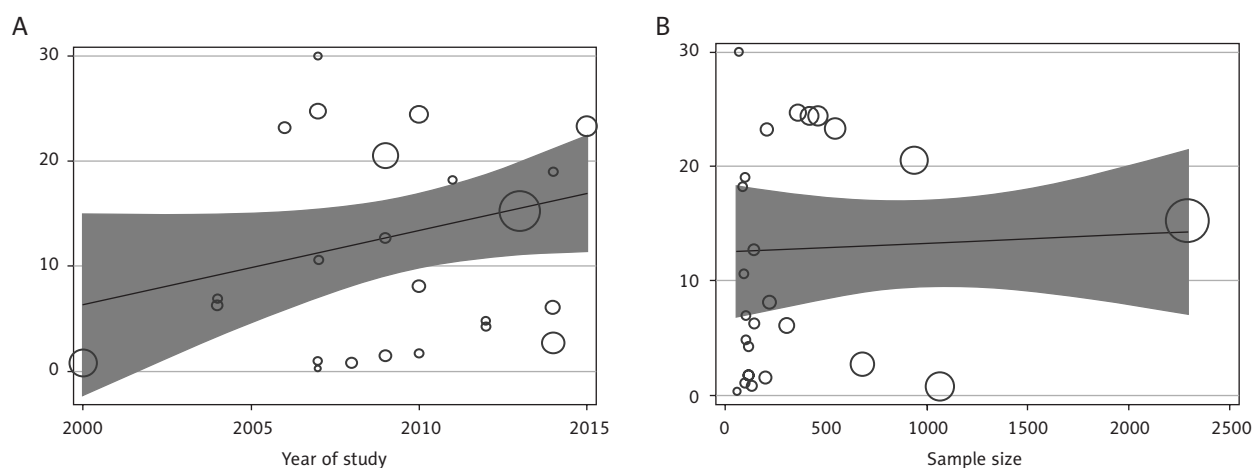


Figure 3. Meta-regression plots of change in prevalence of HIV among IDUs according to changes in years of study and sample size

Evaluation of heterogeneity and meta-analysis

The results of Cochran's Q test and I^2 statistics suggested a significant heterogeneity among the included studies ($Q = 2178.92$, $df = 42$, $p < 0.001$, $I^2 = 98.07\%$). The pooled prevalence of HIV infection in high-risk groups was 0.06% (95% CI: 0.04-0.09%). In order to reduce the heterogeneity, we performed sub-group analysis based on geographical region (3 countrywide study were excluded) (Table 2). Accordingly, the prevalence of HIV among high-risk groups was ranged from 0 among drug addict prisoners in the North to 0.2 (95% CI: 0.018-0.22%) among drug addicts in the South parts of Iran.

Meta-regression

The results of meta-regression analysis are shown in Figure 3. The prevalence of HIV among IDUs was not related to the year of study, and mild increasing trend in this period was not significant ($B = 0.44$, $p = 0.43$). also, the prevalence of HIV among IDUs was not related to study sample size ($p = 0.55$).

Discussion

The present systematic review on HIV cross-sectional studies in Iran was conducted on 43 studies, including 25 studies on injection drug users (IDUs), 4 studies on female sex workers (FSWs), and 11 studies on prisoners. The estimated pooled HIV prevalence was 0.06% in these high-risk groups, ranging from 0.01% in prisoners, who use drugs, to 0.2% in IDUs.

We found that only 4 studies have been conducted on female sex workers in Iran, reporting a prevalence of 0.02% in the South to 0.06% in the West of the country. Although female sex workers have long been understood to be a key affected population, the extent of their disproportionate risk for HIV infection had not yet been documented appropriately.

We found a great deal of heterogeneity in studies regarding HIV prevalence among FSWs. Such heterogeneity reflect various social, political, economic, and cultural factors within every country [54], yet an understanding of how these factors contribute to HIV acquisition; however, transmission risks has only recently been noticed. On the other hand, changes in macro-structural context and policies (such as sex work decriminalization) as well as features of FSWs' work environment are urgently needed.

Although the prevalence of HIV among FSWs in Iran are comparably low, responses for HIV epidemic, such as free condom campaigns, community empowerment, campaigns to address stigma, and structural policy support are highly recommended [55].

Our systematic review on the prevalence of HIV among IDUs in Iran yielded a pooled prevalence of 0.18. Injecting drug use is an important cause of HIV transmission. Globally, around 13 million people inject drugs, and 1.7 million of them are living with HIV [55]. On the other hand, HIV is an important contributor to the burden of drug use and has the potency to spread to a wider community through sexual transmissions [56]. There are a few effective interventions addressing HIV in IDUs, including provision of clean needles and syringes (typically through needle and syringe programs; NSPs) to avoid HIV transmission by sharing contaminated injecting equipment, and treatment of opioid dependence with opioid substitution therapy (OST), particularly methadone and buprenorphine, leading to a reduction of drug injection practices [57]. Opioid substitution therapy (OST) and the distribution of sterile needles/ syringes are fundamental and core components of HIV prevention efforts. However, for various IDUs populations, the coverage could be increased by delivering these interventions through several models, rather than relying on one delivery model. For instance, expansion of both pharmacy and NSP distribution of needles/ syringes, establishment of special clinics, and office-based delivery of OST are some of the combined responses. Condom provi-

sion, instead, could be off paramount importance since sexual transmission of HIV is also a risk for IDUs, and therefore interventions have a maximum effect when they are delivered in combination [58]. Given the challenges of further reducing HIV infection rates and developing an effective vaccine [30], it is critical to focus on behavioral prevention efforts that are based on the best available scientific evidence. Modification of HIV-risk behaviors requires high-risk populations to understand the mechanism of HIV transmission. Without such comprehension, HIV prevention attempts (especially provision of clean needles/ syringes) could be completely useless. Furthermore, provision of ART might also have a role in primary HIV prevention, specifically in IDU populations as well as for people with high-risk sexual encounters [58].

There are some limitations to generalize the results of this review to the whole country. Firstly, sampling of marginalized populations often were carried out using convenient schemes from various locations, including prisons, drug treatment centers, and harm reduction clinics. Secondly, lacking information from many parts of the country affects generalizability of the study at national level. Another limitation is that most studies have been carried out in high-risk areas and settings like prisons, hospitals, or behavioral counseling centers, where the clients have special profile of risky behaviors.

In summary, studies on HIV prevalence in key populations (i.e., high-risk groups) are still lacking in Iran. More complete data is needed to improve the response to HIV epidemic. Moreover, concerted efforts must be launched to gather more reliable and wider information about the epidemic in every part of the country.

Conclusions

Our results indicate that prevalence of HIV infection among high-risk groups in Iran is low. The prevalence of HIV in high-risk groups in different parts of Iran has a different pattern. Due to significant prevalence of HIV in injecting drug users compared to other high-risk groups, there is a need to pay serious attention to this high-risk group and adopt preventive strategies.

Acknowledgement

Herewith, we would like to express our appreciation to Dr. Nedjat, Professor of Epidemiology from Tehran University of Medical Sciences for her technical support.

Conflict of interest

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

References

- Zack MM, Moriarty DG, Stroup DF, Ford ES, Mokdad AH. Worsening trends in adult health-related quality of life and self-rated health – United States, 1993–2001. *Public Health Rep* 2004; 119: 493.
- Alter MJ. Epidemiology of viral hepatitis and HIV co-infection. *J Hepatol* 2006; 44: S6–S9.
- WHO. HIV/AIDS Fact sheet; 2016. Available at: <http://www.who.int/mediacentre/factsheets/fs360/en/> (Accessed: 19.11.2016).
- Solomon SS, Srikrishnan AK, Mehta SH, et al. High prevalence of HIV, HIV/hepatitis C virus co-infection and risk behaviors among IDUs in Chennai, India: a cause for concern. *J Acquir Immune Def Syndr* (1999) 2008; 49: 327.
- Inciardi JA, Surratt HL, Kurtz SP. HIV, HBV, and HCV infections among drug-involved, inner-city, street sex workers in Miami, Florida. *AIDS Behav* 2006; 10: 139–147.
- Dolan K, Kite B, Black E, Aceijas C, Stimson GV. HIV in prison in low-income and middle-income countries. *Lancet Infect Dis* 2007; 7: 32–41.
- Zamani S, Kihara M, Gouya MM, et al. High prevalence of HIV infection associated with incarceration among community-based injecting drug users in Tehran, Iran. *J Acquir Immune Def Syndr* 2006; 42: 342–346.
- Kazerouni PA, Motazedian N, Motamedifar M, et al. The prevalence of human immunodeficiency virus and sexually transmitted infections among female sex workers in Shiraz, South of Iran: by respondent-driven sampling. *Int J STD AIDS* 2014; 25: 155–161.
- Ziaee M, Sharifzadeh G, Namaee MH, Fereidouni M. Prevalence of HIV and hepatitis B, C, D infections and their associated risk factors among prisoners in Southern Khorasan Province, Iran. *Iranian J Public Health* 2014; 43: 229–234.
- Haghdoost AA, Mostafavi E, Mirzazadeh A, et al. Modelling of HIV/AIDS in Iran up to 2014. *J AIDS HIV Res* 2011; 3: 231–239.
- WHO. Hepatitis B Fact sheet; 2016. Available at: <http://www.who.int/mediacentre/factsheets/fs204/en/> (Accessed: 19.11.2016).
- Ministry of Health and Medical Education. National guideline for HIV/AIDS control and treatment. Tehran: MOHME; 2011.
- WHO. Hepatitis C Fact sheet; 2016. Available at: <http://www.who.int/mediacentre/factsheets/fs164/en/> (Accessed: 19.11.2016).
- Khani M, Vakili MM. Prevalence and risk factors of HIV, hepatitis B virus and hepatitis C virus infections in drug addicts among Zanjan prisoners. *Arch Iranian Med* 2003; 6: 1–4.
- Mirahmaizadeh AR, Kadivar MR, Ghane Shirazi R, Fararoei M. Prevalence of HIV infection among intravenous drug addicts in Shiraz, 1998. *Journal of Gorgan University of Medical Sciences* 2001; 3: 39–42.
- Rahbar AR, Rooholamini S, Khoshnood K. Prevalence of HIV infection and other blood-borne infections in incarcerated and non-incarcerated injection drug users (IDUs) in Mashhad, Iran. *Int J Drug Policy* 2004; 15: 151–155.
- Alizadeh AHM, Alavian SM, Jafari K, Yazdi N. Prevalence of hepatitis C virus infection and its related risk factors in drug abuser prisoners in Hamedan-Iran. *World J Gastroenterol* 2005; 11: 4085.
- Talaie H, Shadnia S, Okazi A, Pajouhmand A, Hasanian H, Arianpoor H. The prevalence of hepatitis B, hepatitis C and HIV infections in non-IV drug opioid poisoned patients in Tehran-Iran. *Pakistan J Biol Sci* 2007; 10: 220–224.
- Soudbakhsh A, Nami M, Hadjiabdolbaghi M, Kazemi B. Transfusion transmitted virus prevalence rate in injection drug users (IDUs): a cross sectional study. *Tehran University Medical Journal* 2008; 66: 113–117 [In Persian].
- Meshkati M, Taeri K, Etedali E, Farid F. Prevalence of hepatitis B, C and HIV/AIDS in injecting drug users referred to the Behavioral Diseases Counseling Center in 2004. The first National Congress of infection in drug addicts in Iran; 2007.
- Afsar-Kazarooni P, Amini-Lari M, Joulaei H, Sabet M, Hasanabadi AR, Naghshvarian M. Surveying the prevalence of acquired viral infection and high-risk behaviors associated with AIDS among injecting drug users in Shiraz. *Journal of Fundamentals of Mental Health* 2009; 3: 175–184 [In Persian].
- Tajbakhsh E, Yaghubi R. Serologic evaluation of HIV contamination in Shahrekord prisoners through ELISA and Western blot. *Sci J Iran Blood Transfus Organ* 2008; 4: 365–368.

23. Pourahmad M, Javady A, Karimi I, Ataei B, Kassaian N. Seroprevalence of and risk factors associated with hepatitis B, hepatitis C, and human immunodeficiency virus among prisoners in Iran. *Infect Dis Clin Pract* 2007; 15: 368-372.
24. Behnaz K, Abdollah A, Fateme F, Mohammadreza R. Prevalence and risk factors of HIV, hepatitis B virus and hepatitis C virus infections in drug addicts among Gorgan prisoners. *J Med Sci* 2007; 7: 252-254.
25. Imani R, Karimi A, Rouzbahani R, Rouzbahani A. Seroprevalence of HBV, HCV and HIV infection among intravenous drug users in Shahr-e-Kord, Islamic Republic of Iran. *East Mediterr Health J* 2008; 14: 1136-1141.
26. Sharif M, Sherif A, Sayyad M. Frequency of HBV, HCV and HIV infections among hospitalized injecting drug users in Kashan. *Indian J Sex Trans Dis* 2009; 30: 28-30.
27. Mirahmadzadeh AR, Majdzadeh R, Mohammad K, Forouzanfar M. Prevalence of HIV and hepatitis C virus infections and related behavioral determinants among injecting drug users of drop-in centers in Iran. *Iranian Red Crescent Medical Journal* 2009; 11: 325.
28. Alavi SM, Alavi L. Seroprevalence study of HCV among hospitalized intravenous drug users in Ahvaz, Iran (2001-2006). *J Infect Public Health* 2009; 2: 47-51.
29. Mirzendehtdel S, Nadjji SA, Tabarsi P, et al. Prevalence of HPV and HIV among female drug addicts attending a drop-in center in Tehran, Iran. *Int J Gynecol Obstet* 2010; 108: 254-255.
30. Lemckert AA, Goudsmit J, Barouch DH. Challenges in the search for an HIV vaccine. *Eur J Epidemiol* 2004; 19: 513-516.
31. Zamani S, Radfar R, Nematollahi P, et al. Prevalence of HIV/HCV/ HBV infections and drug-related risk behaviours amongst IDUs recruited through peer-driven sampling in Iran. *Int J Drug Policy* 2010; 21: 493-500.
32. Kheirandish P, SeyedAlinaghi S, Hosseini M, et al. Prevalence and correlates of HIV infection among male injection drug users in detention in Tehran, Iran. *J Acquir Immune Defic Syndr* 2010; 53: 273-275.
33. Hosseini M, SeyedAlinaghi S, Kheirandish P, et al. Prevalence and correlates of co-infection with human immunodeficiency virus and hepatitis C virus in male injection drug users in Iran. *Arch Iran Med* 2010; 13: 318-323.
34. Ghasemian R, Najafi N, Amirhanloo K. The study of infections due to injection drug abuse in the injecting drug users hospitalized at Imam Khomeini Hospital in Sari and Razi Hospital in Ghaemshahr in 2007-2009. *J Mazand Univ Med Sci* 2011; 21: 9-15 [In Persian].
35. Navadeh S, Mirzazadeh A, Mousavi L, Haghdoost A, Fahimfar N, Sedaghat A. HIV, HSV2 and syphilis prevalence in female sex workers in Kerman, South-East Iran; using respondent-driven sampling. *Iranian J Public Health* 2012; 41: 60-65.
36. Moradi AR, Emdadi A, Soori B, Mostafavi E. Prevalence of human immunodeficiency virus infection among injection drug users released from jail. *Addict Health* 2012; 4: 151-155.
37. Majidi M. Prevalence of HIV, hepatitis B and C among drug abusers admitted to ICU of Baharloo hospital in 2010. PhD Thesis of Forensic Medicine. Tehran: Tehran University of Medical Sciences; 2012.
38. Nokhodian Z, Yaran M, Adibi P, Kassaian N, Meshkati M, Ataei B. Seroprevalence of hepatitis B markers among incarcerated intravenous drug users. *J Res Med Sci* 2014; 19 (Suppl 1): S13.
39. Sofian M, Aghakhani A, Banifazl M, et al. Viral hepatitis and HIV infection among injection drug users in a central Iranian City. *J Addict Med* 2012; 6: 292-296.
40. Khajehkazemi R, Osooli M, Sajadi L, et al. HIV prevalence and risk behaviours among people who inject drugs in Iran: the 2010 National Surveillance Survey. *Sex Transm Infect* 2013; 89 Suppl 3: iii29-32.
41. Sajadi L, Mirzazadeh A, Navadeh S, et al. HIV prevalence and related risk behaviours among female sex workers in Iran: results of the national biobehavioural survey, 2010. *Sex Transm Infect* 2013; 89 (Suppl 3): iii37-iii40.
42. Navadeh S, Mirzazadeh A, Gouya MM, Farnia M, Alasvand R, Haghdoost AA. HIV prevalence and related risk behaviours among prisoners in Iran: results of the national biobehavioural survey, 2009. *Sex Transm Infect* 2013; 89 (Suppl 3): iii33-iii36.
43. Ramezani A, Amirmoezi R, Volk JE, et al. HCV, HBV, and HIV seroprevalence, coinfections, and related behaviors among male injection drug users in Arak, Iran. *AIDS Care* 2014; 26: 1122-1126.
44. Alihoseinpoor M. Prevalence of acquired immunodeficiency virus infection among addicts in compulsory residence center of Khorramabad county. The first international and the fifth national congress of HIV/AIDS; Tehran; 2014.
45. Salehi A, Naghshvarian M, Marzban M, Lankarani KB. Prevalence of HIV, HCV, and High-Risk Behaviors for Substance Users in Drop in Centers in Southern Iran. *J Addict Med* 2015; 9: 181-187.
46. Moayedi-Nia S, Bayat Jozani Z, Esmaeili D Javid G, et al. HIV, HCV, HBV, HSV, and syphilis prevalence among female sex workers in Tehran, Iran, by using respondent-driven sampling. *AIDS Care* 2016; 28: 487-490.
47. Malekinejad M, Mohraz M, Razani N, et al. High HIV prevalence in a respondent-driven sampling survey of injection drug users in Tehran, Iran. *AIDS Behav* 2015; 19: 440-449.
48. Naderi N. Epidemiology of hepatitis C in hospitalized addicts in in Loghman Hakim Hospital, 2000-2001. MD Thesis. Tehran: Shahid Beheshti University of Medical Sciences; 2003.
49. Ghanbarzadeh N, Najafi-Semmani M. A study of HIV and other sexually transmitted infections among female prisoners in Birjand. *Scientific Journal of Birjand University of Medical Sciences* 2006; 13: 69-75 [In Persian].
50. Azarkar Z, Sharifzadeh G, Miraki M. HBV, HCV and HIV prevalence among South Khorasan prisoners. *Scientific Journal of Birjand University of Medical Sciences* 2007; 14: 50-56 [In Persian].
51. Saleh M, Kazemifar AM, Saleh AE, Asghar A, Nobari H, Samimi R. Prevalence of HIV, hepatitis B and C seropositivity in expired IV drug abusers in Hamedan. *Forensic Medicine J* 2010; 16: 253-257 [In Persian].
52. Aminzadeh Z, Sarhangi-poor KA. Sero epidemiology of HIV, HBV, HCV and Syphilis among hospitalized IDUs in Loghman-Hakim hospital. *Iranian Journal of Medical Microbiology* 2007; 1: 53-56 [In Persian].
53. Mohammadkhani-Ghiasvand A, Golian-Tehrani S, Modanlu S, Vejdani M, Babaei-Heydarabadi A, Dehghankar L. Investigation of serologic prevalence of HIV and hepatitis B infections and its relationship with behavioral risk factors among drug addicts. *J Health Syst Res* 2016; 12: 70-76.
54. Shannon K, Csete J. Violence, condom negotiation, and HIV/STI risk among sex workers. *JAMA* 2010; 304: 573-574.
55. Shannon K, Strathdee SA, Goldenberg SM, et al. Global epidemiology of HIV among female sex workers: influence of structural determinants. *Lancet* 2015; 385: 55-71.
56. Rachlis B, Brouwer K, Mills E, Hayes M, Kerr T, Hogg R. Migration and transmission of blood-borne infections among injection drug users: understanding the epidemiologic bridge. *Drug Alcohol Depend* 2007; 90: 107-119.
57. Tilson H, Aramrattana A, Bozette S. Preventing HIV infection among injecting drug users in high-risk countries: an assessment of the evidence; 2007 Available at: <http://www.nap.edu/openbook.php?recordid=11731&page=1> (Accessed: 18.02.2010).
58. Mathers BM, Degenhardt L, Ali H, et al. HIV prevention, treatment, and care services for people who inject drugs: a systematic review of global, regional, and national coverage. *Lancet* 2010; 375: 1014-1028.