

# UCSF

## UC San Francisco Previously Published Works

### Title

HIV prevention cascades for injection and sexual risk behaviors among HIV-negative people who inject drug in Iran

### Permalink

<https://escholarship.org/uc/item/5n2387wz>

### Authors

Gangi, Monireh Faghir  
Karamouzian, Mohammad  
Nedjat, Saharnaz  
et al.

### Publication Date

2020-10-01

### DOI

10.1016/j.drugpo.2020.102868

Peer reviewed



Published in final edited form as:

*Int J Drug Policy*. 2020 October ; 84: 102868. doi:10.1016/j.drugpo.2020.102868.

## HIV prevention cascades for injection and sexual risk behaviors among HIV-negative people who inject drug in Iran

Monireh Faghir Gangi<sup>1</sup>, Mohammad Karamouzian<sup>2,3</sup>, Saharnaz Nedjat<sup>4</sup>, Afarin Rahimi-Movaghar<sup>5</sup>, Kamran Yazdani<sup>6</sup>, Mostafa Shokoohi<sup>3,7</sup>, Ali Mirzazadeh<sup>3,8,\*</sup>

<sup>1</sup>Department of Epidemiology and Biostatistics, School of public health, Tehran University of Medical Sciences, Tehran, Iran

<sup>2</sup>School of Population and Public Health, Faculty of Medicine, University of British Columbia, Vancouver, BC, Canada

<sup>3</sup>HIV/STI Surveillance Research Center, and WHO Collaborating Center for HIV Surveillance, Institute for Futures Studies in Health, Kerman University of Medical Sciences, Kerman, Iran

<sup>4</sup>Department of Epidemiology and Biostatistics, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran

<sup>5</sup>Iranian National Center for Addiction Studies (INCAS), Tehran University of Medical Sciences, Tehran, Iran

<sup>6</sup>Department of Epidemiology and Biostatistics, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran

<sup>7</sup>Dalla Lana School of Public Health, University of Toronto, Toronto, Canada

<sup>8</sup>Department of Epidemiology and Biostatistics, Institute for Global Health Sciences, University of California San Francisco, San Francisco, CA, USA.

### Abstract

**Background:** The HIV prevention cascade complements the HIV treatment cascade and helps evaluate the access to and use of harm reduction programs among HIV-negative individuals at risk for HIV, including people who inject drugs (PWID). This study aimed to estimate the HIV prevention cascades among PWID in Iran.

**Methods:** Using data from the 2013 national bio-behavioral surveillance survey, 2,391 PWID were recruited from 31 harm reduction facilities and through outreach efforts across 10 major cities. PWID aged 18 years who reported drug injection in the past year were interviewed, and information regarding their demographic characteristics, sexual and drug injection practices, and

\*Corresponding author: Ali Mirzazadeh (Ali.Mirzazadeh@ucsf.edu).

**Publisher's Disclaimer:** This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

**Conflict of Interest:** All authors declare that they have no conflict of interest.

access to services were gathered. PWID were also tested for HIV infection. We examined the prevention cascade framework among HIV-negative PWID.

**Results:** The majority of PWID were male (97.6%) and more than half aged < 35 years old (55.5%). Overall, 2,092 (92.5% [95% CI: 90.8, 93.9]) were HIV-negative; 93% of whom knew illicit drug injection could increase the risk of HIV transmission, 54% had access to free-of-charge sterile needles and syringes, 51% used sterile needles and syringes in their last injection practice, and 33% used sterile needles and syringes in all injection practices in the past month. Also, 87.8% (95% CI: 85.1, 90.0) of HIV-negative PWID had sex with any partner in the past year; 88% of whom knew using condoms could reduce the risk of HIV transmission, 35% had access to free-of-charge condoms, 32% used condoms in their last sexual practice, and 18% used condoms in all of their sexual practices in the past month.

**Conclusion:** The majority of HIV-negative PWID in Iran were at risk for HIV acquisition through unsafe drug injection or sexual practices. Harm reduction programs should improve access to free sterile needles, syringes, and condoms for PWID.

### Keywords

People who inject drugs; Needle and syringe program; Condom distribution; Prevention cascade; HIV; Iran

## INTRODUCTION

In 2014, the Joint United Nations Programme on HIV/AIDS (UNAIDS) and the World Health Organization (WHO) announced the ambitious yet achievable 90-90-90 targets to be met by 2020 (i.e., 90% of all people living with HIV know their HIV status, 90% diagnosed patients receive antiretroviral therapy, and 90% of those receiving antiretroviral therapy reach viral suppression) (Karatzas et al., 2019). In order to limit the spread of HIV however, focusing on HIV treatment cascade have shown to be inadequate in addressing the HIV pandemic and most countries have been shown to underperform in reaching these goals (Karatzas et al., 2019; Levi et al., 2016). A more effective response needs to include preventative behaviors and products to be used by most at-risk populations and therefore, HIV prevention cascades have emerged in the past few years to complement the HIV treatment cascade. Indeed, HIV prevention cascade sets additional goals to be achieved by 2020 by focusing on reducing the number of new HIV infections below 500,000 through expansion HIV prevention mechanisms such as condoms, pre-exposure prophylaxis, and provision of clean and free needles (G. P. Garnett et al., 2016; J. R. Hargreaves et al., 2016).

In Iran, the HIV epidemic is concentrated among marginalized populations and injection drugs use continues to be its main driver (H. Sharifi et al., 2018). Recent population size estimation studies suggest that around two million people use illicit drugs in Iran; ~208,000 of whom inject drugs (Nikfarjam et al., 2016). People who inject drugs (PWID) in Iran are at risk of numerous adverse mental and physical health outcomes such as mood and anxiety disorders, unsafe sex, HIV and viral hepatitis, suicidal ideation, and fatal overdose (Razieh Khajehkazemi et al., 2013; Rostami, Karamouzian, Khosravi, & Rezaeian, 2018). For example, the prevalence of HIV and hepatitis C virus (HCV) among PWID (HIV: 14.3%

before 2007 and 9.7% after 2007, HCV: 45%) (Malekinejad et al., 2015; Rahimi et al., 2020) and people who use drugs via non-injecting routes (HIV: 5.4% after 2005, HCV: 8%) (Amin-Esmaeili, Rahimi-Movaghar, Haghdoost, & Mohraz, 2012) remains considerably higher than those in the general population.

Iran's approach to drug policy has shifted drastically in the past four decades. After the 1979 Islamic revolution, the Iranian newly established government closed all voluntary treatment programs and introduced residential correctional facilities which indeed led to several adverse consequences during their 15 years of implementation. Iran then opted for a medicalized approach for substance use and voluntary treatment centers providing psychological and antagonist medications were scaled up across the country. When the HIV epidemic started to grow among clusters of PWID inside and outside prisons, Iran's drug policy shifted towards a harm reduction approach with a focus on opioid-maintenance treatment and needle and syringe programs (NSPs) (Ekhtiari et al., 2019; Emran et al., 2006). These services were rapidly scaled up across the country and Iran's experience in showing that harm reduction is both feasible and acceptable in conservative settings became a success story in Middle East and North Africa (Himmich & Madani, 2016; Karamouzian, Madani, Doroudi, & Haghdoost, 2017; Mirzazadeh et al., 2020; Momtazi, Noroozi, & Rawson, 2015). While scaling up treatment and harm reduction services have been of utmost importance in reducing substance use-related morbidities among PWID in Iran, injection drug use continues to be a serious threat to HIV prevention efforts and HIV-negative PWID continue to sero-convert. For example, HIV incidence among PWID in 2014 was estimated as 5.39 per 1,000 person-years (Hamid Sharifi et al., 2018). Further concerns remain regarding the existing harm reduction services' quality and utilization rates (Momtazi et al., 2015). For example, a recent study on 500 PWID in Iran identified several barriers to NSP uptake among PWID (e.g., inflexible hours, limited number of facilities) and called for further investments in these programs (Noroozi et al., 2018).

HIV prevention cascades provide a framework to help achieve these goals and track gaps in service coverage (James R Hargreaves et al., 2016). In order to improve our understanding of HIV prevention cascade and support programs aimed at increasing the coverage of harm reduction services available to PWID (e.g., free condom promotion and needle and syringe services (NSP)) in Iran, we used the data collected in a national survey of PWID in 2013 to evaluate the access to and use of prevention programs (syringe and condom distribution program) among HIV-negative PWID, following the HIV prevention cascade framework (Geoffrey P Garnett et al., 2016).

## METHODS

### Study design and data collection

Data were obtained from the third nation-wide integrated bio-behavioural surveillance (IBBS) survey of PWID in Iran which was conducted between April and December 2013 (Esmaeili et al., 2019).

The aims of the IBBS were to assess i) the prevalence of HIV; ii) HIV-related substance use and sexual risk behaviours; and iii) HIV-related knowledge, attitude, and practices among

PWID. Participants were recruited from 31 harm reduction facilities (e.g., drop-in centers, shelters, and addiction treatment centres) catered towards PWID as well as through outreach recruitment from street locations (19% of sample size) across 10 major cities (Tehran, Shiraz, Kermanshah, Mashhad, Ahvaz, Kerman, Sari, Tabriz, Khorramabad, and Zahedan) across the country (Figure 1). The harm reduction facilities were not selected by random but were chosen based on the input from the Ministry of Health's HIV experts regarding the logistical and capacity constraints of the facilities in regard to being able to administer the survey and collect biological samples. They were also chosen from different cities to represent all subnational regions. All these facilities were supervised by a local medical university from which we recruited and trained our research team. Most of the selected facilities were from those facilities where the previous IBBS rounds (2010) was conducted. At each facility, eligible PWID were recruited by convenience sampling from the clients at the facility and also those reached through outreach services.

Eligibility criteria for the participants were i) holding Iranian citizenship; ii) 18 years of age at the time of the recruitment; iii) self-reporting at least one illicit drug injection practice in the previous year; iv) residing in the surveyed cities; and v) providing verbal informed consent.

Verbal informed consent was obtained from all individual participants included in the study. The study was anonymous, and no identifying information was collected during recruitment, taking informed consent, interview, or HIV testing. A unique identification code was provided to participants to help link survey responses to their HIV test results. Participants were able to receive their HIV test results, post-test counselling, and referrals from the local testing and counselling centre by providing their unique identification code. PWID were given 70,000 Rials (equalled to ~2.5 USD at that time) as an incentive for participating in the study and 15,000 Rials (equalled to ~0.5 USD at that time) if they returned to receive their test results. The study protocol was reviewed and approved by the Ethics Committees of Kerman University of Medical Sciences (Ethics code: K/93/205) and Tehran University of Medical Sciences (Ethics code: IR.TUMS.SPH.REC.1396.3547). The original survey was approved on 2013; however, our analysis for this study was approved in 2019.

### Key indicators and variables

Baseline characteristics and behavioural data were collected through an anonymous pilot-tested questionnaire. As rapid HIV testing was unavailable at the time of the survey, HIV serostatus was estimated using the dried blood spot (DBS) technique (Cassol et al., 1996) and ELISA test (using bioMérieux Vironostika Uni-Form II Ag/Ab) and was coded as positive vs. negative. Using data from the IBBS, we categorized PWID into a number of groups: HIV-negative, HIV-negative and had sex in the past year, HIV-negative and had sex with their spouse(s) in the past year, HIV-negative and had sex with non-paying partner(s) in the past year, HIV-negative and had sex with paying partner(s) in the past year, and HIV-negative male who had sex with men in the past year. We presented the distribution of sex, age, marital status, educational level, employment status, main substance use type in the previous month, and history of incarceration in each of the PWID subgroups defined by their sexual partner type.

We also created a variable related to HIV prevention cascade for two main indicators of safe injection and sex among PWID. These indicators were chosen based on our review of the relevant literature (Moorhouse et al., 2019; Schaefer et al., 2019) as well as feedback received through a discussion panel session with local and regional HIV experts. Regarding the safe injection indicator, PWID who were HIV-negative were asked about their knowledge about risk of HIV transmission via injection drug use, access to free NSP, use of sterile syringe in their last injection, and use sterile syringe in all of their injections in the previous month. Regarding the safe sex indicator, PWID who were HIV-negative and self-reported having had sex in the previous year were asked about their knowledge about the protective role of condoms against HIV transmission, access to free condom contribution services, condom use in last sex, and condom use in all sexual intercourses in the previous month. Access to NSP was measured by asking participants whether they have received free needles and syringes in the past year. Access to condom distribution programs was measured by asking participants whether they have received free condom in the past year.

### Data analysis

Descriptive statistics and frequencies were calculated for all variables for different subgroups of HIV-negative PWID. As PWID were recruited from different facilities in different provinces, facilities were treated as sampling units and the standard errors were clustered by study sites. For analysis of such data, we used survey analysis package (Kreuter & Valliant, 2007). Restricting data to HIV-negative PWID, we estimated the safe injection HIV prevention cascade indicators including the proportion of those who knew injection was a risk factor for HIV acquisition, had access to NSP, used sterile syringe in their last injection and all of their past-month injections. Moreover, restricting data to HIV-negative PWID who had sex in the previous year, we estimated the proportion of PWID who knew about the protective impact of condoms on HIV transmission, access to free condoms, and using condoms during the last sex and all sex in the previous month. These safe sex indicators were further grouped based on PWID's sex with spouse, unpaid sexual partner (e.g., girlfriend or casual sex partner), paid sexual partner, and homosexual sex among male PWID. For all estimated proportions, 95% confidence intervals (CI) were also reported. The estimates for the HIV prevention cascade among PWID who recruited from outreach street locations were almost the same as those who were recruited from facilities; therefore, estimates for the overall sample were reported. Stata version 14 (Stata Corp.) was used throughout data analysis.

## RESULTS

### Descriptive statistics

We analyzed the data for 2,391 participants, of whom 2,092 were HIV-negative (Table 1). The majority of the participants were male (n=2,333; 97.6%), 35+ years old (n=1,327; 55.5%), had middle or a high school level education (n=1,514; 63.4%), and were unemployed or had unstable jobs (n=2,007; 84.5%). Moreover, 47.8% were single (n=1,143), 34.7% (n=832) reported heroin as the drug of choice in the past month, and 76.0% (n=1,824) had a history of incarceration. Other characteristics were almost the same across all PWID subgroups reported in Table 1.

**Prevention cascade for all HIV-negative PWID**

Overall, 92.5% (95% CI: 90.8, 93.9) of participants were HIV-negative. Of 2,092 HIV-negative PWID, 93% knew drug injection could increase the risk of HIV transmission, 54% had access to free-of-charge sterile needles and syringes, 51% used sterile needles and syringes in their last injection practice, and 33% used sterile needles and syringes in all the injection practices in the past month (Figure 2A).

**Prevention cascade for all HIV-negative PWID having sex with any partners**

Also, 87.8% (95% CI: 85.1, 90.0) of all HIV-negative PWID reported experiencing sexual practice with any partner in the past year; 88% of whom knew that using condoms could reduce HIV transmission, 35% had access to free-of-charge condoms, 32% used condoms in their last sexual practice, and 18% used condoms in all their sexual practices with any partners in the past month (Figure 2B).

**Prevention cascade for all HIV-negative PWID having sex with their spouse**

Additionally, 26.2% (95% CI: 21.7, 31.3) of all HIV-negative PWID had sex with their spouse in the past year; 83% of whom knew using condoms in sexual practices could reduce HIV transmission, 38% had access to free-of-charge condoms, 34% used condoms in their last sexual practice, and 15% used condoms in all of their sexual practices with their spouse in the past month (Figure 3A).

**Prevention cascade for all HIV-negative PWID having sex with non-paying partners**

Furthermore, 48.6% (95% CI: 43.4%, 71.4%) of all HIV-negative PWID had sex with a non-paying partner in the past year; 79% knew using condoms in sexual practices could reduce HIV transmission, 33% had access to free-of-charge condoms, 18% used condoms in their last sexual practice, and only 0.2% used condoms in all of sexual practices with their spouses in the past month (Figure 3B).

**Prevention cascade for all HIV-negative PWID having sex with paying clients**

Moreover, 25.7% (95% CI: 20.6%, 31.3%) of HIV-negative PWID had sex with a paying client in the past year; 85% of whom knew that using condoms could reduce the risk of HIV transmission, 47% had access to free-of-charge condoms, 27% used condoms in their last sexual practice, and 20% used condoms in all of their sexual practices with their spouses in the past month (Figure 3C).

**Prevention cascade for all HIV-negative male PWID having sex with another man**

Finally, 6.1% (95% CI: 5.0, 7.3) of HIV-negative male PWID had sex with another man in the past year; 80% of whom knew that condoms could reduce the risk of HIV transmission, 45% had access to free-of-charge condoms, and 13% used condoms in their last sexual practice (Figure 3D).



## DISCUSSION

Our HIV prevention cascade analysis among HIV-negative PWID in Iran highlights the gaps in existing services and identifies areas for action. Our findings suggest that most HIV-negative PWID were at risk for HIV acquisition through unsafe injection or sex. Only one third of PWID who were HIV-negative had access to and regularly used sterile needles and syringes for injection. Indeed, the biggest gap was access to free sterile needles and syringes. Moreover, less than one-fifth of PWID who were HIV-negative regularly used condoms and the major gap was access to free condoms. However, only one-tenth of male HIV-negative PWID who had sex with men used condoms in their last sex which was mainly due to lack of knowledge about condom protection effect, access to free condoms, and limited safe sexual practices.

We found limited access to free needles and syringes and condoms to be the major gaps in HIV prevention across all different subgroups of PWID. Inaccessibility of these services poses a serious threat to harm reduction programs tailored towards PWID and restricts the potential of existing services (Fernandes et al., 2017; Krishnaratne, Hensen, Cordes, Enstone, & Hargreaves, 2016). These findings are in line with previous studies suggesting that despite the availability of free of charge programs such as NSPs, opioid agonist therapy, and condom distribution services, PWID continue to engage in unsafe sexual and injection practices and the uptake of and retention in harm reduction services are very far from ideal in Iran ((Massah & Shishehgar, 2018)). For example, two nation-wide surveys suggested that the majority of PWID in Iran had practiced unsafe injection or sex. Among HIV-positive PWID, about 20% had practiced safe injection and sex and the rest were likely to have transmitted HIV to their sexual or injecting partners. On the other hand, only less than 30% of HIV-negative PWID had practiced dual safe injection and sex and were therefore at a low risk of HIV acquisition (Esmaeili et al., 2019).

Moreover, these surveys reported that condomless sex among PWID had increased from 60% in 2010 to 69% in 2013 and we found that inconsistent condom use was common among HIV-negative PWID. These concerning estimates highlight the need to identify the underlying causes for limited accessibility or availability of such services in Iran.

Indeed, our understanding of the dynamics of harm reduction service delivery and quality are limited in Iran, and there is an urgent need for qualitative studies to help identify the underlying barriers to accessing harm reduction services among PWID. This is particularly important for marginalized PWID whose sole source of obtaining sterile needles and condoms is through government-funded harm reduction services. A limited body of evidence suggest that similar to several international settings (Van Boekel, Brouwers, Van Weeghel, & Garretsen, 2013), socio-cultural stigma (e.g., negative attitudes towards PWID and their families) within several communities across Iran creates barriers to accessing important health and harm reduction services and therefore prevent PWID from getting the help they need (Abedinia, Rasoolinajad, Noorbala, & Badie, 2019; Amin-Esmaeili et al., 2016; Deilamizade, Moghanibashi-Mansourieh, Mohammadian, & Puyan, 2019; Karamouzian, Akbari, Haghdoost, Setayesh, & Zolala, 2015; SeyedAlinaghi et al., 2013; Zolala, Mahdavian, Haghdoost, & Karamouzian, 2016). Furthermore, while Iran's drug



policy has shifted from complete criminalization of substance use to a more evidence-based -yet heavily medicalized-approach in the past 40 years, PWID continue to face structural stigma and discrimination (e.g., facing ignorance and receiving substandard care) when seeking healthcare and harm reduction services (Karamouzian et al., 2015; Rahmati-Najarkolaei et al., 2010; Tavakoli et al., 2020). The existing services often provide fragmented services requiring PWID clients to refer to multiple centers to receive all the care and treatment services they need; policies and practices that significantly contribute to low service uptake (Tavakoli et al., 2020). Overall, our findings of limited uptake of NSP services as well as several recent studies that highlight the low quality of existing harm reduction services (Malekinejad et al., 2015), call for an urgent need to revisit and revise these services to improve their quality and utilization rate.

To prevent PWID clients from falling through the cracks of referrals within the healthcare sector (e.g., some services are provided by the Ministry of Health, some are provided by the Ministry of Welfare, and some through NGOs), further actions are required to improve the quality of existing services, as well as consider integrating multiple healthcare services in addressing comorbidities (Donoghoe, Verster, & Mathers, 2009; Socías et al., 2019), applying a holistic approach to PWID's health aimed at improving their overall quality of life (Andersson et al., 2020), enhancing supervision and monitoring as well as implementing meaningful stigma reduction interventions within the context of harm reduction service delivery (e.g., contact-based training and education programs targeting medical students, healthcare professionals, and law enforcement) (Andersson et al., 2020; Ekhtiari et al., 2019; Livingston, Milne, Fang, & Amari, 2012). Ignoring the intersectional stigma associated with injection drug use could indeed undermine all of the country's efforts aimed at reducing harms and HIV prevention among PWID (Andersson et al., 2020). As shown elsewhere, people with current or past experience with injection drug use could help run harm reduction services effectively (Allman et al., 2006; Greer, Amlani, Pauly, Burmeister, & Buxton, 2018; Kerr, Tyndall, Li, Montaner, & Wood, 2005) and therefore need to be further involved and adequately supported in Iran's HIV prevention response and help develop impactful and culturally sensitive stigma-reducing interventions.

Similar to findings from previous studies in Iran (R. Khajehkazemi et al., 2014) and internationally (Messersmith et al., 2015; Mumtaz, Hilmi, Majed, & Abu-Raddad, 2020), we found most of PWID had sufficient HIV knowledge and awareness towards HIV transmission and acquisition mechanisms through sexual pathways, irrespective of the type of their sexual partners. While such a fairly high level of HIV knowledge could be due largely to the educational programs as part of harm reduction strategies that Iran has long provided to key affected individuals, including PWID, we believe that there is room to improve and expand these efforts.

Unlike HIV knowledge, HIV-related practices and behaviors were considerably poor. While inconsistencies by sexual partners were observed; for example, using condoms in the last sexual practice ranged from 13% for male-same-sex sexual contacts to 34% for their spouses, all of these estimates showed that a large proportion of PWID were found to be at a high risk of HIV acquisition through unsafe sexual behaviors. Poor access to condoms could, to a great extent, explain their poor utilization: more than half of PWID reported not

having access to free-of-charge condoms. Harm reduction programs should facilitate access to condoms for PWID and improve efforts in raising awareness of the PWID with regard to the dual risk of sexual and injection pathways.

### Limitations

Our study had two major limitations. First, our facility-based sampling approach to recruiting PWID may limit the representativeness of our sample as well as the generalizability of our findings to the target population of PWID in Iran, particularly those who do not seek harm reduction services. While some of the PWID in our study were recruited from street locations and hotspots, a large proportion of our sample were recruited from health service facilities. This may have led to overestimation of HIV prevention cascade indicators, and in fact, both HIV-related knowledge and practice indicators could be even lower than what we observed. Second, similar to other behavioral surveys of PWID, self-report measures are not free from biases, in particular, social desirability bias which is an issue for sexual behaviours. This bias could have compromised the validity of the findings; however, to mitigate this bias, we used gender-matched interviewers aiming to improve trust between interviewees and interviewers.

### Conclusion

Our results highlight the limited accessibility of free condom program and NSP services among PWID in Iran. Our findings also call for modifying the existing services to identify and address the factors that contribute to creating individual (e.g. low knowledge, misconception and SES) and structural (e.g. stigma) barriers to accessing necessary harm reduction services among PWID. Our new analytical method defined the gaps in needle and condom programs targeted PWID in Iran. To assess the progress in closing such gaps, we recommend that our analytical method be repeated with the new data being collected in the next round of IBBS survey for PWID.

### Acknowledgment

This article is a part of the dissertation registered under the Ethics Code No. IR.TUMS.SPH.REC.1396.3547. The dissertation was published in Persian in 2019.

**Funding:** The study was funded by the Global Fund to Fight AIDS, Tuberculosis and Malaria through UNDP Iran, and by Ministry of Iran. Mohammad Karamouzian is supported by the Vanier Canada Graduate Scholarship (Vanier CGS) and the Pierre Elliott Trudeau Doctoral Scholarship. For this paper, we also received support from the Tehran University of Medical Sciences, and the University of California, San Francisco's International Traineeships in AIDS Prevention Studies (ITAPS), U.S. NIMH, R25MH064712.

### References

- Abedinia N, Rasoolinajad M, Noorbala A, & Badie BM (2019). I am HIV-positive, but I am a human being: qualitative study on experiences of stigma in health care centres in the Islamic Republic of Iran. *East Mediterr Health J*, 25(10), 669–676. doi:10.26719/emhj.19.012 [PubMed: 31774132]
- Allman D, Myers T, Schellenberg J, Strike C, Cockerill R, & Cavalieri W (2006). Peer networking for the reduction of drug-related harm. *International Journal of Drug Policy*, 17(5), 402–410.
- Amin-Esmaeili M, Rahimi-Movaghar A, Haghdoost A. a., & Mohraz M (2012). Evidence of HIV epidemics among non-injecting drug users in Iran: a systematic review. *Addiction*, 107(11), 1929–1938. [PubMed: 22551085]

- Amin-Esmaeili M, Rahimi-Movaghar A, Sharifi V, Hajebi A, Radgoodarzi R, Mojtabei R, ... Motevalian A (2016). Epidemiology of illicit drug use disorders in Iran: prevalence, correlates, comorbidity and service utilization results from the Iranian Mental Health Survey. *Addiction*, 111(10), 1836–1847. [PubMed: 27177849]
- Andersson GZ, Reinius M, Eriksson LE, Svedhem V, Esfahani FM, Deuba K, ... Ekström AM (2020). Stigma reduction interventions in people living with HIV to improve health-related quality of life. *The Lancet HIV*, 7(2), e129–e140. [PubMed: 31776098]
- Cassol S, Weniger BG, Babu PG, Salminen MO, Zheng X, Htoon MT, ... Ou CY (1996). Detection of HIV type 1 env subtypes A, B, C, and E in Asia using dried blood spots: a new surveillance tool for molecular epidemiology. *AIDS Res Hum Retroviruses*, 12(15), 1435–1441. doi:10.1089/aid.1996.12.1435 [PubMed: 8893051]
- Deilamzade A, Moghanibashi-Mansourieh A, Mohammadian A, & Puyan D (2019). The sources of stigma and the impacts on Afghan refugees with substance abuse disorders: A qualitative study in Iran. *J Ethn Subst Abuse*, 1–13. doi:10.1080/15332640.2018.1556764
- Donoghoe M, Verster AD, & Mathers B (2009). WHO, UNODC, UNAIDS technical guide for countries to set targets for universal access to HIV prevention, treatment and care for injecting drug users. Geneva: WHO/UNODC/UNAIDS.
- Ekhtiari H, Noroozi A, Farhoudian A, Radfar SR, Hajebi A, Sefatian S, ... Rawson R (2019). The evolution of addiction treatment and harm reduction programs in Iran: a chaotic response or a synergistic diversity? *Addiction*. doi:10.1111/add.14905
- Emran R, Nassirimanesh B, Afshar P, Ohiri K, Claeson M, & Power R (2006). HIV/AIDS harm reduction in Iran. *The Lancet*, 368(9534), 434–435.
- Esmaeili A, Shokoohi M, Danesh A, Sharifi H, Karamouzian M, Haghdoost A, ... Mirzazadeh A (2019). Dual Unsafe Injection and Sexual Behaviors for HIV Infection Among People Who Inject Drugs in Iran. *AIDS and Behavior*, 23(6), 1594–1603. [PubMed: 30460664]
- Fernandes RM, Cary M, Duarte G, Jesus G, Alarcão J, Torre C, ... Carneiro AV (2017). Effectiveness of needle and syringe Programmes in people who inject drugs—An overview of systematic reviews. *BMC public health*, 17(1), 309. [PubMed: 28399843]
- Garnett GP, Hallett TB, Takaruza A, Hargreaves J, Rhead R, Warren M, ... Gregson S (2016). Providing a conceptual framework for HIV prevention cascades and assessing feasibility of empirical measurement with data from east Zimbabwe: a case study. *The Lancet HIV*, 3(7), e297–e306. [PubMed: 27365204]
- Garnett GP, Hallett TB, Takaruza A, Hargreaves J, Rhead R, Warren M, ... Gregson S (2016). Providing a conceptual framework for HIV prevention cascades and assessing feasibility of empirical measurement with data from east Zimbabwe: a case study. *Lancet HIV*, 3(7), e297–306. doi:10.1016/s2352-3018(16)30039-x [PubMed: 27365204]
- Greer AM, Amlani A, Pauly B, Burmeister C, & Buxton JA (2018). Participant, peer and PEEP: considerations and strategies for involving people who have used illicit substances as assistants and advisors in research. *BMC public health*, 18(1), 834. [PubMed: 29976169]
- Hargreaves JR, Delany-Moretlwe S, Hallett TB, Johnson S, Kapiga S, Bhattacharjee P, ... Garnett GP (2016). The HIV prevention cascade: integrating theories of epidemiological, behavioural, and social science into programme design and monitoring. *The Lancet HIV*, 3(7), e318–e322. [PubMed: 27365206]
- Hargreaves JR, Delany-Moretlwe S, Hallett TB, Johnson S, Kapiga S, Bhattacharjee P, ... Garnett GP (2016). The HIV prevention cascade: integrating theories of epidemiological, behavioural, and social science into programme design and monitoring. *Lancet HIV*, 3(7), e318–322. doi:10.1016/s2352-3018(16)30063-7 [PubMed: 27365206]
- Himmich H, & Madani N (2016). The state of harm reduction in the Middle East and North Africa: A focus on Iran and Morocco. *Int J Drug Policy*, 31, 184–189. doi:10.1016/j.drugpo.2016.02.013 [PubMed: 27012581]
- Karamouzian M, Akbari M, Haghdoost A-A, Setayesh H, & Zolala F (2015). “I am dead to them”: HIV-related stigma experienced by people living with HIV in Kerman, Iran. *Journal of the Association of Nurses in AIDS Care*, 26(1), 46–56.

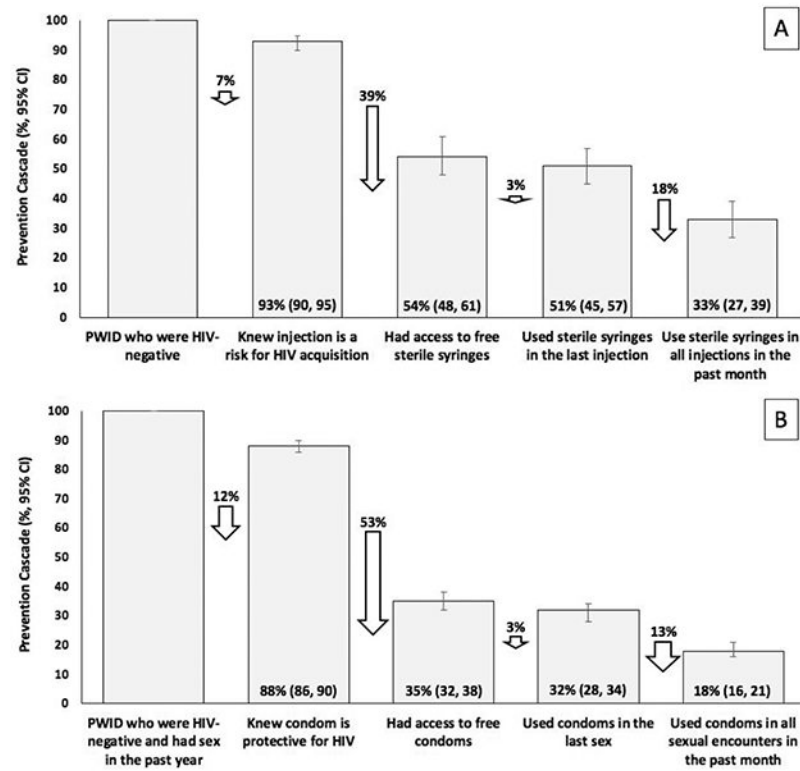
- Karamouzian M, Madani N, Doroudi F, & Haghdoost AA (2017). Improving the quality and quantity of HIV data in the Middle East and North Africa: key challenges and ways forward. *International journal of health policy and management*, 6(2), 65. [PubMed: 28812781]
- Karatzas N, Peter T, Dave S, Fogarty C, Belinsky N, & Pant Pai N (2019). Are policy initiatives aligned to meet UNAIDS 90-90-90 targets impacting HIV testing and linkages to care? Evidence from a systematic review. *PLoS One*, 14(6), e0216936. doi:10.1371/journal.pone.0216936 [PubMed: 31166957]
- Kerr T, Tyndall M, Li K, Montaner J, & Wood E (2005). Safer injection facility use and syringe sharing in injection drug users. *The Lancet*, 366(9482), 316–318.
- Khajehkazemi R, Haghdoost A, Navadeh S, Setayesh H, Sajadi L, Osooli M, & Mostafavi E (2014). Risk and vulnerability of key populations to HIV infection in Iran; knowledge, attitude and practises of female sex workers, prison inmates and people who inject drugs. *Sex Health*, 11(6), 568–574. doi:10.1071/sh14165 [PubMed: 25419677]
- Khajehkazemi R, Osooli M, Sajadi L, Karamouzian M, Sedaghat A, Fahimfar N, ... Haghdoost A-A (2013). HIV prevalence and risk behaviours among people who inject drugs in Iran: the 2010 National Surveillance Survey. *Sex Transm Infect*, 89(Suppl 3), iii29–iii32. [PubMed: 24037249]
- Kreuter F, & Valliant R (2007). A survey on survey statistics: What is done and can be done in Stata. *Stata Journal*, 7(1), 1–21. Retrieved from <http://www.stata-journal.com/article.html?article=st0118> <http://www.stata-journal.com/sjpdf.html?article=st0118>
- Krishnaratne S, Hensen B, Cordes J, Enstone J, & Hargreaves JR (2016). Interventions to strengthen the HIV prevention cascade: a systematic review of reviews. *The Lancet HIV*, 3(7), e307–e317. [PubMed: 27365205]
- Levi J, Raymond A, Pozniak A, Vernazza P, Kohler P, & Hill A (2016). Can the UNAIDS 90-90-90 target be achieved? A systematic analysis of national HIV treatment cascades. *BMJ Glob Health*, 1(2), e000010. doi:10.1136/bmjgh-2015-000010
- Livingston JD, Milne T, Fang ML, & Amari E (2012). The effectiveness of interventions for reducing stigma related to substance use disorders: a systematic review. *Addiction*, 107(1), 39–50.
- Malekinejad M, Navadeh S, Lotfizadeh A, Rahimi-Movaghar A, Amin-Esmaeili M, & Noroozi A (2015). High hepatitis C virus prevalence among drug users in Iran: systematic review and meta-analysis of epidemiological evidence (2001–2012). *International Journal of Infectious Diseases*, 40, 116–130. [PubMed: 26460088]
- Massah O, & Shishehgar S (2018). Methamphetamine dependence, psychological well-being, criminality and high risk sexual behaviors in female-only methadone services in tehran and karaj, iran. *Iranian Journal of Psychiatry and Behavioral Sciences*, 12. doi:10.5812/ijpbs.61859
- Messersmith LJ, Adjei R, Beard J, Agyarko-Poku T, Wondergem P, Falconer A, ... Adu-Sarkodie Y (2015). Drug use and sexual behavior: the multiple HIV vulnerabilities of men and women who inject drugs in Kumasi, Ghana. *J Acquir Immune Defic Syndr*, 68 Suppl 2, S124–130. doi:10.1097/qai.0000000000000445 [PubMed: 25723976]
- Mirzazadeh A, Shokoohi M, Karamouzian M, Ashki H, Khajehkazemi R, Salari A, ... Kazerooni PA (2020). Declining trends in HIV and other sexually transmitted infections among female sex workers in Iran could be attributable to reduced drug injection: a cross-sectional study. *Sexually Transmitted Infections*, 96(1), 68–75. [PubMed: 31836679]
- Montazi S, Noroozi A, & Rawson RA (2015). An overview of Iran drug treatment and harm reduction programs. *Textbook of Addiction Treatment: International Perspectives*, 543–554.
- Moorhouse L, Schaefer R, Thomas R, Nyamukapa C, Skovdal M, Hallett TB, & Gregson S (2019). Application of the HIV prevention cascade to identify, develop and evaluate interventions to improve use of prevention methods: examples from a study in east Zimbabwe. *Journal of the International AIDS Society*, 22, e25309. [PubMed: 31328375]
- Mumtaz GR, Hilmi N, Majed EZ, & Abu-Raddad LJ (2020). Characterising HIV/AIDS knowledge and attitudes in the Middle East and North Africa: Systematic review and data synthesis. *Glob Public Health*, 15(2), 275–298. doi:10.1080/17441692.2019.1668452 [PubMed: 31558094]
- Nikfarjam A, Shokoohi M, Shahesmaeili A, Haghdoost AA, Baneshi MR, Haji-Maghsoudi S, ... Tarjoman T (2016). National population size estimation of illicit drug users through the network

- scale-up method in 2013 in Iran. *International Journal of Drug Policy*, 31, 147–152. [PubMed: 26980349]
- Noroozi M, Marshall BDL, Noroozi A, Armoon B, Sharifi H, Farhoudian A, ... Pouya RH (2018). Do needle and syringe programs reduce risky behaviours among people who inject drugs in Kermanshah City, Iran? A coarsened exact matching approach. *Drug Alcohol Rev*, 37 Suppl 1, S303–s308. doi:10.1111/dar.12646 [PubMed: 29271013]
- Rahimi J, Gholami J, Amin-Esmaili M, Fotouhi A, Rafiemanesh H, Shadloo B, & Rahimi-Movaghar A (2020). HIV prevalence among people who inject drugs (PWID) and related factors in Iran: a systematic review, meta-analysis and trend analysis. *Addiction*, 115(4), 605–622. [PubMed: 31631425]
- Rahmati-Najarkolaei F, Niknami S, Aminshokravi F, Bazargan M, Ahmadi F, Hadjizadeh E, & Tavafian SS (2010). Experiences of stigma in healthcare settings among adults living with HIV in the Islamic Republic of Iran. *J Int AIDS Soc*, 13, 27. doi:10.1186/1758-2652-13-27 [PubMed: 20649967]
- Rostami M, Karamouzian M, Khosravi A, & Rezaeian S (2018). Gender and geographical inequalities in fatal drug overdose in Iran: A province-level study in 2006 and 2011. *Spatial and spatio-temporal epidemiology*, 25, 19–24. [PubMed: 29751889]
- Schaefer R, Gregson S, Fearon E, Hensen B, Hallett TB, & Hargreaves JR (2019). HIV prevention cascades: a unifying framework to replicate the successes of treatment cascades. *The Lancet HIV*, 6(1), e60–e66. [PubMed: 32066995]
- SeyedAlinaghi S, Paydary K, Kazerooni PA, Hosseini M, Sedaghat A, Emamzadeh-Fard S, & Mohraz M (2013). Evaluation of stigma index among people living with HIV/AIDS (PLWHA) in six cities in Iran. *Thrita*, 2(4), 69–75.
- Sharifi H, Mirzazadeh A, Shokoohi M, Karamouzian M, Khajehkazemi R, Navadeh S, ... McFarland W (2018). Estimation of HIV incidence and its trend in three key populations in Iran. *PLoS One*, 13(11), e0207681. [PubMed: 30496204]
- Sharifi H, Mirzazadeh A, Shokoohi M, Karamouzian M, Khajehkazemi R, Navadeh S, ... Haghdoost AA (2018). Estimation of HIV incidence and its trend in three key populations in Iran. *PLoS One*, 13(11), e0207681. doi:10.1371/journal.pone.0207681 [PubMed: 30496204]
- Socías ME, Karamouzian M, Parent S, Barletta J, Bird K, & Ti L (2019). Integrated models of care for people who inject drugs and live with hepatitis C virus: A systematic review. *International Journal of Drug Policy*, 72, 146–159. [PubMed: 31147142]
- Tavakoli F, Karamouzian M, Rafiei-Rad AA, Iranpour A, Farrokhnia M, Noroozi M, ... Sharifi H (2020). HIV-Related stigma among healthcare providers in different healthcare settings: a cross-sectional study in Kerman, Iran. *International journal of health policy and management*, 9(4), 163–169. [PubMed: 32331496]
- Van Boekel LC, Brouwers EP, Van Weeghel J, & Garretsen HF (2013). Stigma among health professionals towards patients with substance use disorders and its consequences for healthcare delivery: systematic review. *Drug and alcohol dependence*, 131(1-2), 23–35. [PubMed: 23490450]
- Zolala F, Mahdavian M, Haghdoost AA, & Karamouzian M (2016). Pathways to addiction: a gender-based study on drug use in a triangular clinic and drop-in center, Kerman, Iran. *International journal of high risk behaviors & addiction*, 5(2).



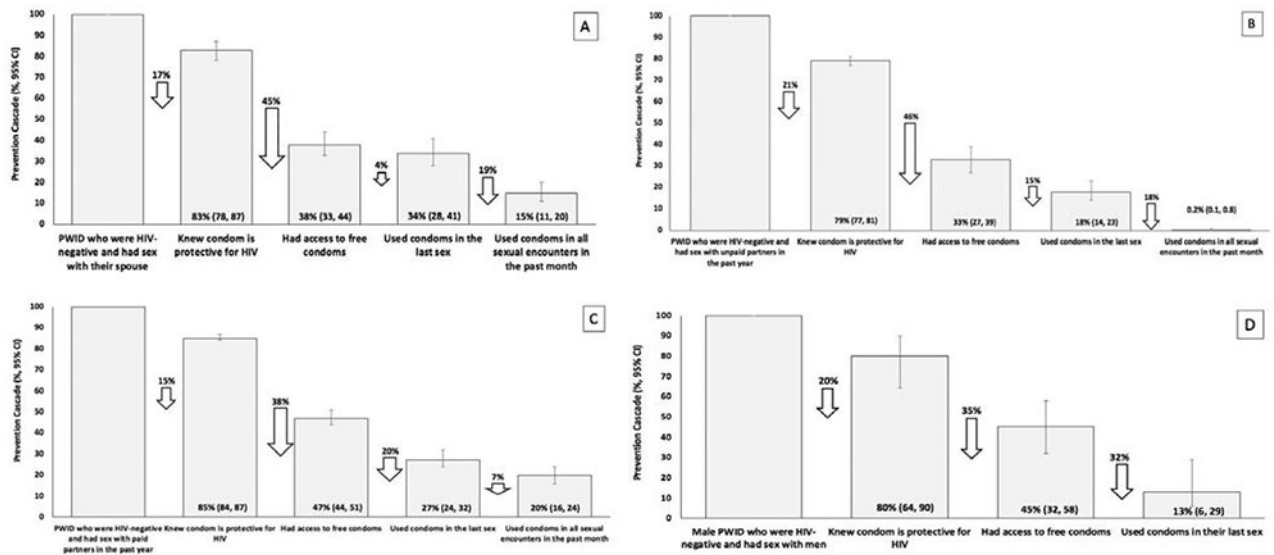
**Figure 1.** Study site of the bio-behavioral surveillance (IBBS) survey of people who inject drugs (PWID) in Iran, 2013





**Figure 2.** HIV prevention cascade for safe injection (A) and safe sex (B) among people who inject drugs (PWID) in Iran. In both figures, the denominator for all % is the estimated number of people for the first column. CI: 95% Confidence Intervals.





**Figure 3.** HIV prevention cascade for safe sex among people who inject drugs (PWID) in Iran. A: PWID who had sex with their spouse(s) in the past year; B: PWID who had sex with non-paying partner(s) in the past year; C: PWID who had sex with paying clients in the past year; D: Male PWID who had sex with another man in the past year. In all figures, the denominator for all % is the number of people for the first column. CI: 95% Confidence Intervals.

**Table 1.**

Characteristics of HIV-negative people who inject drugs overall and in subgroups defined by type of their sexual partners in Iran

Characteristics		Total (n= 2,391)	HIV- negative PWID (n=2092)	HIV- negative PWID who had sex in the past year (n= 1227)	HIV- negative PWID and who had sex with their spouse(s) in the past year (n=447)	HIV- negative PWID who had sex with non- paying partner(s) in the past year (n= 733)	HIV- negative PWID who had sex with paying clients in the past year (n= 468)	HIV- negative male PWID who had sex with another man in the past year (n= 99)
		Number (%)	Number (%)	Number (%)	Number (%)	Number (%)	Number (%)	Number (%)
Sex	Male	2,333 (97.6)	2,048 (97.9)	1,212 (98.7)	441 (98.6)	728 (99.4)	463 (98.9)	99 (100)
	Female	58 (2.5)	44 (2.1)	15 (1.3)	6 (1.4)	5 (0.6)	5 (1.1)	-
Age groups	<19 years	9 (0.5)	8 (0.4)	5 (0.4)	1 (0.2)	4 (0.5)	2 (0.4)	2 (2.1)
	20-24 years	132 (5.5)	125 (6.0)	94 (7.8)	13 (2.9)	70 (9.5)	38 (8.1)	9 (9.1)
	25-34 years	921 (38.5)	822 (39.3)	523 (43.3)	136 (30.5)	352 (48.1)	216(46.1)	47 (47.4)
	35+	1,327 (55.5)	1,135 (54.3)	585 (48.5)	297 (66.4)	307 (41.9)	212(45.4)	41 (41.4)
Current Marital status	Single	1,143 (47.8)	953(45.6)	497(41.3)	0 (0.0)	402 (54.9)	236 (50.5)	62 (62.5)
	Married	625 (26.1)	579 (27.7)	440 (36.5)	447 (100)	164 (22.4)	102(21.7)	9 (9.0)
	Other (widow, divorced)	594 (24.7)	535 (25.6)	249 (20.6)	0 (0.0)	153 (20.9)	120 (25.6)	26 (26.5)
	Temporary marriage (i.e. Sjgheh)	25 (1.4)	21 (1.1)	19 (1.6)	0 (0.0)	13 (1.8)	10 (2.2)	2 (2.0)
Education	Illiterate	131(5.4)	122 (5.9)	61 (5.1)	31 (7.0)	21 (2.8)	23 (4.9)	6 (6.1)
	Primary school or less	636 (26.6)	547 (26.1)	325 (26.9)	148 (33.1)	182 (24.9)	126 (26.9)	28 (28.3)
	Middle / high school / Diploma	1,514 (63.4)	1,324 (63.3)	770 (63.8)	249 (55.8)	498 (67.9)	300 (64.1)	63 (63.6)
	University	108 (4.6)	97 (4.7)	50 (4.2)	18 (4.1)	32 (4.4)	19 (4.1)	2 (2.0)
Employment	Unemployed/ unstable job	2,007 (84.5)	1,751 (84.3)	979 (81.6)	344 (77.5)	598 (82.2)	391 (84.3)	84 (84.6)
	Employed/stable job	367(15.5)	326 (15.7)	220 (18.4)	100 (22.5)	130 (17.8)	73 (15.7)	15 (15.4)
Substance type in past month *	Opium/ Opium mix	134 (5.6)	87 (4.1)	40 (3.3)	23 (5.1)	29 (3.9)	23 (4.9)	5 (5.0)
	Heroin	832 (34.7)	711 (33.9)	374 (30.4)	155 (34.6)	246 (33.5)	178 (38.1)	32 (32.3)
	Crack	220 (9.2)	180 (8.6)	135 (11.0)	44 (9.8)	40 (5.4)	52 (11.1)	13 (13.1)
	Norgesic	47 (2.0)	40 (1.9)	33 (2.6)	8 (1.8)	19 (2.5)	10 (2.1)	4 (4.0)
	Crystal methamphetamine	199 (8.3)	179 (8.5)	126 (10.2)	33 (7.4)	79 (10.7)	57 (12.2)	21 (21.2)
<b>Lifetime History of incarceration</b>		1,824 (76.2)	1,584 (75.8)	897 (73.1)	347 (77.7)	580 (79.1)	418 (89.3)	92 (92.9)

\* as some people reported using more than one type of drug, the % would not add up to 100%.

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript